

---

Environmental  
Studies  
Research  
Funds

---

026

# Bibliography on the Fate and Effects of Arctic Marine Oil Pollution

Environmental Studies Revolving Funds Report No. 026

March 1986

# **BIBLIOGRAPHY ON THE FATE AND EFFECTS OF ARCTIC MARINE OIL POLLUTION**

*Edited by*

Stuart C. Young

ESRF/ASTIS Project  
The Arctic Science and Technology Information System  
The Arctic Institute of North America  
The University of Calgary  
2500 University Dr. N.W.  
Calgary, Alberta T2N 1N4

ESRF/ASTIS Scientific Advisor: R. Bergeron

*The correct citation for this publication is:*

Young, S.C. 1986. Bibliography on the fate and effects of arctic marine oil pollution. Environmental Studies Revolving Funds Report No. 026. Ottawa, 212 p.

Published under the auspices of the Environmental Studies Revolving Funds.

ISBN 0-920783-25-2

©1986 — The Arctic Institute of North America

## CONTENTS

Introduction (English) . . . . .	v
Introduction (française) . . . . .	ix
Bibliography . . . . .	1
Subject Index . . . . .	166
Geographic Index . . . . .	174
Title Index . . . . .	178
Serial Index . . . . .	191



## ACKNOWLEDGEMENTS

The editor wishes to acknowledge the help of the following in the preparation of this bibliography:

- Raymond Bergeron, Scientific Adviser to the ESRF/ASTIS Project, for his advice and support, and for collecting comments on the draft version.
- Olav Loken, Director of ESRF, Martin Barnett, former ESRF/ASTIS Program Officer, and Natalie Sutterlin, current ESRF/ASTIS Program Officer, for their advice and assistance.
- John Vandermeulen and Norm Snow, scientific advisors for this bibliography.
- Howard Hume and Norm Snow, and the members of the ESRF Oil Spill Research and Countermeasures Program Study Committee and the Marine Environmental Effects and Monitoring Program Study Committee, for their advice in the initial stages of this work and comments on the draft.
- J.E. Sutherland and her staff at the Library, Bedford Institute of Oceanography, for adding an alternate location to many documents and for providing comments on the draft.
- the researchers and others who sent copies of reports, contributed lists of references, and provided comments on the draft via our questionnaire. Thanks to M.G. Carls, L.A. Clarke, J. Clogg, E.E. Cudby, D.F. Dickins, M. Dunbar, A. Elverhoi, F.R. Engelhardt, P. Ferris, S.D. Gill, H. Hume, F.A. Leighton, M. Lewis, D.B. Peakall, J.R. Percy, F. Potter, G.A. Sergy, N. Snow, T.S. Spearing, N. Sutterlin, R.B. Taylor, J.H. Vandermeulen and R.J. Wiseman.
- special thanks to A.L. Samson, J.H. Vandermeulen, P.G. Wells and C. Moyse for kind permission to use their 1980 work *A selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment* (Economic and technical review report, EPS 3-EC-80-5) as the foundation for this bibliography.

# INTRODUCTION

## Background

This bibliography is the second in a series of bibliographies to be prepared by the ESRF/ASTIS Project on the priority subjects of the Environmental Studies Revolving Funds. The purpose of the ESRF/ASTIS Project is to enhance the ASTIS database in each of the ESRF priority subjects and, in addition, to produce the printed bibliographies themselves, in order to provide a central source of environmental and social information relating to the Canada Lands. ESRF research on arctic marine oil pollution is coordinated mainly by two ESRF Program Study Committees: Marine Environmental Effects and Monitoring, and Oil Spill Research and Countermeasures.

## Scope of the Bibliography

The scope of this bibliography is to a large extent based on that of the 1980 edition of *A selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment*, compiled by A.L. Samson, J.H. Vandermeulen, P.G. Wells and C. Moyse. We have incorporated all "arctic" citations from that bibliography (which is now out-of-print), in addition to new citations from the literature since 1980. Our selection criteria are outlined below.

Subject scope: "Fate and effects" refers to the physical, chemical and biological fate (e.g., dispersion, deposition, weathering, biodegradation, etc.) and biological effects (e.g., toxicity, sublethal effects, etc.) of petroleum and its hydrocarbon constituents. Environmental assessment studies and studies of potential sensitivities of marine and shoreline areas to spills are included where there is some discussion of petroleum pollution effects. Simple baseline descriptions of existing biota and physical morphology have generally been excluded. Literature on the detection and tracking of oil spills has been excluded; trajectory modelling research has been included where it concerns itself with arctic locations or conditions. Studies on oil spill dispersants *per se* have been excluded, but research on the fate and effects of oil/dispersant mixtures have been included.

Geographic scope: In general terms, the geographic coverage includes the arctic regions plus Cook Inlet and the Gulf of Alaska. However, documents covering conditions of arctic relevance such as oil/ice interaction

have been gathered from anywhere within the area of average maximum sea ice extent (as commonly identified in atlases, e.g., *Polar regions atlas*. [Washington, D.C.] : Central Intelligence Agency, 1978). In conforming with this definition of scope, oil/ice literature on the 1979 Kurdistan spill in Cabot Strait was included, but research on the 1977 Bouchard #65 spill at Buzzard's Bay was excluded as it falls outside the indicated area. Finally, laboratory research involving arctic species or northern crude oils (where this could be determined from the available citation prior to ordering the document) has been included regardless of location.

Literature types: Research literature and information, including monographs, scientific journals, conference proceedings, theses, and government, corporate and institute reports.

Chronological scope: Material available up to and including December 1985.

### **Comprehensiveness of the Bibliography**

This bibliography contains 748 citations. Relevant documents were located through a search of the ASTIS online bibliographic database, followed by retrospective searches of the following databases: ASFA (Aquatic Sciences and Fisheries Abstracts), BIOSIS Previews, Chemical Abstracts Condensates, Comprehensive Dissertation Abstracts, Enviroline, NTIS, Oceanic Abstracts, and Pollution Abstracts. Further references were obtained from the EPS bibliography referred to above, from the files of John Vandermeulen and other researchers, and from the documents themselves. Relevance was determined solely by the criteria outlined above; no value judgements were made on the quality or completeness of results as these are outside the bibliographer's jurisdiction. Thus in some cases "in-progress" documents reporting partial results or even lost samples have been cited.

In almost all cases the actual documents were obtained and examined for relevance prior to indexing and inclusion in the bibliography. Where documents could not be obtained in time to do this, they were indexed sight-unseen, provided they were clearly relevant and an unambiguous citation was available. Such citations contain the note "Document not seen by ASTIS" and, of course, have no abstract or location code.

There are undoubtedly some works which should be in this bibliography but which have been missed. We would ask the reader's help in locating them. The bibliography should eventually find its way into the hands of many oil spill fate and effects researchers. We would ask you to check to see if everything that you and your organization have published on this topic (within the geographic scope outlined above) is included. Please inform us of any missing items, and, if convenient, please send us a copy.

ESRF/ASTIS will continue to work to include items overlooked, to locate items not yet examined, and to report newly published material, all of which will be added to the ASTIS database, which is publicly available through QL Systems Ltd. Such material can be found online in ASTIS by searching under subject terms such as "Marine oil spills — Environmental aspects", "Biodegradation of petroleum", "Weathering of petroleum", and so on.

## Organization of the Bibliography

In the main section of the bibliography citations are sorted by first author, with cross-references from additional authors. Citations with no author appear at the beginning of the bibliography. Each author's works are further sorted by title. The bibliography contains four indexes which refer back to the main section of the bibliography by citation number. Terms in the Subject and Geographic Indexes are taken from the ASTIS Subject and Geographic Thesauri. Please note that in the Subject and Geographic Indexes, when documents are listed under a specific term (e.g., "Herschel Island waters, Y.T.") they are not listed again under broader terms (e.g., "Beaufort Sea"). Leading articles (A, The, Le, etc.) are removed in the Title Index. The Serial Index allows documents to be found under the title of the serial or other larger work in which they appeared.

## Availability of Documents

The last line of most citations (i.e. the line preceding the abstract) contains a location code indicating where the document may be obtained on interlibrary loan. The standard Canadian interlibrary loan codes are used. Most documents which have location codes have one or more of the following:

- ACU — Interlibrary Loan Office, Room 218, Library Tower, University of Calgary, Calgary, Alberta, Canada T2N 1N4. Telephone (403) 220-5967.
- NFSMO — Ocean Engineering Information Centre, Memorial University of Newfoundland, St. John's, Newfoundland, Canada A1B 3X5. Telephone (709) 737-8377.
- NSDB — The Library, Bedford Institute of Oceanography, Box 1006, Dartmouth, Nova Scotia, Canada B2Y 4A2. Telephone (902) 426-3675.
- OON — Canada Institute for Scientific and Technical Information, National Research Council Canada, Montreal Road, Ottawa, Ontario, Canada K1A 0S2. Telephone (613) 993-1600.

Please give the ASTIS document number and full citation when ordering.

Documents, with or without location codes, may also be available from their publishers.

# INTRODUCTION

## Présentation

Cette bibliographie est la deuxième d'une série de bibliographies réalisées par le project FRÉE/ASTIS sur les sujets prioritaires des Fonds renouvelables pour l'étude de l'environnement. En plus d'assurer la publication de ces bibliographies, le project FRÉE/ASTIS vise à enrichir la base de données ASTIS dans chacun des sujets prioritaires des FRÉE afin de constituer une source centrale de renseignements environnementaux et sociaux portant sur les terres du Canada. La coordination de la recherche commanditée par les FRÉE sur la pollution par le pétrole des milieux marins arctiques touche particulièrement deux comités de programme des FRÉE soit le comité Incidences sur le milieu marin et surveillance des effets et le comité Recherches sur les versements et contre-mesures.

## Portée de la bibliographie

La portée de la bibliographie est fondée en grande partie sur celle de l'édition de 1980 de *A selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment* (Une bibliographie selective sur le sort et les effets de la pollution aux hydrocarbures dans les environnements marins du Canada), compilée par A.L. Samson, J.H. Vandermeulen, P.G. Wells et C. Moyse. Nous avons incorporé à cette bibliographie maintenant épuisée toutes les entrées «arctiques» ainsi que les nouvelles citations provenant des ouvrages publiés depuis 1980. Nos critères de sélection sont exposés dans le texte qui suit.

Portée des sujets: «Le sort et les effets» comprend le devenir physique, chimique et biologique du pétrole et des différents hydrocarbures qui le composent (par exemple, leur dispersion, dépôt, altération, biodégradation, etc.) de même que leurs effets biologiques (par exemple leur toxicité, leurs effets sub-létaux, etc.). Les études d'évaluation des répercussions environnementales ainsi que celles sur la vulnérabilité potentielle des rivages et sites marins aux déversements de pétrole ont été incluses lorsqu'elles comprenaient une part de discussion sur les effets de la pollution par le pétrole. Les ouvrages se limitant à la description du biote ou de la géomorphologie du milieu concerné ont pour la plupart été exclus de même que la littérature traitant de la détection et du dépistage des déversements pétroliers. Cependant la recherche sur les modèles de trajectoire a été incluse lorsqu'elle portait sur des sites ou des conditions arctiques. Quant aux

dispersants, c'est à dire ces substances utilisées pour la dispersion des nappes de polluants pétroliers, les études les concernant directement per se ont été exclues mais les recherches sur le sort et les effets des mélanges hydrocarbures/dispersants ont été incluses dans la présente bibliographie.

Portée géographique: De façon générale, l'aire géographique considérée comprend les régions arctiques ainsi que Cook Inlet et le golfe de l'Alaska. Cependant les documents traitant de conditions pouvant se rapporter au milieu arctique, telle que l'interaction de la glace et des hydrocarbures, ont été rassemblés pour tout site compris dans la zone d'extension maximale moyenne de la glace de mer (telle qu'indiquée couramment dans les atlas comme *Polar regions atlas*. [Washington, D.C.] : Central Intelligence Agency, 1978). Conformément à la définition de la portée géographique, les textes concernant l'effet des hydrocarbures sur la glace lors du déversement Kurdistan de 1979 dans le détroit de Cabot ont été inclus alors que la recherche traitant du déversement Bouchard #65 de 1977 dans la baie de Buzzard a été exclue puisque hors des limites établies. Enfin, la recherche effectuée en laboratoire mais s'appliquant aux espèces arctiques ou aux hydrocarbures bruts de provenance nordique (lorsque ces informations pouvaient être tirées de la citation disponible avant que ne soit commandé le document) a été incluse quelle que fût sa localisation géographique.

Types d'ouvrages: Toute documentation et ouvrage d'information concernant la recherche, y compris les monographies, les revues scientifiques, les actes de conférences, les thèses ainsi que les rapports d'instituts, de sociétés et de gouvernements.

Portée chronologique: Les ouvrages qui étaient disponibles jusqu'à décembre 1985 inclusivement.

## Étendue de la bibliographie

Cette bibliographie contient 748 entrées. Les ouvrages pertinents ont été repérés grâce à l'interrogation de la base de données bibliographiques informatisée d'ASTIS mais aussi par une recherche retrospective des bases de données: ASFA (Aquatic Sciences and Fisheries Abstracts), BIOSIS Previews, Chemical Abstracts Condensates, Comprehensive Dissertation Abstracts, Enviroline, NTIS, Oceanic Abstracts et Pollution Abstracts. D'autres entrées proviennent de la bibliographie EPS ci-haut mentionnée, des dossiers de John Vandermeulen et d'autres chercheurs, et des ouvrages eux-mêmes. La pertinence n'a été déterminée qu'en fonction des critères exposés ci-haut: aucun jugement de valeur n'a été porté sur la qualité et le niveau de complétude des résultats puisque cela ne relève pas de la compétence du bibliographe. Par conséquent on pourra trouver référence à quelques ouvrages en cours rapportant des résultats partiels et même à des travaux s'appliquant à des échantillons perdus.

Dans presque tous les cas, les ouvrages actuels furent obtenus et examinés quant à leur pertinence avant leur indexation et leur inclusion dans la bibliographie. Lorsque les documents ne purent être obtenus à temps, ils furent indexés sans être examinés, pourvu qu'ils étaient clairement pertinents et si une citation non équivoque était disponible. De telles entrées ont reçu la notation «Document not seen by ASTIS» et ne contiennent aucun résumé ou code d'accès.

Il existe sûrement des travaux qui devraient figurer dans cette bibliographie mais que nous n'avons pu localiser. Nous prions donc nos lecteurs de nous aider à le faire. Cette bibliographie devrait se retrouver éventuellement avant longtemps, entre les mains de nombreux chercheurs intéressés par ce sujet du sort et des effets des déversements de pétrole. Nous prions ces chercheurs et leurs groupes de recherche de vérifier si tout ce qu'ils ont publié à ce sujet se trouve dans cette bibliographie (dans les limites de sa portée géographique). Nous leurs serons reconnaissants, ainsi qu'à tous les lecteurs de signaler tout texte qui devrait figurer dans cette bibliographie et, si possible, de nous en faire parvenir un exemplaire.

FRÉE/ASTIS continuera à rechercher les textes manquants, à localiser les ouvrages déjà cités mais non-examinés et à signaler les arrivées de nouveau matériel publié, toutes les nouvelles entrées étant par la suite ajoutées à la base de données ASTIS, disponible par l'entremise de QL Systems Ltd. Ces informations peuvent être retrouvées par l'interrogation en direct de la base de données ASTIS sous des rubriques telles que: «Marine oil spills — Environmental aspects», «Biodegradation of petroleum», «Weathering of petroleum», et ainsi de suite.

## **Organisation de la bibliographie**

Dans le corps principal de la bibliographie, les entrées sont classées sous le nom du premier auteur, avec des renvois aux autres auteurs. Les citations sans auteur paraissent au début de la bibliographie. Les travaux d'un même auteur sont ensuite classés par titre. La bibliographie contient quatre index qui rapportent le lecteur au corps de la bibliographie par indicatif d'entrée. La terminologie dans les index de sujets et de sites géographiques provient du dictionnaire de sujets et de sites géographiques de l'ASTIS. Veuillez noter que dans les index de sujets et de sites géographiques, lorsqu'un document est classé sous une rubrique spécifique (par exemple, «Herschel Island waters, Y.T.»), il n'est pas de nouveau classé sous une rubrique plus générale (par exemple, «Beaufort Sea»). Les articles en début de titre (A, The, Le, etc.) ne paraissent pas à l'index des titres. L'index des périodiques permet de trouver un document sous le titre du périodique ou de l'ouvrage dans lequel il fut publié.



1  
Ala  
(A  
  
Re  
Do  
AS Des  
Esti sub  
mor Est  
affe G  
tion t  
Pr .  
  
2  
Ben  
  
Fait  
vi. I  
IAS  
Cov  
Ref  
AS  
ACI  
  
T  
the  
cont  
deve  
OCS  
  
3  
Bird  
(MA  
AS  
ACI  
An e  
acts  
the  
Adm.  
know  
leaving  
  
4  
Effect  
Out  
17 p  
AS7  
NSL  
Ar  
as 7  
EAP  
1980  
about  
for s  
the i  
strate  
propo  
ques  
shifts  
man  
propo  
paper  
forth

Re  
Do  
AS  
Des  
sub:  
Est:  
mor  
liffe  
ful  
1991  
2001

- 2 Ben  
Fah  
of 1  
1977  
Gov  
Dra  
Ref  
AST  
ACI  
... T  
the  
cont  
deve  
OCS

3  
Bird  
(Ma  
ASI  
ACI  
An  
e  
the  
Adm.  
know  
Letter

[illegible]

1

# **Alaska peninsula oil spill.**

(Annual report - Smithsonian Institution. Center for Short Lived Phenomena, 1970, p. 154-157, ill.)

## **References.**

*Document not seen by ASTIS. Citation from AB.*  
*ASTIS document number 171484.*

Describes effects of this event in which a toxic slick of a light oily substance devastated wildlife along 400 mi of the Alaska coast. Estimates indicate that 86,600 birds, mostly murre, died, with mortalities exceeding 300 per mi near Port Moller. Toxins also affected 400 hair seals and several whales. Many forms of marine fauna were killed off. Investigations failed to identify exactly the toxin involved or its source and the cause of the event may never be completely resolved. (Au)

2

# **Beaufort Sea synthesis report : environmental impacts of OCS development in northern Alaska : proceedings.**

Fairbanks : Arctic Project Office, 1977.

vi, 219p. : maps, figures, tables ; 28cm.

(Arctic project bulletin, no. 15, 1977)

Cover title.

Draft.

## **References.**

*ASTIS document number 19216.*

ACU

... The purpose of the meeting was to "synthesize" our knowledge of the Beaufort Sea, as it relates to the proposed leasing of the outer continental shelf; to assess the likely impacts of petroleum development of the shelf; and to review the adequacy of ongoing OCSEAP studies addressing these impacts. ... (Au)

3

# **Bird deaths mount in Alaska.**

(Marine pollution bulletin, v. 1, no. 5, May 1970, p. 66)

*ASTIS document number 173797.*

ACU, NSDB

An estimated 10,000 birds in the Kodiak Islands group of Alaska were oiled during February and early March [1970]. The source of the oil, identified by Federal Water Pollution Control Administration officials as Middle East crude or bunker oil, is not known. Surveys of the islands for oiled birds and mammals were carried out .... (Au)

4

# **Effects of crude oil on polar bears : summary report.**

Ottawa : DIAND, 1981.

17 p. : ill. ; 29 cm.

*ASTIS document number 178152.*

NSDB(ENV.)

... An investigative study on the effects of crude oil was conducted as part of the Eastern Arctic Marine Environmental Studies (EAMES) Program. ... [The] experiment conducted in February 1980 at Churchill, Manitoba was to emphasize investigation of the ability of polar bears to regulate their body temperatures once their fur had been fouled by crude oil. ... The impact of exposure to oil on the bears' ability to maintain their heat balance was to be related to the characteristics of Midale crude oil to its changes with exposure, and its uptake through the skin as measured by blood plasma oil levels. An ongoing health program would monitor any shifts occurring in clinical streps-related parameters. Because of the unexpected and extensive grooming activity by the bears after oil exposure and consequent severe toxicity effects, two of the experimental animals died. Therefore, it became necessary to increase the analytical component of the study program to include further assessments of hydrocarbon residues, a more detailed clinical

assessment, and a comprehensive pathology. Results obtained from this study will now be used to predict the effects of a spill in field and enable the implementation of preventive and corrective measures. (Au)

5

# **Frozen sea research.**

(Annual review of activities 1982 - Canada. Institute of Ocean Sciences, Patricia Bay, p. 32-35, ill., map)

*ASTIS document number 133418.*

ACU

This article reports on the activities of the Frozen Sea Research Group. It's three field operations during 1982 were firstly in conjunction with the studies of the Northwest Passage (Transport R & D), secondly a "channel flow" experiment of near-surface flow in arctic waters and thirdly oceanographic investigation in the vicinity of the Ross ice shelf, Antarctica. The contracted CTD survey covering most of the channels in the Canadian Arctic Archipelago and concentrating on Amundsen Gulf is the most comprehensive survey to date covering the archipelago as a whole. Studies of a polynya have been completed as well as work on the formation of gas hydrates during oil well blowouts at depth. Experiments were undertaken to investigate subsea containment of underwater oil well blowouts. Other preliminary studies are outlined and instrument developments described. (ASTIS)

6

# **The hazards and risks of offshore drilling.**

(Oil under the ice / D.H. Pimlott, D. Brown, K.P. Sam. - Ottawa : Canadian Arctic Resources Committee, 1976, p. 93-110)

## **References.**

*ASTIS document number 177237.*

ACU

This chapter offers a general review of the effects of oil on arctic marine ecosystems and their seabird, mammal, fish and invertebrate inhabitants. Ice and climatic hazards to drilling operations are also covered. (ASTIS)

7

# **Ice conditions hinder oil weathering in Baltic Sea spill.**

(Oil spill intelligence report, v. 2, no. 20, 1979, p. 2)

*Document not seen by ASTIS.*

*ASTIS document number 180521.*

8

# **Oil released in arctic environments : oil and ice/snow interactions.**

(Fate and weathering of petroleum spills in the marine environment : a literature review and synopsis / by Randolph E. Jordan [and] James R. Payne. Ann Arbor : Ann Arbor Science, [1980], p. 108-114, ill.)

## **References.**

*ASTIS document number 46590.*

ACU

Discusses mechanisms of transport and characteristics of the spread of oil spilled in cold water environments with ice cover. Environmental effects on oil weathering rates are noted. (ASTIS)

9

# **Oil spills and oil pollution in the Arctic and Antarctic, 1970 - May 1983 : citations from the Pollution Abstracts database.**

Springfield, Va. : National Technical Information Service, 1984.

1 microfiche : 11 x 15 cm.

(NTIS PB83-864397)

#### References.

Includes index.

ASTIS document number 173185.

ACU

This bibliography contains [88] citations concerning the environmental and biological consequences of oil spills and oil pollution in the arctic [and antarctic] regions. Topics include prevention, detection, behavior, control, and recovery of arctic oil spills and pollution. Some attention is given to effects upon particular biological species. (Au)

10

#### Recovery potential of oiled marine northern environments.

(Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 499-795, ill., maps, tables, charts)

#### References.

Cover title.

ASTIS document number 6718.

ACU

Over 160 participants from nine countries met to discuss: 1) the long-term fate of petroleum hydrocarbons after spills - changes in composition and microbial degradation, 2) physiological stresses and response in chronically oiled organisms, and 3) long-term effects of oil spills on marine intertidal communities. It was concluded that it will take at least 5 to 15 years for the marine environments involved to return to a stable state. (ASTIS)

#### ABBOTT, F.

See: 177.

#### ABDELNOUR, R.

See: 30, 31.

#### ABERNETHY, S.

See: 731.

#### ACREMAN, J.

See: 459.

#### ACRES CONSULTING SERVICES

11

Oil and gas under ice laboratory study / Acres Consulting Services. Canadian Marine Drilling Limited [Sponsor]. Canada. Environmental Protection Service [Sponsor].

Niagara Falls, Ont. : Acres Consulting Services Ltd., 1980.

1 microfiche : ill., figures, table ; 11 X 15 cm.

(Beaufort E.I.S. reference work, no. RWC17)

ASTIS document number 108022.

ACU, NSDB(ENV.)

A laboratory study of the behavior of oil and gas under ice has been conducted by Acres Consulting Services .... The prime objectives of the study were defined as follows. - To determine the influence of currents on oil herding within depressions and under

broken sea ice. - To determine the influence of currents on oil migration between depressions and under broken sea ice. The tests were conducted in Acres' ice flume at the Niagara Falls laboratories. Two different ice covers were used with undulated and broken cover sections. This report contains a description of the test facilities, test procedures, and detailed observations. A number of photographs have been attached and a videotape recording ... has also been prepared. (Au)

#### ACRES/SANTA FE POMEROY ARCTIC SERVICES

See: 428.

#### ADAMS, W.A.

12

#### Light intensity and primary productivity under sea ice containing oil / Adams, W.A.

Victoria, B.C. : Beaufort Sea Project, 1975.

156p. : ill., figures, charts, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 29)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 29)

Bibliography: p.34-39.

ASTIS document number 15504.

ACU, NFSMO

... The scope of the present impact study is limited to assessment of some physical and chemical parameters of the ice covered Arctic sea subjected to under-ice crude oil discharges, especially those parameters which strongly influence marine plant growth such as light intensity. These have been correlated with algal activity, diversity, and abundance. ... (Au)

#### AGOSTI, J.M.

13

#### The oxidation of certain Prudhoe Bay hydrocarbons by microorganisms indigenous to a natural oil seep at Umiat, Alaska / Agosti, J.M. Agosti, T.E.

(Proceedings - Symposium on the Impact of Oil Resource Development in Northern Plant Communities, 23rd AAAS Alaska Science Conference, University of Alaska, Fairbanks, 1972, p. 80-85)

#### References.

ASTIS document number 179191.

OOO

In order to study the oil-oxidizing capabilities of psychrophilic and other microorganisms, bacterial samples were personally collected from the vicinity of a natural oil seep above the Arctic Circle. The bacteria were tested in mineral salts medium and in enriched medium using fresh water from a tundra lake at Prudhoe Bay, both containing crude oil from a Prudhoe Bay well as their only source of carbon. Oil oxidation was determined by: (1) visual observation, (2) weight loss extraction and (3) biochemical oxygen demand. While measurements using gas chromatography and weight loss methods were not conclusive, visual observation of six of 14 samples cultured on enriched medium showed complete emulsification of crude oil within seven days at 20 degrees C. The sample showed no visual evidence of crude remaining at 48 hours. Observation by ZoBell, Scripps Institution, using our samples, showed unusually rapid oxidation of the mineral oil at lower temperatures. Subcultures initially incubated at 4 degrees C oxidized appreciable amounts of oil in medium kept cold enough to contain mush ice at near -4 degrees C. Some dozen morphological types were observed using a phase contrast microscope. Limited isolations were made. To our knowledge and that of experts in the field, few tests of this type have been conducted previously above 60 degrees North

Latitude. Practical application of this research would be that hyperactive cultures be freeze-dried or slurried, then seeded by air over tundra oil spills should such an event occur along the Arctic segment of the proposed 800-mile Trans-Alaska Pipeline. ... (Au)

See also: 748.

AGOSTI, T.E.

See: 13.

AHEARN, D.G.

See: 193.

AHERN, T.P.

See: 720.

AINLEY, D.G.

14

**Influence of petroleum on egg formation and embryonic development in seabirds /** Ainley, D.G. Grau, C.R. Morell, S.H. Roudybush, T.E. LeValley, R.R. Huber, H.R. Strong, C.S. Wootton, T.A. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 13 : Biological studies, 1981, p. 315-356, ill., maps)

References.

ASTIS document number 167924.

ACU

... general objectives were to appraise the effects that brief, sublethal exposure to an oil spill would have on the reproduction of Cassin's Auklets (*Ptychoramphus aleuticus*) and Western Gulls (*Larus occidentalis*) nesting on the Farallon Islands, California. These species are representative of many birds breeding in Alaska and the lower Pacific Coast states that are at risk from oil pollution during the reproductive period. ... The specific objectives were to determine the effects of a single oral dose of bunker C fuel oil and Prudhoe Bay crude oil on the egg production, hatching success, fledging success, egg yolk structure, and yolk composition of Cassin's Auklet. ... We now know, based on the work reported here, that ingestion of oil in very small amounts, not large enough to be lethal in terms of exposure can have negative repercussions as well. ... it conceivably can cause a reduction in breeding success of surviving adults. ... (Au)

15

**Petroleum ingestion reduces reproduction in Cassin's Auklets /** Ainley, D.G. Grau, C.R. Roudybush, T.E. Morell, S.H. Utts, J.M.

(Marine pollution bulletin, v. 12, no. 9, Sept. 1981, p. 314-317, ill.)

References.

ASTIS document number 179469.

OON

Sublethal doses of petroleum reduced reproduction in a free-living seabird, Cassin's Auklet (*Ptychoramphus aleuticus*), nesting on Southeast Farallon Island, California. The proportion of birds laying

eggs was reduced 9-13 days after ingestion by gelatin capsule 300, 600 or 1000 mg bunker C fuel oil, or 1000 mg Prudhoe Bay crude oil. In addition, among those auklets that eventually laid eggs, hatching was reduced by doses of 1000 mg of bunker C but was unaffected by other treatments. Chick development after hatching was unaffected by any treatment. The total time of egg formation from onset of rapid yolk formation to laying was 13 days, and it is early in this period that auklets are vulnerable to petroleum. (Au)

## ALASKA. COASTAL ENERGY IMPACT PROGRAM

See: 16.

## ALASKA. DEPT. OF FISH AND GAME. MARINE/COASTAL HABITAT MANAGEMENT

16

**Recommendations for minimizing the impacts of hydrocarbon development on the fish, wildlife, and aquatic plant resources of the northern Bering Sea and Norton Sound /** Alaska. Dept. of Fish and Game. Marine/Coastal Habitat Management. Starr, S. J. Kuwada, M.N. Trasky, L.L. Alaska. Coastal Energy Impact Program [Sponsor]. United States. National Oceanic and Atmospheric Administration [Sponsor].

[Alaska] : National Oceanic and Atmospheric Administration, 1981.

viii, 525 p. : ill. ; 28 cm.

References.

ASTIS document number 174912.

ACU

... The object of ... [this] Coastal Energy Impact Study is to (1) develop a comprehensive inventory of fish, wildlife, and aquatic plant resources in the coastal and offshore marine waters of the northern Bering Sea-Norton Sound region, (2) assess and quantify the effects of major activities associated with oil and gas development on fish and wildlife populations, and (3) develop guidelines and recommendations for preventing, reducing, or ameliorating fish, wildlife, aquatic plant, and habitat losses due to hydrocarbon exploration, development and production. ... [The following disturbances are examined with respect to sources and biological effects, and area sensitivity and mitigative measures: site preparation; noise and disturbance; drilling muds and cuttings; oil pollution; dredging and filling, gravel mining, and gravel island construction; shoreline alteration; formation waters; cooling waters and water withdrawal; interference with subsistence, commercial or sports harvests; secondary development; and air pollution.] (Au)

## ALBERT, T.F.

17

**Some thoughts regarding the possible effects of oil contamination on bowhead whales, *Balaena mysticetus* /** Albert, T.F.

(Tissue, structural studies and other investigations on the biology of endangered whales in the Beaufort Sea / Edited by T.F. Albert. - Washington, D.C. : U.S. Bureau of Land Management, 1981, p. 945-953)

References.

ASTIS document number 176559.

It is my opinion that a significant recent oil spill covering a significant area of a lead (or leads) through which bowheads are migrating may pose the gravest of threats to the bowhead whale. Widespread contamination of the near shore lead during the spring migration will put nearly the entire stock at risk, since it is felt that most bowheads utilize the same lead system. ... In the

laboratory it was shown that oil will adhere to roughened areas of preserved bowhead skin. Such areas include: (1) the hundreds of small eroded areas particularly common on the head, (2) the tactile hairs, (3) the conical depressions in the skin from which the tactile hairs emerge. The most likely immediate effect would be on the animal's senses, namely, vision and tactile information provided by hairs. Damage to the eyes is likely to include a conjunctivitis and an inflammation of the cornea. Another effect might include irritation of the skin, particularly involving areas with existing erosions of the skin surface. Such sites might provide an avenue for entry of bacteria into the blood stream and such skin damage could have an effect on the animal's ability to manipulate skin blood flow in response to thermoregulatory needs. Other significant effects could include: the development of a bronchitis or pneumonia from inhaled irritants (combined with resident pathogenic microbes), direct damage to gut associated lymphoimmune tissue (and thereby lowered resistance to disease), and the formation of a mechanical blockage in the stomach and/or small intestine due to ingestion of tar balls and/or matted baleen hairs. (Au)

## ALEXANDER, V.

See: 85.

## ALLARD, J.L.

See: 744.

## ALLEN, A.A.

18

### Canola oil as a substitute for crude oil in cold water spill tests / Allen, A.A. Nelson, W.G.

(Spill technology newsletter, v. 8, no. 1, Jan.-Feb. 1983, p. 4-10, ill.)

#### References.

ASTIS document number 132500.

ACU, NSDB

The physical properties and behavioral characteristics of Canola oil (also known as rape seed oil) were assessed and compared with Prudhoe Bay crude oil under a variety of conditions in the cold chambers at the University of Alaska, Anchorage. Emphasis was placed on the feasibility of using this nontoxic vegetable oil for testing containment and recovery equipment in cold climates, focusing on its potential applications involving oleophilic/sorbent recovery systems with or without ice. ... The behaviour of Canola oil and crude oil in the presence of rope mop fibres, sorbent pads, and ice was examined. ... The objectives were to assess the oleophilic properties of each of these media while noting the rates of oil uptake and release. A simple oil-and-water shake test was also conducted under warm and cold conditions, to compare the tendencies for Canola oil and crude oil to emulsify with seawater. (Au)

19

### Case study : oil recovery beneath ice / Allen, A.A.

(Tenth Annual Offshore Technology Conference, 1978 : proceedings, volume 1. - Dallas, Tex. : Offshore Technology Conference, 1978, p. 261-266, ill., map)

ASTIS document number 173215.

ACU, NFSMO

Approximately 6,000 gal of No. 2 diesel oil were spilled during the winter of 1977 from an onshore storage tank in Nome, Alaska. The oil saturated the snow and soil adjacent to the storage tank and penetrated the ice cover of Snake River. Oil containment and recovery operations involved the removal of contaminated snow, soil, and ice; sorption of oil with 3 M sorbent materials and with

available snow at the site; and the collection of oil from beneath an ice cover 3 to 4 ft thick using an oil mop. The oleophilic, closed-loop rope mop was fed beneath the ice between two holes, one for the oil mop wringer assembly and collection reservoir and the other for the system's tail pulley. Recovery totaled approximately 2,000 gal over a period of 1 week with air temperatures approaching -30 degrees F (-35 degrees C). Recovery rates of 2 gal/min were achieved with the rope mop beneath the ice, while oil-water ratios were in excess of 95 percent. (Au)

20

### Oil spill countermeasures in landfast sea ice / Allen, A.A. Nelson, W.G.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 297-304, ill.)

#### References.

ASTIS document number 162000.

... Controlled oil releases under laboratory and actual field conditions have shown that oil spills in the landfast ice zone will tend to remain highly immobilized and achieve relatively thick concentrations. Such spills will encounter natural conditions that encourage accumulation of the oil at or near the ice surface, limit the areal extent of the oil, and help preserve certain physical and chemical characteristics that facilitate its control. A summary of these phenomena for oil in landfast sea ice reveals several important operational considerations for the development of specific Arctic countermeasure techniques. Such techniques for the containment and removal of oil in the landfast ice zone are presented, emphasizing the use of natural materials and conditions for their implementation. (Au)

See also: 500, 501.

## ALYESKA PIPELINE SERVICE COMPANY

See: 87.

## AMERICAN PETROLEUM INSTITUTE

21

### The proceedings of the Conference on Assessment of Ecological Impact of Oil Spills, 14-17 June, 1978,

Keystone, Colorado / American Petroleum Institute [Sponsor]. United States. National Oceanic and Atmospheric Administration [Sponsor]. United States. Office of Naval Research [Sponsor]. United States. Coast Guard [Sponsor]. United States. Dept. of Energy [Sponsor]. United States. Environmental Protection Agency [Sponsor]. United States. Fish and Wildlife Service [Sponsor].

[Arlington, Va.] : American Institute of Biological Sciences, 1978.

2 v. : ill., figures, tables ; 28 cm.

#### References.

ASTIS document number 84220.

ACU, NSDB

These proceedings include papers delivered to the following sessions: the socio-economic-legal aspects of oil spills; the impact of the Argo Merchant spill (12/15/76); the impact of the Bouchard #65 barge spill in Buzzards Bay (1/28/77); the impact of the Nepeco #140 barge spill in the St. Lawrence River (6/23/76); highlights regarding the impacts of other pertinent oil spills; impact of the Ekofisk Bravo blowout (4/22/77) in the North Sea; effects of spills on wildlife; effects of spills on water column organisms; effects of spills on

benthic organisms; and, effects of spills in extreme climatic zones. (ASTIS)

See also: 399.

AMERO, B.

See: 720.

ANDERSON, C.K.

22

**Results of the Coast Guard's tarball sampling program /**  
Anderson, C.K. Shuh, J.L.  
Washington, D.C. : U.S. Coast Guard Oceanographic Unit,  
1979.

vi, 7 p. : maps ; 24 cm.

(Report - United States. Coast Guard, CG-TR-79-02)

(NTIS AD-A-079 584)

References.

Also available in microfiche.

ASTIS document number 178292.

OON

The U.S. Coast Guard has been conducting a tarball sampling program since December 1971 and to date over 1000 tows have been made. [Tarballs are lumps of weathered petroleum product which are found floating on the sea surface.] These tows have been made in the North Atlantic Ocean, the Labrador Sea, Gulf of Mexico, North Pacific Ocean, Bering Sea and the Gulf of Alaska. In general, low tar concentrations are found in the polar area, the average concentration being less than 0.03 mg/sq. m., and can probably be attributed to the small number of natural seeps and limited amount of man's activities in these areas. High average concentrations (greater than 1.65 mg/sq. m.) were found in the North Atlantic and North Pacific Oceans and the Gulf of Mexico where man's activities in the form of both drilling and shipping are greater. (Au)

ANDERSON, J.W.

23

**Effects of oil and chemically dispersed oil in sediments on clams /** Anderson, J.W. Kiesser, S.L. McQuerry, D.L. Fellingham, G.W.

Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 349-353, ill.)

References.

ASTIS document number 171042.

Several field experiments with natural sediments in the intertidal zone were conducted over a two-year period to compare the effects of Prudhoe Bay crude oil and this same oil dispersed with Corexit 9527 (1 part Corexit to 10 parts oil). The clams used were *Protothaca staminea* and *Macoma inquinata*. Exposure periods ranged from one to six months. In a one-month exposure to about 2,000 parts per million (ppm) total oil in sediments, survival of *P. staminea* was two to three times greater than that of *M. inquinata*, and both species exhibited lower tolerance to oil alone in sediment than dispersed oil at the same concentration. However, uptake of naphthalenes and phenanthrenes by *M. inquinata* was greater from sediments mixed with dispersed oil than oil alone. Dispersed oil in this 30-day exposure also produced a decrease (compared to field controls) in the concentration of some of the free amino acids in the tissues of *M. inquinata*. Four- and six-month field exposures of small *P. staminea* to sediment contained oil or dispersed oil (about

2,000 ppm) reduced growth in both oil treatments (four-month exposure) or in just the chemically dispersed oil treatment (six-month exposure). In the latter experiment initial petroleum concentrations in the surface sediments (top 3 centimeters) were higher (about 3,000 ppm) for the dispersed oil than for oil alone. Surface layers in both conditions were free of contamination (down to 6 cm) after six months. (Au)

24

**Research to determine the accumulation of organic constituents and heavy metals from petroleum-impacted sediments by marine detritivores of the Alaskan outer continental shelf /** Anderson, J.W. Augenfied, J.M. Crecelius, E.A. Riley, R.G. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 172-234, ill.)

References.

ASTIS document number 169820.

ACU

Several benthic Alaskan species (*Macoma inquinata*, *Protothaca staminea*, and *Abarenicola pacifica*) were exposed to detritus bearing heavy metals or hydrocarbon concentrations. Accumulation of this material in the animals was observed, as well as changes in feeding rates and eventual fate of the material as metabolites. (ASTIS)

25

**Research to determine the accumulation of organic constituents and heavy metals from petroleum-impacted sediments by marine detritivores of the Alaskan outer continental shelf /** Anderson, J.W. Augenfied, J.M. Crecelius, E.A. Riley, R.G.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 350-403, ill.) (NTIS PB80-130065, p. 350-403, ill.)

References.

ASTIS document number 178446.

ACU

During FY1977 and 1978, experiments were conducted to examine the bioavailability of petroleum hydrocarbons and trace metals from petroleum-impacted marine sediments. The feasibility of using bivalve condition index and free amino acid pool as indicators of stress due to petroleum exposure was also tested. Prudhoe Bay crude was the test oil in all experiments. When simultaneously exposed to 600 micro g/g oil in sediment for 40 days in the field, detectable levels of hydrocarbons were present in two deposit-feeding species, *Phascolosoma agassizii* and *Macoma inquinata*, but not in *Protothaca staminea*, a filter-feeder. These results suggest that mode of feeding is a determinate factor in the availability of sediment-sorbed hydrocarbons to benthic animals. Tissue magnification of hydrocarbon concentrations above those in or on sediments was not observed. ... Both free amino acid content and condition index of *Macoma inquinata* were sensitive to stress, as they showed significant reductions, compared to control animals, during field exposure to oiled sediment. Compared to sediment concentrations, nickel, zinc, and selenium in *Macoma inquinata*. ... Exposure to oil-contaminated sediment did not appear to affect trace metals content of either species. ... Recent research with a mud-ingesting polychaete, *Abarenicola pacifica*, indicates that this species takes up and retains more phenanthrene than naphthalenes. With this organism and our experimental system, it has been possible to detect behavioral modifications, ingestion (= egestion, rate reduction, and decreases in phenanthrene content of sediment after passage through the gut. (Au)

26.

Toxicity of chemically dispersed oil to shrimp exposed to constant and decreasing concentrations in a flowing system / Anderson, J.W. Kiesser, S.L. Bean, R.M. Riley, R.G. Thomas, B.L.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 69-75)

References.

ASTIS document number 171670.

The shrimp *Pandalus danae* was exposed, in a flowing system, to a water extract of Prudhoe Bay crude oil and to chemically dispersed dilutions of this oil. Mortality produced over a period of 10 hours to 9 days was followed to the point of 50 percent survival in each tank. The product of time to 50 percent mortality (in days) and the measured concentration (in parts per million (ppm)) in each tank was used to describe the toxicity of the solutions. This toxicity index (ppm-days) was 4.5 times higher in the winter and fall than in spring and summer tests with the same oil extract. In the warmer months, when shrimp were more sensitive, oil dispersed with chemicals was about half as toxic as the seawater extract of the oil. Differences in the concentrations of specific petroleum hydrocarbons in the seawater extract and the chemically dispersed oil aid in explaining the toxicity observed. Toxic aromatics represent 98 percent of the extract but only 67 percent of the dispersed oil since the latter is enriched with droplets of oil containing 33 percent saturated and other insoluble components. Linear dilution of dispersed oil to zero in 26 hours resulted in toxicity indices quite similar to those produced in constant exposures. (Au)

See also: 72, 73, 596, 601, 602.

ANDREWS, S.A.

See: 593.

ANWEILER, G.G.

See: 724.

## AQUATIC ENVIRONMENTS LIMITED

27

Nearshore marine fisheries investigations in coastal areas of southeast Baffin Island / Aquatic Environments Limited. DenBeste, J. McCart, P.J. Esso Resources Canada [Sponsor]. Aquitaine Company of Canada Limited [Sponsor]. Canada-Cities Service Ltd. [Sponsor].

[Calgary : Distributed by APOA], 1978.

3 microfiches : ill., figures, maps, tables ; 11x16cm.

(APOA project no. 146 : Biological environmental investigations and analyses in Davis Strait 1978. Report, no. 6)

(Eastern Arctic Marine Environmental Studies)

Bibliography.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EA MES order no. ES36.

ASTIS document number 62898.

CU, NFSMO

Nearshore marine habitats between Edgell Island and Brevoort Island on the southeast coast of Baffin Island were examined during

two cruises of the M.V. Calanus, August 7 to 21 and August 30 to September 7, 1978. ... Principal emphasis ... was placed on an examination of zooplankton communities in the mouth of Frobisher Bay, an important migratory bird feeding area, and on studies of the species composition, relative abundance, life history, and food habits of fish inhabiting nearshore environments. ... Most of the adult fish in nearshore areas are bottom dwelling species which feed on benthic and epibenthic organisms. Densities of adult fish in nearshore habitats along the southeast Baffin Island coast are relatively low when compared with areas in the western Arctic and temperate locations. The wide distribution of most bottom-dwelling species limits the potential damage to populations as a result of oil reaching coastal environments. ... (Au)

## AQUITAINE COMPANY OF CANADA LIMITED

See: 27.

## ARCTEC CANADA LIMITED

28

The behaviour of crude oil spilled under multi-year ice / Arctec Canada Limited. Comfort, G. Purves, W.F. Canada. Environmental Emergency Branch [Sponsor].

Ottawa : Dept. of the Environment, 1982.

x, 76 p. : ill., figures, tables ; 28 cm.

(Technology development report, EPS 4-EC-82- 4).

ISBN 0-662-12121-X.

Appendices.

References.

ASTIS document number 113263.

ACU, NFSMO

In June 1978, a total of 1.8 cubic m of Norman Wells crude oil was discharged at three locations under a multi-year ice cover in Griper Bay, Northwest Territories. ... This report describes the results of a site investigation that was carried out during September 1979, at which time the fate of the spilled oil was determined. The three sites were cored and drilled and the quantity of oil remaining in the ice sheet was estimated. Samples of surfaced oil and oil within the ice sheet were collected and analyzed to obtain estimates of the amount of weathering the oil had undergone. Only a small amount of the oil which was originally discharged was still remaining in the ice sheet. ... Oil on the ice surface was severely weathered with an average weight loss (by evaporation) of more than 42%. It was found that the oil had migrated horizontally within the ice sheet as well as vertically. The test sites still containing oil within the ice sheet had experienced a 400% increase in area of contamination over that originally occupied by the initial discharge. The test site was relatively free of oil and it appeared that the natural processes of dispersion and evaporation had been relatively effective in cleanup. (Au)

29

The interaction of crude oil and natural gas with laboratory-grown saline ice / Arctec Canada Limited. Purves, W.F. Canada. Environmental Emergency Branch. Research and Development Division [Sponsor].

[Ottawa : Environmental Protection Service, Dept. of Fisheries and the Environment, c1978].

v, 18p. : ill., figures ; 28cm.

(Technology development report, EPS 4-EC-78- 9)

ISBN 0-662-10062-X.

References.

ASTIS document number 17493.

ACU, NFSMO

Norman Wells crude oil and natural gas were injected under 35 cm

of saline ice in the laboratory, and 20 cm of additional ice was grown under the oil and gas. ... It is concluded that the presence of gas greatly increases the area over which spilled oil will surface, but does not affect the timing of its appearance. (Au)

30

**Novel countermeasures for an Arctic offshore well blowout /**  
Arctec Canada Limited. Abdelnour, R. Nawwar,  
A.M. Hildebrand, P. Purves, W.F.  
[Ottawa] : Dept. of Fisheries and the Environment, 1977.  
x, 135p. : ill., maps (part. fold.), graphs; tables ; 28cm.  
(Economic and technical review report, EPS 3-EC-77- 14)  
ISBN 0-662-01028-0.

Arctec Canada Limited produced this report under contract to the Environmental Emergency Branch.

Bibliography: p. 95-135.

ASTIS document number 1678.

ACU, NFSMO

The problems of cleaning up oil spilled by an offshore well blowout in the Arctic are reviewed. In-situ burning is recommended as the most promising disposal technique. Various techniques are proposed for holding the oil in a burnable layer. In calm conditions a deep-skirted boom may be suitable, but a floating cargo net is shown to be more suitable for up to 80% ice cover. For 80-100% ice coverage, it is demonstrated analytically and experimentally that oil floating amidst the ice is burnable. In the presence of large floes, techniques for breaking up the ice are proposed to allow gas to escape and oil to be burned. (Au)

31

**Oil movement under ice /** Arctec Canada Limited.  
Sayed, M. Abdelnour, R. Canada. Atmospheric  
Environment Service [Sponsor].  
[S.I.] : Environment Canada, Atmospheric Environment  
Service, 1982.

1 v.

Document not seen by ASTIS.

ASTIS document number 181374.

## ARCTEC, INC.

32

**A field guide for arctic oil spill behavior /** Arctec, Inc.  
Schulze, R. United States. Coast Guard. Research  
and Development Center [Sponsor].  
Washington, D.C. : U.S. Coast Guard, Office of Research  
and Development, 1984.  
4 microfiches : ill., maps ; 11 x 15 cm.  
NTIS AD-A-151 064)

Appendix.

References.

ASTIS document number 173142.

ACU, NSDB(NTIS)

A Field Guide for oil Spill Behaviour was developed to provide the On-Scene Coordinator (OSC) with the spill behavior information needed to assess whether timely and adequate containment and removal actions are taken. The field guide describes arctic ice conditions, the physical properties of oil as it weathers, oil spill behavior in cold water and ice conditions, and spill retention potential for the Alaskan shoreline. The guide then uses six spill scenarios to show the user how to apply spill behaviour information to solve real world problems. (Au)

33

**The transport and behavior of oil spilled in and under sea ice /**  
Arctec, Inc. Cox, J.C. Schultz, L.A.  
Johnson, R.P. Shelsby, R.A. United States.  
Bureau of Land Management [Sponsor].  
(Environmental assessment of the Alaskan continental shelf :  
Final reports of principal investigators. Vol. 3 : Physical  
science studies, 1981, p. 427-597, ill.)

Appendices.

References.

ASTIS document number 167878.

ACU

The objective of this program has been to study the behavior of oil spilled beneath ice cover in the presence of a current. ... The project included both an analytical investigation of the mechanisms of oil-ice interaction and laboratory studies conducted in ARCTEC's glass-walled Ice Flume. [Major results include information on slick thickness, oil behaviour in various types of ice under-surface, and vertical migration of oil through ice]. ... (Au)

34

**Transport of oil under smooth ice /** Arctec, Inc. Uzuner,  
M.S. Weiskopf, F.B. Cox, J.C. Schultz, L.A.  
United States. Corvallis Environmental Research  
Laboratory [Sponsor].  
Corvallis, Or. : Corvallis Environmental Research  
Laboratory, 1979.

1 microfiche : ill. ; 11 x 15 cm.

(Report - United States. Environmental Protection Agency,  
EPA-600/3-79-041)

(NTIS PB-299 235)

References.

ASTIS document number 176974.

Previous studies of oil-ice interaction have been limited to spreading under quiescent conditions. The present study examines the current driven spread of oil under a smooth ice cover. Generalized relations between current speed and oil transport rate are developed and found to be strongly dependent upon the orientation of the oil slick to the direction of current flow. Methods for application are presented. (Au)

See also: 184.

## ARCTIC LABORATORIES LIMITED

See: 206, 239, 243, 459.

## ARCTIC LAND USE RESEARCH PROGRAM (CANADA)

See: 397.

## ARCTIC PETROLEUM OPERATORS ASSOCIATION

See: 342, 419.



## ARCTIC SCIENCE AND TECHNOLOGY INFORMATION SYSTEM

35

Oil spill related research in the public domain at the Arctic Institute of North America : citations and abstracts / Arctic Science and Technology Information System. Consolidex Magnorth Oakwood Joint Venture [Sponsor]. Pallister Resource Management Ltd. [Sponsor]. Calgary, Alta. : CMO Lancaster Sound Joint Venture, 1983. xiii, 115 p. ; 29 cm. (Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document, no. RMPD13)

Also available as 3 microfiches.  
ASTIS document number 121401.

ACU, NFSMO

... These documents are a representative sampling of oil spill research reports available to the public at academic and government libraries. The purpose of this present compilation is to provide an overview of the nature of this research. The reports listed include studies of the biological effects and toxicity of oil in marine environments, the behavior of spilled oil, and oil spill contingency planning, methods and technology. An examination of this sampling will provide the reader with some insight into the existing knowledge of most all aspects of offshore oil spills. This listing does not seek to identify the full extent of that research and knowledge; nor has it been prepared by the Arctic Institute research staff as a bibliography. ... (Au)

## ARCTIC SCIENCES LIMITED

Data report no. 5 : Nearshore studies of the physical oceanography of Cape Warrender, Cape Fanshawe and Cape Hay, 1979 / Arctic Sciences Limited. Birch, J.R. Petro-Canada [Sponsor].

Sidney, B.C. : Arctic Sciences Ltd., 1981.

3 microfiches : ill., figures, maps, tables ; 10 x 16 cm. (Eastern Arctic Marine Environmental Studies)

Appendices.

References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. EN23.

ASTIS document number 82546.

ACU, NFSMO, NSDB(ENV.)

... Arctic Sciences Limited conducted an extensive program of physical oceanographic studies in western Baffin Bay ... three nearshore zones were determined to be of particular interest ... Cape Warrender, Cape Fanshawe, and Cape Hay ... Cape Warrender was chosen because it is in this region that (much of) the intrusive flow into Lancaster Sound appears to break away from the coast and turn across the Sound. Cape Fanshawe was of interest for similar reasons. ... Cape Hay was chosen largely because of the important bird colony there. An oil spill entering Lancaster Sound could follow the intrusive flow across the Sound and could ultimately pass close to Cape Hay. Consequently, it was felt that the nearshore area at Cape Hay should be studied closely in order to answer such questions as: how long might a slick remain near the bird colony, and how close to shore could the oil come. ... (Au)

37

Deep-water blowout trajectory models for the Lancaster Sound region / Arctic Sciences Limited. Marko, J.R. Canada. Environmental Emergency Branch [Sponsor].

Ottawa : Environmental Protection Service, Dept. of the Environment, 1982.

x, 134 p. : figures, tables ; 28 cm.

(Technology development report, EPS 4-EC-82- 2) ISBN 0-662-11990-8.

Appendices.

References.

ASTIS document number 94790.

ACU, NFSMO

Procedures were developed to simulate sea surface movements of oil released from deep-water oil blowouts. Emphasis was laid upon making realistic allowances for the horizontal spreading of oil by turbulence and current-features not included in the 5 nautical mile grid of residual currents utilized. The current values in this grid were established through the use of recent data from moored current-meters and drift-buoys. Simulations were carried out for four hypothetical blowout locations in Lancaster Sound and in the immediately adjoining sector of Baffin Bay. Separate scenarios were calculated at each site for steady winds from each of the four basic directions and for actual recorded wind sequences. Considerable contamination of shorelines occurred in most cases, except under westerly winds which generally tended to sweep oil out into the more open Baffin Bay region. ... (Au)

38

Movement of oil slicks in northwestern Baffin Bay, SLIKTRAK simulations / Arctic Sciences Limited. Narayanan, S. Marko, J.R. Fissel, D.B. Petro-Canada [Sponsor].

Sidney, B.C. : Arctic Sciences Ltd., 1979.

2 microfiches : ill., figures, tables ; 10x16cm.

(Eastern Arctic Marine Environmental Studies)

Appendix.

References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. EN27.

ASTIS document number 82589.

ACU, NFSMO, NSDB(ENV.)

SLIKTRAK is used to simulate the spill movements in the northwestern Baffin Bay/Lancaster Sound area, using the current data estimated from the displacement data set associated with the drift of satellite-tracked drift buoys, and the wind data from Cape Sherard. ... SLIKTRAK predicts that the shore pollution is relatively low if the blowout occurs at the Philpots drilling site. Oil-spills at Jameson site contaminate the Bylot Island shore slightly. ... The coast line of Baffin Island would be polluted significantly if the spills occurred at Byam Martin, Jameson or Norlands sites. SLIKTRAK provides a qualitative picture of the oil movements in the area. ... Recommendations for improved modelling and assessment procedures are included. (Au)

39

Oil spill simulations in the southeastern Beaufort Sea and along the proposed eastern tanker route / Arctic Sciences Limited. Marko, J.R. Foster, C.R. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1981.

[67] p. : ill., figures ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD17)

References.

ASTIS document number 89281.

ACU, NSDB(ENV.)

J.R.

of the

This report presents the results of 15 simulated accidental releases of oil into the Arctic marine environment. The types and locations of the individual releases are believed to be typical of expectations during the summer-fall season of maximum human activity in the proposed Beaufort Sea oil production area and along associated tanker routes. ... (Au)

40

**Oil spill simulations in the southeastern Beaufort Sea, 1969 - 1978** / Arctic Sciences Limited. Marko, J.R.

Foster, C.R. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1981.

i v. (various pagings) : ill., figures ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD14)

References.

*ASTIS document number 87580.*

ACU, NSDB(ENV.)

This report presents the results of 10 annual simulations (1969-1978) of the fate of oil discharged from a continuously running blowout in the southeastern Beaufort Sea. The periods simulated ran from July 15 to October 30 and the blowout site was chosen as (70.3 degrees N, 135 degrees W). These results supplement and expand the statistical basis of an earlier simulation of the August 1-September 30, 1978 period (Marko and Foster, 1981), utilizing the same surface current configurations, spreading assumptions, dissipation and wellhead data, and calculational procedures .... (Au)

41

**The oil spill trajectory data bases for Beaufort Sea and tanker route simulations** / Arctic Sciences Limited.

Marko, J.R. Cuypers, L.E. Birch, J.R.

Fissel, D.B. Lemon, D.D. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1981.

viii, 99 p. : ill., tables ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD16)

Appendix.

References.

*ASTIS document number 87556.*

ACU, NSDB(ENV.)

As part of the documentation required in support of its proposal for oil production in the Beaufort Sea, Dome Petroleum Ltd. has assessed the potential impact of the project upon the environment in terms of a finite number of specific spill scenarios in which oil enters the marine environment from accidental events such as production-well blow-outs and tanker explosions and groundings. ... The present report is intended to provide a detailed description of the methods used to calculate the movements and distributions of the spilled oil masses. The description is divided into two main components, namely: the underlying oil trajectory model ... and the specific configurations of wind, current and ice chosen for each of the scenario calculations .... In each case indications are given of the accuracy of both the calculational assumptions and the representations of the acting environment. In the latter instance indications are also provided for our particular choices of "typical" environmental conditions. (Au)

42

**Oil well blowout simulations for the Dundas drill site, Lancaster Sound, N.W.T. / Arctic Sciences Limited.**

Marko, J.R. Petro-Canada Exploration Inc.

[Sponsor]. Consolidex Magnorth Oakwood Joint Venture [Sponsor].

[Calgary, Alta. : CMO Lancaster Sound Joint Venture], 1983.

i v. (various pagings) : figures, tables ; 29 cm.

(Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document no. RMPD15)

Appendices: A. Oil parcel parameters and oil flow descriptions at the Dundas site. - B. Documentation for Arctic Sciences Ltd.'s oil spill simulation model. - C. Ocean current modelling input. - D. Parcel track program. - E. Snapshot program. - F. Program for the display of oil in biologically sensitive areas. - G. Oil in ice display program.

References.

Contents: [Section 1.] Summer oil well blowout simulations for the Dundas drill site, Lancaster Sound, N.W.T. / Arctic Sciences Ltd. - [Section 2.] Winter oil well blowout simulations for the Dundas drill site, Lancaster Sound, N.W.T. / J.R. Marko.

Also available as 6 microfiches.

*ASTIS document number 121428.*

ACU, NFSMO

The two research reports presented here in one volume were undertaken "to simulate the fate of oil from a hypothetical blowout at the proposed Dundas K-56 drillsite in Lancaster Sound". (ASTIS)

See also: 239.

**ARHELGER, S.D.**

43

**Arctic hydrocarbon biodegradation** / Arhelger, S.D.

Robertson, B.R. Button, D.K.

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 270-275, ill., map)

References.

*ASTIS document number 174963.*

ACU

Supplemented sterile sea water was inoculated with small sample volumes of raw sea water and examined for oil related microbial activity. A ubiquitous Alaskan water microbial population of 1,000 to 100,000/l was indicated. In situ <sup>14</sup>C-dodecane oxidation rates based on <sup>14</sup>CO<sub>2</sub> recovery were: Port Valdez, 0.7 g/l day; Chukchi Sea, 0.05 g/l day; and Arctic Ocean, 0.001 g/l day. Computations show that population estimates and oxidation rate measurements are compatible with each other. (Au)

See also: 597, 598.

**ATLANTIC BIOLOGICAL SERVICES LTD.**

44

**Benthos : nearshore studies in the Makkovik Bay and**

Cartwright region / Atlantic Biological Services Ltd.

Barrie, J.D. Bennett, B.A. Browne, S.M.

Moir, A.J. Total Eastcan Exploration Ltd. [Sponsor].

[Ottawa : OLABS], 1980.

xii, 158 p. : figures, tables ; 28 cm.

(OLABS program report)

Appendices.

References.

*ASTIS document number 117161.*

ACU

... The present report describes results of benthic sampling carried out during summer (1 August to 5 September 1979) at two locations on the central Labrador coast: Makkovik Bay and near Cartwright. Quantitative samples were collected at two sites at each location from the high tide mark to a depth of 50 m using grab, diver-operated airlift and intertidal techniques. This report represents the results obtained in the first year of a multi-year study. ... The ultimate aim of the study is to typify the geographic and geological features of the Labrador coast described by Owens (1977) and McLaren (1980) in terms of their biota. This predictive capability can then be used to plan monitoring and baseline studies, to make evaluations on the impact of an oil spill, and to plan countermeasures. (Au)

**ATLAS, R.M.**

45

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development of the outer continental shelf in the Beaufort Sea / Atlas, R.M.**  
(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 9 : Chemistry and microbiology, p. 1-286, maps)

(NTIS PB-261 408, p. 1-286, maps)

References.

*ASTIS document number 175137.*

ACU

... This project was designed to investigate the potential interactions of microorganisms and pollutants that may result from development of petroleum resources in the outer continental shelf of the Beaufort Sea. Knowledge about the naturally occurring microorganisms is essential for such an assessment. Studies have been begun on establishing a baseline description of microbial communities in the Beaufort Sea. This baseline description includes quantitative information on the occurrence of different physiological groups of microorganisms and on the qualitative taxonomic characteristics of dominant species of microorganisms. It includes information on the ability of the indigenous microorganisms to transform petroleum hydrocarbons that might enter the ecosystem from outer continental shelf petroleum development. (Au)

46

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf in the Gulf of Alaska / Atlas, R.M.**  
(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 9 : Chemistry and microbiology, p. 287-344, ill., maps)

(NTIS PB-261 408, p. 287-344, ill., maps)

References.

*ASTIS document number 175145.*

ACU

... This project was designed to investigate the potential interactions of microorganisms and pollutants that may result from development of petroleum resources in the outer continental shelf of the Gulf of Alaska. Knowledge about the naturally occurring microorganisms is essential for such an assessment. Studies have been begun on establishing a baseline description of microbial communities in the Gulf of Alaska. This baseline description includes quantitative information on the occurrence of different physiological groups of microorganisms and on the qualitative taxonomic characteristics of dominant species of microorganisms. It includes information on the ability of the indigenous microorganisms to transform petroleum hydrocarbons that might enter the ecosystem from outer continental shelf petroleum development. Also, information is included on the

natural incidence of potential human pathogens in shellfish in the Gulf of Alaska. (Au)

47

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf of Alaska / Atlas, R.M.**  
United States. Outer Continental Shelf Energy Assessment Program [Sponsor]. United States. Bureau of Land Management [Sponsor].  
(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. II : Receptors, Microbiology, Ecological processes, p. 1-223, ill., maps)

Appendix.

References.

*ASTIS document number 168092.*

ACU

[The objectives of the study are:] ... To examine the biodegradation of petroleum hydrocarbons in Beaufort Sea sediment. ... To examine the biodegradation and weathering of petroleum in and under sea ice. ... To determine the distribution of microbiological populations in Cook Inlet [and Norton Sound and assess the potential interactions of microorganisms and petroleum hydrocarbons.] ... (Au)

48

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf of Alaska / Atlas, R.M.**  
United States. Outer Continental Shelf Energy Assessment Program [Sponsor]. United States. Bureau of Land Management [Sponsor].  
(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 1-60, maps)

*ASTIS document number 169161.*

ACU

[This study sets out] ... A. To determine the distribution of microbiological populations in ice covered waters of the Bering and Beaufort Seas, and to assess the potential interactions in such areas of microorganisms and pollutants produced by petroleum development on the outer continental shelf. ... B. To examine the potential rates of degradation of various classes of petroleum hydrocarbons within the regions in the Bering Sea into which hydrocarbon contaminants may be transported as a result of petroleum development in the St. George and North Aleutian Shelf lease areas. ... C. To determine the distribution of microbiological populations in Norton Sound and to assess the potential interactions of microorganisms and petroleum hydrocarbons. Specifically: ... To determine if a natural oil seepage in Norton Sound has altered the distribution of microbial populations. ... (Au)

49

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf of Alaska / Atlas, R.M.**  
United States. Outer Continental Shelf Energy Assessment Program [Sponsor]. United States. Bureau of Land Management [Sponsor].  
(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 1-61, maps)

(NTIS PB80-186851, p. 1-61, maps)

*ASTIS document number 169846.*

## ACU

The main objectives of this study were to characterize microbial populations in Lower Cook Inlet and the Beaufort Sea, to determine microbial hydrocarbon biodegradation potentials in Lower Cook Inlet and the Beaufort Sea, to study denitrification potentials in the Beaufort Sea and to study degradation of petroleum in sediment in the Beaufort Sea. ... (Au)

## 50

**Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf of Alaska / Atlas, R.M.**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VI : Receptors, Microbiology, p. 1-84, ill., maps)

(NTIS PB80-130057, p. 1-84, ill., maps)

References.

ASTIS document number 175706.

## ACU

The main objectives of this study were to characterize microbial populations in Lower Cook Inlet, to determine microbial hydrocarbon biodegradation potentials in Lower Cook Inlet, to study degradation of petroleum under ice in the Beaufort Sea and to study degradation of petroleum in sediment in the Beaufort Sea. In situ experiments were begun and sampled in Elson Lagoon to determine the fate of oil trapped under ice or in sediment. ... Hydrocarbon utilizers in Cook Inlet were found in higher numbers in Kachemak Bay, near Kennedy entrance and near Upper Cook Inlet than elsewhere in this area. Hydrocarbon biodegradation potentials in Cook Inlet were lower in November than in April. Hexadecane and naphthalene were utilized to a greater extent than pristane and benzantracene, indicating the resistance of highly branched and condensed aromatic hydrocarbons to biodegradation.

The diversities of heterotrophic bacterial communities in Cook Inlet were high, indicative of a pristine area. ... Our studies indicate that both simple aliphatic and aromatic compounds are degraded by microorganisms indigenous to areas of the Beaufort Sea, Gulf of Alaska and Cook Inlet. (Au)

## 51

**An assessment of the biodegradation of petroleum in the Arctic / Atlas, R.M.**

(Microbial ecology / edited by M.W. Loutit and J.A.R. Miles. New York : Springer-Verlag, 1978, p. 86-90, ill.)

Presented at First International Microbial Ecology Symposium, 1977.

References.

ASTIS document number 32654.

## ACU, NSDB

This paper is based on studies on the fate of oil in several Arctic ecosystems including near and offshore marine environments, estuaries, freshwater lakes, and various types of soil. (Au)

## 52

**Bacterial populations associated with the Arctic amphipod**

*Boeckosimus affinis* / Atlas, R.M. Busdosh, M. Krichevsky, E.J. Kaneko, T.

(Canadian journal of microbiology, v. 28, no. 1, Jan. 1982, p. 92-99, figures tables)

References.

ASTIS document number 83844.

## ACU, NSDB

Microbial populations associated with the amphipod *Boeckosimus affinis* were examined using scanning electron microscopy and by detailed characterization of viable isolates. Bacterial populations were observed on food particles in the midgut, on the anal plates,

and on faecal matter, but no bacteria were observed on the surfaces or on the gut lining of the amphipod. The dominant bacterial populations associated with the amphipods were in the *Vibrio-Beneckea* group. Exposure to petroleum hydrocarbons resulted in a decreased dominance of the vibriolike bacterial populations associated with the amphipods. During captivity (without feeding) there were successional changes in the bacterial populations associated with the amphipods; the diversity of the bacterial community increased and the bacterial populations became less stringent in their physiological and nutritional requirements. (Au)

## 53

**Bacterial populations of the Beaufort Sea / Atlas, R.M.**

Griffiths, R.P.

(The Alaskan Beaufort Sea : ecosystems and environments / Edited by P. W. Barnes, D.M. Schell and E. Reimnitz - Orlando, Okla. ; Toronto, Ont. : Academic Press, 1984, p. 327-345, maps)

References.

ASTIS document number 171530.

## ACU

Prior to 1975 there was little information on the bacteria of the Beaufort Sea. Since that time several studies have been conducted on many aspects of the ecology of the Beaufort Sea, including bacteriology. Like other polar seas, the Beaufort Sea is ice-covered for much or all of the year and has continuous sunlight during the summer and a continuous darkness during the winter. Bacteria living in arctic ecosystems must be adapted to these conditions. The studies discussed here consider the bacteria that occur in the Beaufort Sea with respect to their numbers, diversity, physiological adaptations, metabolic activities, and the potential impact of oil and gas development on them. (Au)

## 54

**Distribution of hydrocarbons and microbial populations related to sedimentation processes in Lower Cook Inlet and Norton Sound, Alaska / Atlas, R.M. Venkatesan, M.I. Kaplan, I.R. Feely, R.A. Griffiths, R.P. Morita, R.Y.**

(Arctic, v. 36, no. 3, Sept. 1983, p. 251-261, figures, tables)

(Technical paper - Oregon State University, Corvallis. Agricultural Research Station, no. 6556)

(Contribution - Los Angeles. University of California. Institute of Geophysics and Planetary Physics, no. 2303)

(Contribution - U.S. NOAA. Environmental Research Laboratories. Pacific Marine Research Laboratory, no. 542)

References.

ASTIS document number 122963.

## ACU, NFSMO

In spring and summer 1978 and spring 1979 an integrated study was carried out to examine the interrelationships of physical (sediment deposition), chemical (organic carbon and hydrocarbon concentrations), and biological (microbial populations and activities) factors in the Cook Inlet and Norton Sound regions with respect to the probable sinks and fates of hydrocarbon contaminants within these ecosystems. Most of the fine-grained sediment entering Cook Inlet is transported out of the inlet into Shelikof Strait. However, significant sediment accumulation occurs within areas of Kamishak and Kachemak bays. In Norton Sound, sediment from the Yukon River is transported counterclockwise around the embayment and approximately 50% is deposited in the nearshore regions of the sound. In both regions, areas of high sediment accumulation are richer in organic carbon and hydrocarbon derived from land, are areas of low sediment accumulation. In general, areas with high sediment accumulation rates for fine-grained particles are also areas of relatively high microbial activity. Results suggest that these elevated microbial activities reflect biodegradation of detrital carbon

associated with these particles. Also, the Cook Inlet and Norton Sound region were found to be free from petroleum hydrocarbon contamination (with the exception of one area in Cook Inlet). No evidence was found of hydrocarbon accumulation resulting from a gas seepage in Norton Sound, nor for accumulation of hydrocarbons in sediments of lower Cook Inlet and Shelikof Strait from oil well operations in upper Cook Inlet. (Au)

55

**Effects of hydrocarbons on microorganisms and petroleum biodegradation in arctic ecosystems / Atlas, R.M.**

(Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 63-100)

References.

ASTIS document number 168629.

This is a general review of the effects of petroleum hydrocarbons on microbial population, taxonomic composition, and metabolism in arctic marine, tundra, pond and river ecosystems. It includes a discussion of microbial degradation in these ecosystems as well. (ASTIS)

56

**Effects of petroleum and related pollutants on arctic microorganisms / Atlas, R.M. Sextstone, A. Busdosh, M.**

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1975, p. 208)

Abstract only.

ASTIS document number 177229.

NSDB

Arctic microorganisms were exposed to various concentrations of crude oil, natural gas and the combustion product SO<sub>2</sub>. Selected bacteria, algae, fungi and lichens and also mixed communities were examined for effects on nitrogen fixation, photosynthesis and respiration. Sulfur dioxide and crude oil reduced photosynthetic activity, as measured by <sup>14</sup>CO<sub>2</sub> fixation, up to 90%, but natural gas had no similar effect. Respiration of mixed communities, aquatic and terrestrial, and of isolated organisms capable of hydrocarbon metabolism increased when exposed to petroleum hydrocarbons. Sulfur dioxide had no effect on the respiratory activity of any tested microorganism. Using the acetylene-ethylene method greater than 90% inhibition of nitrogen fixation of algae and lichens was observed when crude oil was applied, less than 20% inhibition followed SO<sub>2</sub> exposure and no inhibition was caused by natural gas. In addition to these metabolic responses Arctic microbial communities exposed to chronic oil contamination showed a greater percentage of fungi, mesophiles and oxidative microorganisms as compared to similar uncontaminated areas. (Au)

57

**Effects of petroleum pollutants on arctic microbial populations / Atlas, R.M. Schofield, E.A. Morelli, F.A. Cameron, R.E.**

(Environmental pollution, v. 10, no. 1, Jan. 1976, p. 35-43, ill.)

References.

ASTIS document number 172766.

ACU, NSDB

Microorganisms encounter oil in the Arctic from natural seepages and accidental spillages. Incubation of Prudhoe crude oil with water from coastal ponds along Prudhoe Bay resulted in several changes in the microbial communities. Bacterial populations increased by several orders of magnitude; amoeboid protozoa were replaced by flagellated protozoa; coccoid green algae completely disappeared; diatoms increased and blue-green and green filamentous algae appeared to be unaffected. The microbial populations associated with a natural oil seepage at Cape Simpson were markedly different

from those of the adjacent areas. The seep was devoid of vascular plant cover and, in some areas, of bacteria. Fungi were found to be abundant in the bacteria-free regions. Lichens flourished in the older sections. Underlying oil slicks experimentally floated in Prudhoe Bay, the bacterial population increased, in large part attributable to oil degrading Pseudomonads, but species diversity appeared to be unaffected. (Au)

58

**Effects of temperature and crude oil composition on petroleum biodegradation / Atlas, R.M.**

(Applied and environmental microbiology, v. 30, no. 3, Sept. 1975, p. 396-403, ill.)

References.

ASTIS document number 180920.

ACU

The biodegradability of seven different crude oils was found to be highly dependent on their composition and on incubation temperature. At 20 C lighter oils had greater abiotic losses and were more susceptible to biodegradation than heavier oils. These light crude oils, however, possessed toxic volatile components which evaporated only slowly and inhibited microbial degradation of these oils at 10 C. No volatile toxic fraction was associated with the heavier oils tested. Rates of oil mineralization for the heavier oils were significantly lower at 20 C than for the lighter ones. Similar relative degradation rates were found with a mixed microbial community, using CO<sub>2</sub> evolution as the measure, and with a Pseudomonas isolate from the Arctic, using O<sub>2</sub> consumption as the measure. The paraffinic, aromatic, and asphaltic fractions were subject to biodegradation. Some preference was shown for paraffin degradation, especially at low temperatures. Branched paraffins, such as pristane, were degraded at both 10 and 20 C. At best, a 20% residue still remained after 42 days of incubation. Oil residues generally had a lower relative percentage of paraffins and higher percentage of asphaltics than fresh or weathered oil. (Au)

59

**Fate and effects of oil pollutants in extremely cold marine environments / Atlas, R.M.**

[Arlington, Virginia : Office of Naval Research], 1977. i, 52 leaves : figures, tables ; 28cm.

(Annual report - United States. Office of Naval Research. no. 5)

(NTIS AD-A-048 334)

References.

ASTIS document number 18767.

ACU, NSDB(NTIS)

Petroleum degradation was studied using Prudhoe Bay crude oil incubated in situ in several Arctic ecosystems. Studies were conducted in water, ice and sediment ecosystems. No biodegradation of oil was found when oil was allowed to freeze into the ice matrix. When oil was spilled under ice evaporative losses were greatly restricted and biodegradation rates were very low. In sediment, biodegradative changes in the oil were found within a few days of spillage. ... (Au)

60

**Fate and effects of oil pollutants in extremely cold marine environments / Atlas, R.M.**

Louisville, Ky. : Louisville University, Dept. of Biology, 1979. 80 p.

(NTIS AD-A-070 992)

Final report, 1973-1979.

References.

Document not seen by ASTIS.

ASTIS document number 182257.

NSDB(NTIS)

Studies were conducted on the fate and effects of crude and refined

oils in Arctic ecosystems. Major conclusions of the study were: (1) Microbial populations respond rapidly to an introduction of hydrocarbons into the environment by an increase of the number of hydrocarbon utilizing bacteria and a decrease in species diversity; (2) Hydrocarbons will remain in arctic ecosystems for prolonged periods following contamination. Following initial abiotic weathering, biodegradation occurs slowly. The fate depends on the particular ecosystem that is contaminated. Refined oil spillages may contaminate drinking water supplies for long periods of time; (3) Hydrocarbon biodegradation in the arctic is limited mainly by nitrogen and phosphorus, and to a lesser extent by low temperatures. Hydrocarbon utilizing microorganisms are widely distributed; (4) When crude oil is exposed on water, biodegradation reduces absolute amounts of petroleum hydrocarbons, but does not appear to alter the relative percentages of oil components. This appears to be a major difference between petroleum biodegradation in the arctic and in temperate regions; and (5) Petroleum contamination of arctic sediments will result in alterations of the benthic community. Petroleum exhibits differential toxicity to benthic invertebrates. (Au)

- 61  
**Interactions of microorganisms and petroleum pollutants in the Arctic / Atlas, R.M. Schofield, E.A.**  
(Abstracts of the Annual Meeting of the American Society for Microbiology, 1974, p. 64)  
Document not seen by ASTIS.  
ASTIS document number 181110.

- 62  
**Introduction to the Workshop on Ecological Effects of Hydrocarbon Spills in Alaska / Atlas, R.M. Brown, J.**  
(Arctic, v. 31, no. 3, Sept. 1978, p. 155-157, figure)  
ASTIS document number 103292.  
ACU, NFSMO

With continued development of Arctic petroleum reserves there has been growing interest in the fate and effects of petroleum hydrocarbons that may be spilled in northern environments. ... There have been a number of studies made during the past decade on the ecological effects of hydrocarbon spillage in the Arctic areas [This article offers an overview of some of the research undertaken on this subject since 1970.] (Au)

- 63  
**Microbial degradation of petroleum in the Arctic / Atlas, R.M. Busdosh, M.**  
(Proceedings of the Third International Biodegradation Symposium / Edited by J.M. Sharpley and A.M. Kaplan. - London : Applied Science Pub., 1976, p. 79-85, map)  
References.  
ASTIS document number 175234.  
ACU

Microorganisms capable of petroleum utilization were found to be distributed widely in arctic coastal waters with highest concentrations in Prudhoe Bay, Alaska, and lowest in a freshwater pond at Barrow, Alaska. When Prudhoe or Barrow crude oils were incubated with nutrient-enriched water from Prudhoe Bay, about 25% of the oil was lost abiotically and 25% was biodegraded. The weight of the paraffinic and aromatic fractions of the oils decreased during degradation. Oil biodegradation in two coastal ponds at Barrow was nutrient-limited. Addition of an oleophilic fertilizer stimulated biodegradation in the ponds. Seeding with an oil-degrading microorganism also enhanced oil biodegradation in the saline pond but not in the freshwater pond. Direct contact with Prudhoe crude oil was toxic to several invertebrate test organisms. Water-soluble oil components were much less toxic. Enhancing biodegradation by seeding with an oil-degrading microorganism and

adding an oleophilic fertilizer did not result in increased toxicity to the invertebrate test organisms. (Au)

- 64  
**Microbial studies as part of Alaska's Outer Continental Shelf Environmental Assessment Program for offshore petroleum development / Atlas, R.M. United States. Bureau of Land Management [Sponsor].**

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 112-120)

References.

ASTIS document number 175960.  
ACU

... It is essential that an environmental assessment program, especially for offshore petroleum development, include consideration of the ability of the indigenous microorganisms to degrade petroleum pollutants. It is also essential that consideration be given to how inputs from offshore petroleum development will affect the natural metabolic activities of the indigenous microorganisms. ... Changes in microbial populations can be used to detect and monitor ecologic effects of offshore petroleum development. ... The BLM-NOAA sponsored OCEAP program has included microbiological studies touching on each of the above areas. Studies have been started in the Beaufort Sea and Gulf of Alaska, including Cook Inlet regions. Studies have included determination of population levels of a variety of physiologically differentiated microorganisms and taxonomic characterization of the dominant microorganisms. ... (Au)

- 65  
**Petroleum biodegradation in the Arctic / Atlas, R.M. Schofield, E.A.**

(Impact of the use of microorganisms on the aquatic environment : proceedings / Edited by A.W. Bourquin, D.G. Ahearn and S.P. Meyers. - Corvallis, Ore. : U.S. National Environmental Research Center, 1975. Ecological research series, EPA-660/3-75-001, p. 183-198, ill., maps)

(NTIS PB-240 159, p. 183-189, ill., maps)

References.

ASTIS document number 179213.

OON

Alaskan Arctic waters from Prudhoe Bay were found to contain indigenous microbial populations, capable of degrading petroleum hydrocarbons, in concentrations similar to those found in our prior studies of temperate Atlantic coastal waters. The microorganisms were capable of degrading Prudhoe crude oil at 5 C and showed greater oil emulsification than previously studied organisms. Southern Alaskan waters from Port Valdez also contained oil-degrading microorganisms, but these degraded Prudhoe crude at much slower rates than the Arctic organisms and did not show the same ability to emulsify oil. In situ tests in Prudhoe Bay revealed higher oil biodegradation rates when a N and P fertilizer was added. Increases of several orders of magnitude in the populations of oil degraders, especially *Pseudomonas* species, were found underlying miniature oil slicks in Prudhoe Bay. These increases were accompanied by a similar, although slightly less extensive, increase of *Staphylococcus epidermidis*, a non-oil degrading mesophile. Several oil degrading bacteria and yeasts associated with naturally-occurring seepages, or artificially-introduced oil spills, in the Arctic were isolated. These organisms, including members of the genera *Rhodotorula* and *Pseudomonas*, are being tested as possible seed inocula to enhance oil biodegradation in the Arctic. (Au)

66

**Prudhoe crude oil in arctic marine ice, water, and sediment ecosystems : degradation and interactions with microbial and benthic communities / Atlas, R.M. Horowitz, A. Busdosh, M.**

(Recovery potential of oiled marine northern environments. Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 585-590, tables, charts)

Paper presented at Symposium on Recovery Potential of Oiled Marine Northern Environments held at Halifax, Nova Scotia, October 10-14, 1977.

## References.

ASTIS document number 6726.

ACU

A variety of in situ models were used to simulate oil spills in different arctic ecosystems. Numbers of oil-degrading microorganisms were found to increase after oil contamination. Oil contamination of sediment resulted in mortality of indigenous invertebrates. Recolonization of oil-contaminated sediments began shortly after oil contamination but benthic communities were significantly different in oil-contaminated sediment compared with the control, 2 mo after oil contamination. Petroleum hydrocarbons were degraded slowly. Ice greatly restricted losses of light hydrocarbons. Following initial abiotic losses, biodegradation of oil was limited and did not significantly alter the relative percentages of hydrocarbons in the residual oil. We concluded that petroleum hydrocarbons will remain in arctic ecosystems for prolonged periods after oil contamination. (Au)

67

**Responses of the lichens *Peltigera aphthosa* and *Cetraria nivalis* and the alga *Nostoc commune* to sulfur dioxide, natural gas, and crude oil in Arctic Alaska / Atlas, R.M. Schofield, E.A.**

(Astarte, v. 8, no. 2, 1975, p. 53-60, charts, table)

## References.

ASTIS document number 4669.

ACU, NSDB

The sensitivity of the Arctic populations of the lichens *Peltigera aphthosa* and *Cetraria nivalis* and the alga *Nostoc commune* to three pollutants, i.e. sulfur dioxide, natural gas, and crude oil, was determined by measuring rates of nitrogen fixation, carbon dioxide fixation, and oxygen consumption. SO<sub>2</sub> was most inhibitory to CO<sub>2</sub> fixation, but did not inhibit O<sub>2</sub> consumption. Prudhoe crude oil severely inhibited both N<sub>2</sub> and CO<sub>2</sub> fixation. Natural gas has a much lesser effect on the test organisms. Lichens appeared to be less sensitive to the pollutants than the free alga. (Au)

68

**Studies on petroleum biodegradation in the Arctic / Atlas, R.M.**

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 261-269, map)

## References.

ASTIS document number 174971.

ACU

Microorganisms capable of biodegrading petroleum were found to be widely distributed in the Beaufort and Chukchi Seas, but to constitute only a low percentage of the indigenous heterotrophic microbial populations. Concentrations of hydrocarbon utilizing microorganisms were lower in ice than in water or sediment. Hydrocarbon biodegradation potential was also lower in ice than in water or sediment. Natural rates of degradation were slow; maximal losses from experimental oil spills were less than 50% during the

Arctic summer due to combined abiotic and biodegradative losses. Rates of biodegradation were found to be limited by temperature and concentrations of available nitrogen and phosphorous. Residual oil had similar percentages of hydrocarbon classes as fresh oil; biodegradation of all oil component classes, including paraffinic and aromatic fractions, apparently proceeded at similar rates. (Au)

See also: 130, 131, 299, 300, 301, 315, 316, 318, 319, 320, 607, 608, 609.

AUDUNSON, T.

69

**The experimental oil spill on Haltenbanken, 1982 /**

Audunson, T. [Editor]. Celius, H.K. [Editor].

Johansen, O. [Editor]. Steinbakke, P. [Editor].

Sorstrom, S.E. [Editor].

Trondheim, Norway : Institutt for Kontinentalsokkelundersokelser, 1984.

109 p. : ill., maps ; 30 cm.

(Publikasjon - Institutt for Kontinentalsokkelundersokelser, nr.112)

## Appendices.

## References.

ASTIS document number 178098.

... In the period 25 July-1 August 1982, a comprehensive oil spill experiment was executed on Haltenbanken [at 65 02 N, 07 33 E] under the auspices of FOH [the Norwegian Marine Pollution Research and Monitoring Programme]. ... This publication is based on the report from sub-project 1, 'Drift and Spread of Oil', which was IKU's-the Continental Shelf Institute's - main responsibility during the experiment. It focuses on the behaviour of oil spilled at sea, preceded by an environmental data collecting phase and completed by a numerical modelling phase. [The drift and spread of oil on the surface, vertical distribution of oil in the water column, weathering of oil and prediction of oil drift, are covered.] ... (Au)

AUGENFELD, J.M.

70

**Effects of Prudhoe Bay crude oil contamination on sediment working rates of *Abarenicola pacifica* / Augenfeld, J.M.**

(Marine environmental research, v. 3, no. 4, 1980, p. 307-313, ill.)

## References.

ASTIS document number 178659.

OON

... The burrowing and feeding activities of certain organisms transport sediment from the lower anoxic areas to the surface, where aerobic microbes can metabolise hydrocarbons more rapidly. ... Their activity could aid in the recovery of intertidal zones from the effects of oil pollution if they can continue to feed in uncontaminated sediment. ... Lugworms (*Abarenicola pacifica*) were exposed to sediment containing 250 to 1000 ppm Prudhoe Bay crude oil. At concentrations of 500 and 1000 ppm the rate of feeding, as measured by faecal production, was reduced by 70%. Smaller control animals turned over more sediment in proportion to their size than larger ones. Exposure to oil at high levels abolished this difference by greater depression of the rate of faecal production by smaller individuals. ... (Au)

71

**Effects of Prudhoe Bay crude oil in sediment on *Abarenicola pacifica* in laboratory and field experiments / Augenfeld, J.M.**

Sequim Bay, Wash. : Pacific Northwest Laboratory, 1980.



1 microfiche : ill. : 11 x 15 cm.

(Report - Battelle Memorial Institute. Pacific Northwest Laboratories, no. PNL-SA-8134)

#### References.

ASTIS document number 175757.

ACU

Hydrocarbon pollutants are particularly persistent in fine grained intertidal sediments ... and, once introduced, may affect local populations for extended periods .... In view of this vulnerability it would be advantageous to identify responses on the part of organisms typically found in such habitats which could provide early warnings of a deterioration in environmental quality. ... Casual observations in our laboratory suggested that the rate of burrowing of *Abarenicola pacifica*, a species typical of muddy tidal flats, was reduced by hydrocarbons in its environment. Gordon, Dale and Keizer (1978) reached similar conclusions for *Arenicola marina*, a larger, related form, typical of sandy intertidal areas. Their work was carried out in the laboratory for periods of up to two weeks. The work described here included similar experiments using *Abarenicola* and was extended to explore the possibility of using burrowing rates of lugworms as an indicator of pollution levels in the field over longer periods of time. If a reduction in burrowing rates is reflected in reduced food intake, a decline in nutritional status might be expected. In this study we examined the level of free amino acids in the tissues as a possible indicator of nutritional status. (Au)

72

Effects of Prudhoe Bay crude oil-contaminated sediments on *Protothaca staminea* (Mollusca: Pelecypoda) : hydrocarbon content, condition index, free amino acid level / Augenfeld, J.M. Anderson, J.W. Woodruff, D.L. Webster, J.L.

(Marine environmental research, v. 4, no. 2, 1980-1981, p. 135-141)

#### References.

ASTIS document number 178667.

COON

*Protothaca staminea* and *Macoma inquinata* were exposed to sediment contaminated with 1237 ppm Prudhoe Bay crude oil in the field. Eighty-five per cent of the *Protothaca* and 17% of the *Macoma* survived 54 days' exposure. Body burdens of saturated and di- and tri-aromatic hydrocarbons were less than 2 ppm and quite variable. The condition index of *Protothaca* was reduced by 6% by exposure to oil. The level of free glycine in the mantle, gills and adductor muscle did not change significantly, but the taurine level fell, leading to a decrease in the taurine: glycine ratio. It was concluded that *Protothaca*, a filter feeder, is affected less severely by oil pollution than *Macoma*, a detritivore, perhaps because the feeding activity of filter feeders is less inhibited. (Au)

73

Exposure of *Abarenicola pacifica* to oiled sediment : effects on glycogen content and alterations in sediment-bound hydrocarbons / Augenfeld, J.M. Anderson, J.W. Kiesser, S.L. Fellingham, G.W.

Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 443-449, ill.)

#### References.

ASTIS document number 170950.

A one-month field experiment was conducted to determine the alterations of specific hydrocarbons within a fine sediment mixed with oil and to assess the impact of this contamination on the deposit-feeding polychaete, *Abarenicola pacifica*. Fresh or weathered Prudhoe Bay crude oil was mixed with sediment in nominal concentrations between zero and 1,000 parts per million (ppm). Oiled sediment filled the exposure chambers or was placed in a

layer over clean sediment. After one month of exposure under field conditions, concentrations of individual saturate and aromatic hydrocarbons in the worms' body wall muscles were below limits of detection (less than 0.2 ppm saturates and less than ppm aromatics). Analysis of both saturates and aromatics in core samples of sediment systems containing or lacking worms indicated that bioturbation occurred in some instances. The relative release rates of specific aromatic hydrocarbons from sediments were greater at the surface and appeared to decrease with increasing molecular weight. The effect of exposure to oiled sediment on glycogen content of *Abarenicola* body wall was significant ( $p < 0.02$ ). Analysis of individual variability in populations sampled between February and August showed that test groups of 12 control and 12 exposed animals could be used to demonstrate a reduction of 10 milligrams per gram (mg/g) in glycogen levels resulting from environmental conditions. Within the proper testing framework, analysis of *Abarenicola* glycogen content could be used to assess the effects of oil spills on benthic infauna. (Au)

See also: 24, 25.

AUSTIN, T.

See: 534.

AYERS, R.C.

74

Oil spills in the Arctic Ocean : extent of spreading and possibility of large-scale thermal effects / Ayers, R.C.

Jahns, H.O. Glaeser, J.L.

(Science, v.186, Nov. 29, 1974, p. 843-845)

Reply to ASTIS document number 172537, Oil and ice in the Arctic Ocean : possible large-scale interactions / W.J. Campbell, S. Martin, in Science, v. 181, July 29, 1973, p. 56-58.

Reviewed by ASTIS document number 172561, Oil spills in the Arctic Ocean : extent of spreading and possibility of large-scale thermal effects [reply] / S. Martin, W.J. Campbell, in Science, v. 186, Nov. 29, 1974, p. 843-845.

#### References.

ASTIS document number 172553.

ACU, NSDB

This paper questions the assumptions made by Campbell and Martin regarding spill thickness, volume and affected area in their paper on potential spills in the Arctic Ocean. Their projections of albedo changes and oil diffusion mechanisms are also brought into question. (ASTIS)

BABCOCK, M.M.

See: 585.

BAIRD, D.A.

See: 696.

BAKER, B.A.

See: 646.



# BALDOCCHI, F.M.

See: 744.

# BALLOU, T.

See: 272.

# BARBER, F.G.

75

Oil spilled with ice : some qualitative aspects / Barber, F.G. (Proceedings of Joint Conference on Prevention and Control of Oil Spills, June 15-17, 1971, Sheraton Park Hotel, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1971, p. 133-137, ill.) (NTIS AD-748 157)

References.

ASTIS document number 174920.

ACU

... [This brief article] gives an indication of the ways in which containment by an ice cover of spilled oil can occur and of some of the ways in which the containment may be utilized in cleanup. There is in the experience the implication that certain characteristics of an ice cover may be usefully simulated in a man-made structure. (Au)

76

An oiled arctic shore / Barber, F.G. (Arctic, v. 24, no. 3, Sept. 1971, p. 229, ill.)

ASTIS document number 101567.

ACU

A portion of the fuel oil spilled into the harbour at Resolute, Northwest Territories, late in August 1970 went ashore there and, as yet, a firm arrangement concerning cleanup has not been made. The oiling occurred mainly on the upper portion of the intertidal zone, but not above high water .... The oil was believed to have been a mixture of diesel fuel and a heavier fuel, perhaps as heavy as a Bunker C type, but was generally "light" enough so that some penetration into the gravel occurred. ... Apparently the spill occurred from a tanker with a cargo comprising a variety of fuel oils which, during a hose or tank cleaning operation, discharged an oil waste onto the water surface at a position just off the tank farm. At the time (believed to be late on 24 August or early on 25 August), the harbour contained a considerable amount of ice, apparently as much as 8 to 9 tenths ice cover in some places, which in turn contained the oil and limited its movement to the immediate shore to the north and east. A portion of the ice became quite heavily stained with oil and some of this ice eventually moved out of the harbour with the northerly winds of 1 September. However, ablation of a portion of the stained ice occurred while it was grounded on the intertidal zone causing somewhat heavier oiling there and patchiness in the distribution of oil which was visually quite evident on 3 September .... By 1 October the intertidal zone was covered with the ice and only a light stain was visible at the high water line. Recent experience and experiment have demonstrated that ice cover can provide effective control of spilled oil. It seems that the containment at Resolute was also quite effective and would have permitted consideration of a number of cleanup options. For example, the oil might have been pumped into containers ashore or into a ship or barge, or pumped in discrete amounts to other areas of ice cover in a direction away from the tank farm and burned. ... (Au)

# BARCHARD, W.

77

Effects of hydrocarbons and heavy metals on fish harvest / Barchard, W. [Participant]. Birchard, E.C. [Participant]. Bond, B. [Participant]. Langtry, T. [Participant]. Metkosh, S. [Participant]. Schell, D.M. [Participant]. Sekerak, A.D. [Participant]. Sonntag, N. [Participant]. Thomas, D.R. [Participant]. Thomson, D.H. [Participant]. (Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. - Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34, p. 178-190)

References.

ASTIS document number 177920.

ACU

Several species of fish, particularly coregonids, are harvested by residents of Tuktoyaktuk and the more inland communities including Aklavik, Fort McPherson and Arctic Red River. ... Due to the existing and possible expanding human use of fish in the future and experiences associated with tainting elsewhere in the world, the potential for hydrocarbon or heavy metal contamination and subsequent decrease in fish harvests is an area of potential concern within the Beaufort Sea. The following sections briefly summarize qualitative and quantitative evidence regarding the mechanisms of hydrocarbon and heavy metal uptake by fish, as well as the recommendations of the subgroup on monitoring strategies which may be required to address this question in the Beaufort region. [This workshop discussion paper concludes that fish tainting by hydrocarbons is unlikely to be of concern except in sheltered bays such as Tuktoyaktuk Harbour, and that heavy metal contamination in conjunction with hydrocarbon development in the Beaufort is not likely to be a serious problem.] ... (Au)

# BARNES, P.W.

78

Fast ice thickness and snow depth relationships related to oil entrapment potential, Prudhoe Bay, Alaska / Barnes, P.W. Reimnitz, E. Toimil, L.J. Hill, H.R. (POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979. proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 2, p.1205-1225, ill., map, photos.)

References.

ASTIS document number 55980.

ACU, NFSMO

... Investigations in early May, 1978, studied the relationship between ice bottom morphology, sea bed morphology, tidal currents, and variations in snow thickness at three sites representing three different fast-ice environments - protected bay, deep, open lagoon, and narrow tidal channel. ... Snow depth and ice thickness ... exhibit a negative correlation - thin ice coinciding with a thicker insulating snow cover. ... The results imply a seasonal stability for the snow ridge pattern and that sub-ice oil concentrations would be indicated by surficial snow morphology in the fast ice zone. Sub-ice oil would spread parallel to the troughs most readily, and therefore upwind and downwind. ... (Au)

79

Fast-ice thickness and snow depth in relation to oil entrapment potential, Prudhoe Bay, Alaska / Barnes, P.W. Reimnitz, E. Toimil, L.J. Hill, H.R.

Menlo Park, Ca. : U.S.G.S., 1979.  
30 p. : ill., maps : 28 cm.  
(Open-file report - U.S. Geological Survey, 79- 539)

## References.

ASTIS document number 177857.

NSDB

In winter, the undersurface of the sea ice on shallow arctic shelves acts upon the sea bed directly by contact and indirectly by influencing currents and turbulence. The under-ice surface would serve as a trap for pollutants such as oil and gas released from the sea bed. A knowledge of the morphology of the undersurface of the ice is a first step in understanding the sea-bed interactions and in evaluating the quantities, configuration, and dispersal patterns of sub-ice pollutants. ... In early May, 1978, the relationships between under-ice morphology, sea bed morphology, tidal currents, and variations in snow thickness were studied. At three sites representing three different environments - protected bay, deep, open lagoon, and narrow tidal channel - trenches were cut through the ice. ... Snow depth, ice thickness, and ice drafts were measured and an upward-directed side-scanning sonar was towed to examine the morphology of the under-ice surface in an area 100 m square.

The results imply that there is a seasonal stability to the snow ridge pattern and that oil concentrations under the ice would be indicated by surficial snow morphology in the fast ice zone. Spreading directions would be enhanced in the elongate dimensions of the under-ice ridges and troughs, that is, upwind and downwind. In spring, gases will leak to the surface. (Au)

See also: 327.

# BARRETT, R.T.

80

Small oil spill kills 10-20,000 seabirds in north Norway /

Barrett, R.T.

(Marine pollution bulletin, v. 10, no. 9, Sept. 1979, p. 253-255, ill., map, tables)

## References.

ASTIS document number 33596.

ACU, NSDB

An estimated 10-20,000 seabirds were killed by a very small oil spill off the coast of North Norway in March 1979. Despite the fact that over 90% of these were Brunnich's Guillemots *Uria lomvia*, the breeding population of this species was not considered to have been seriously threatened by this spill. On the other hand, this episode did illustrate how extremely vulnerable certain seabird species are to oil. (Au)

BARRIE, J.D.

See: 44.

BARRIE, W.B.

See: 460, 461, 462.

# BARRY, T.

81

The effects of chronic (episodic) oil spills resulting from normal petroleum development activities on birds / Barry, T. [Participant]. Bunch, J.N. [Participant]. Duval, W.S. [Participant]. Everitt, R. [Participant]. Guimont, F. [Participant]. Johnson, S. [Participant]. McComiskey, J. [Participant]. Schweinsburg, R.E. [Participant]. Thomas, D.R. [Participant]. Wolfe, D.A. [Participant].

(Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. - Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34, p. 154-162)

## References.

ASTIS document number 177954.

ACU

Oil spills occur as a result of normal hydrocarbon development activities in the Beaufort Sea. At present, these spills are largely restricted to fuel oils (No. 2 diesel) used for various shorebased and offshore operations (primarily marine vessels), but will likely include crude oil spills at offshore production facilities in the future. Information available through spill report files indicates that the volume of chronic (episodic) spills is inversely related to spill frequency, with the largest proportion of spills involving volumes of less than 1 barrel. At present, the greatest frequencies and largest volumes of oil spills are associated with existing shorebases in the Beaufort development region ... although it is expected that the frequency of spills in offshore areas will increase incrementally as development proceeds. ... [This workshop discussion paper concludes that chronic/episodic oil spills will cause mortality of birds under some circumstances, and that a monitoring program should be started along the Beaufort Sea Coast.] (Au)

82

Effects of oil in open water areas around offshore structures during periods of ice cover on eiders and diving ducks / Barry, T. [Participant]. Bunch, J.N. [Participant].

Danielewicz, B. [Participant]. Everitt, R.

[Participant]. Jandali, T. [Participant]. Johnson, S. [Participant]. McDonald, J. [Participant].

Marko, J.R. [Participant]. Melling, H. [Participant].

(Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. - Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34, p. 166-174)

## References.

ASTIS document number 177970.

ACU

... Data collected by Dome Petroleum ... indicated as many as 40 birds/sq km during spring in open water areas within several kilometres of an exploratory drilling structure located near the shear zone [of the Beaufort Sea.] Chronic (episodic) accidental spills of petroleum hydrocarbons (diesel, crude) into the marine environment occur as a result of routine oil and gas exploration activities in the Beaufort Sea ... and will likely occur with greater frequency as larger volumes of oil are handled during production. It is also important to emphasize that even small oil spills in marine environments can result in extensive mortality of waterfowl and other species of marine-associated birds (Barrett 1979). A review of 100 world-wide oil spills completed by Duval et al. (1981) indicated that the circumstances surrounding spills (particularly location and season) and the types of habitats affected by oil in relation to the abundance and distribution of birds, were more important factors

than spill volume in determining the impact of these events. The major concern and basis for this [workshop discussion] hypothesis is that eiders and diving ducks, which have been assigned a very high Oil Vulnerability Index (OVI; King and Sanger 1979), may suffer extensive mortality if they contact an oil slick near an offshore production structure located near the shear zone. This concern is greatest during the spring migration period when birds may be concentrated in relatively high densities in available open water. (Au)

**BARRY, T.W.**

83

Likely effects of oil in the Canadian Arctic / Barry, T.W.  
(Marine pollution bulletin, v. 1, no. 5, May 1970, p. 73-74, map)

ASTIS document number 178250.

ACU, NSDB

Potential threats to Arctic seabirds and mammals from northern petroleum development are enumerated in this brief article. Several early (1950s and 1960s) spills and their effects and cleanup measures are mentioned. The possibility of oil spilled during icebreaker petroleum transportation operation is discussed, as well as pipeline leakages and offshore blowouts. (ASTIS)

**BARSDATE, R.J.**

84

Microbial release of soluble trace metals from oil impacted sediments / Barsdate, R.J.

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 10 : Chemistry and microbiology, p. 367-380) (NTIS PB-261 409, p. 367-380)

ASTIS document number 176460.

ACU

This project is an investigation of the possible remobilization of trace metals from crude oil impacted sediments [from the Bering Sea and Izembek Lagoon]. The initial results of laboratory experiments suggest that the copper concentration of sediment pore water may increase following the addition of oil, and tentatively the effect is ascribed to the occlusion of trace metal binding or exchange sites by components of the oil. (Au)

85

Natural oil seeps at Cape Simpson, Alaska : aquatic effects / Barsdate, R.J. Alexander, V. Benoit, R.E.

(Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 122)

Abstract only.

ASTIS document number 175900.

ACU

In ponds at the natural oil seeps of Cape Simpson, Alaska, phytoplankton productivity and abundance, as well as number of bacteria, were high in waters in contact with old tars and asphalts. Both oil-free ponds and ponds containing much fresh, low viscosity oil were substantially less productive. The ionic composition of the water was little influenced by the seeps. Phytotoxicity may limit primary productivity in waters in contact with fresh oil, but at lower levels of hydrocarbon stress productivity is high, possibly because of reduced grazing pressure. (Au)

**BARTONEK, J.C.**

See: 111.

**BATES, C.C.**

See: 305.

**BATES, T.**

See: 171.

**BATTELLE MEMORIAL INSTITUTE. NEW ENGLAND MARINE RESEARCH LABORATORY**

86

Baffin Island Oil Spill Project : chemistry component - 2 : analytical biogeochemistry : report on 1983 field experiments / Battelle Memorial Institute. New England Marine Research Laboratory. Boehm, P.D. Steinhauer, W. Cobb, D. Duffy, S. Brown, J. Canada. Baffin Island Oil Spill Project [Sponsor]. Edmonton, Alta. : [BIOS Project], 1984. 2 microfiches : ill., maps ; 11 X 15 cm. (Working report - Baffin Island Oil Spill Project, 83- 2) References.

Fiche heading title: Chemistry 2 : analytical biogeochemistry : 1983 study results.

"Final report contract no. OSZ83-00039".

Also available in paper.

ASTIS document number 160091.

ACU

The fourth year of a continuing series of analytical chemical studies of oil fate and transport from the Baffin Island Oil Spill (BIOS) program has been undertaken. ... Oil concentration in the sediments of Bay 9 after reaching a high of approximately 10 ppm in 1981 decreased to 1-3 ppm in 1982, but were seen to increase to levels of 5-10 ppm in 1983. Detrital feeding benthic animals in Bay 11 appear to have achieved a balance of uptake and depuration of oil while decreasing (through metabolism?) their toxic aromatic hydrocarbon burden. ... Levels of oil in the water column are very low, generally less than 0.5 ppb. [The concentration and composition of residual oil in oiled shoreline plots was also measured]. (Au)

**BATTELLE MEMORIAL INSTITUTE. PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.**

87

Determination of acute and chronic effects of treated ballast water on selected aquatic biota from Port Valdez, Alaska / Battelle Memorial Institute. Pacific Northwest Laboratories, Richland, Wash. Wolf, E.G. Strand, J.A. Alyeska Pipeline Service Company [Sponsor].

[Richland, Wash.] : Battelle Pacific Northwest Laboratories, 1973.

1 v. (various pagings) : ill., maps ; 28 cm.

Appendices.

References.

ASTIS document number 177148.

NSDB(O.S.BIB.)

Batelle Pacific Northwest Laboratories initiated in November 1971 a program under contract for Alyeska Pipeline Service Company to determine the acute and chronic effects of simulated treated ballast water on indigenous biota of Port Valdez. Treated ballast water containing 5-10 ppm oil (derived from Prudhoe Bay crude) ... produced 90 percent or more mortality in 96 hours or less in chum (*Oncorhynchus keta*) and pink (*O. gorbuscha*) salmon. Concentrations of 50 percent or less of treated ballast water had low mortality on salmonids over a 96-hour period. Treated ballast water with oil concentrations up to 30 ppm (by IR spectrometry) did not enhance the natural mortality of amphipods (*Anisogammarus locustoides*), mollusc (*Mytilus edulis*), polychaetes (*Neriesvexillosa*), shore crabs (*Flemingrabsus oregonensis*), and intertidal isopods (*Idotea fewkes*). The toxicity potential of treated ballast wastes on juvenile salmonids was not significantly altered by the treatment process, fish species, fish size, diluent seawater for ballast simulation and temperatures from 13.5 degrees to 20 degrees C. Physiologically stressed fish displayed a higher toxicity response to untreated ballast than acclimated fish. Chum and pink salmon juveniles exposed to low level (10-20 percent) concentrations of treated ballast waters displayed mortality rates measurably higher than control fish. Growth rates of chum salmon were also much lower as the result of exposure to 5 and 10 percent treated ballast. Histological analyses revealed that significant tissues degradation occurred at treated ballast concentrations as low as 1 percent. ... Mussels (*Mytilus edulis*) did not exhibit any histopathological response when exposed to 100, 30 and 10 percent treated ballast water. The pre- and post-embryonic survival of Pacific herring (*Clupea harengus pallasii*) eggs was significantly impaired as the result of exposure to treated ballast water .... (Au)

**BAXTER, D.M.**

See: 541, 542, 543.

## BEAK CONSULTANTS

88

**Environmental impact assessment and oilspill contingency plan in support of an application for a drilling authority to Panarctic - Jackson Bay G-16 / Beak Consultants.** Panarctic Oils Ltd. [Sponsor].

Calgary : Beak Consultants Limited, 1974.

iv. : ill. ; 29cm.

Project title: Proposed offshore well - Jackson Bay G-16, environmental impact assessment and contingency plan.

References.

*ASTIS document number 31160.*

ACU, ACPO

Panarctic ... have made application to drill ... [an] offshore well in Jackson Bay near Ellef Ringnes Island. ... In order to determine if conditions exist which could result in environmental problems when drilling the well, Panarctic Oils Ltd. ... has retained Beak Consultants Limited ... to prepare a statement of present environmental setting, an impact analysis, and a site specific oilspill contingency plan. (Au)

89

**Wildlife surveys - Cape Grassy : a pre-operational study of the distribution and abundance of wildlife in the Cape Grassy area / Beak Consultants.** Panarctic Oils Ltd. [Sponsor].

Carruthers, D.R. Wright, E.M.

Larsen, D. Thompson, I. Dwernychuk, W.

[Calgary] : Beak Consultants Limited, 1975.

15 leaves : ill., maps (part. fold.), col. photos. ; 29cm.

References.

*ASTIS document number 40525.*

ACU, ACPO

... This study was aimed at defining the wildlife distribution and abundance in the Cape Grassy area of the north coast of Melville Island. ... Information on the fate of oil spilled in the study area is non-existent. ... The study was conducted almost exclusively by flying linear and coastal transects. ... On the basis of data gathered during the ... study and on the theoretical oilspill scenario ... Beak concludes that: 1. An estimated 700 to 1400 ringed seals would be affected most seriously during April and May when seal pups are in their lairs. 2. Polar bear and bearded seal populations are not likely to be seriously affected by an oilspill. 3. There are no major waterfowl concentrations in the area. 4. If oil reached the shoreline and contaminated shore leads, a small population of water birds would be affected during various stages of their life cycle in the Arctic. (Au)

90

**Wildlife surveys - Jackson Bay : a pre-operational study of the distribution and abundance of wildlife in the Jackson Bay area / Beak Consultants.** Panarctic Oils Ltd.

Carruthers, D.R. Wright, E.M. Larsen, D.

Thompson, I. Dwernychuk, W.

[Calgary] : Beak Consultants Limited, 1975.

10 leaves : ill., maps (part. fold.) ; 29cm.

A report for Panarctic Oils Ltd.

References.

*ASTIS document number 40533.*

ACU, ACPO

... This study was aimed at defining the wildlife distribution and abundance in the Kristoffer Bay-Danish Strait of Ellef Ringnes and King Christian islands. ... The study was conducted exclusively by flying linear and coastal transects. ... Based on ... data for the time period of the study and the theoretical oilspill scenarios ... Beak concludes that an oilspill at the proposed Jackson Bay offshore well would have minimal effects on the wildlife of the Jackson Bay study area. (Au)

**BEAN, R.M.**

See: 26, 596.

## BEAUFORT SEA ENVIRONMENTAL ASSESSMENT PANEL

See: 535.

## BEAUFORT SEA PROJECT (CANADA)

91

**Offshore drilling for oil in the Beaufort Sea, a preliminary environmental assessment / Beaufort Sea Project (Canada).** Milne, A.R. Smiley, B.D.

Rev. ed.

Victoria, B.C. : Beaufort Sea Project, Dept. of the Environment, 1975.

43 leaves : figures, maps ; 29cm.

*ASTIS document number 18775.*

ACU, NFSMO, NSDB(ENV.)

... This report is an environmental assessment and by assuming hypothetical worst-case oil well blowout scenarios, examines the nature of the transport and fate of oil in the Beaufort Sea and draws conclusions regarding the impact of the oil on the environment, including climate, seabirds, marine mammals and other marine organisms. ... (Au)

See also: 481, 485.

**BECH, C.**

See: 338.

**BEDARD, C.**

See: 122, 144.

**BEJDA, A.J.**

See: 522.

**BELICEK, J.**

See: 510.

**BELORE, R.C.**

See: 117.

**BEND, J.R.**

See: 547.

**BENNETT, B.A.**

See: 44.

**BENNETT, E.B.**

See: 341.

**BENOIT, R.E.**

See: 85.

**BENVILLE, P.E.**

See: 517, 518, 519, 735.

**BERCHA, F.G.**

92

Determination of probabilities of oil blowouts in the Beaufort Sea / Bercha, F.G.

(Spill technology newsletter, v. 2, no. 2, Mar.-Apr. 1977, p. 13-22, ill.)

References.

ASTIS document number 172189.

ACU, NSDB

... In the work described herein, use is not made of historical data on blowout events (except comparatively); but rather the drilling

system and its interaction with geological and environmental forces is directly analyzed utilizing techniques which have previously been used for risk assessment of military and nuclear reactor systems. ... from the network analysis leading to the generation of blowout probabilities, it is possible to determine relative contributions of engineering, human and operator errors as well as environmental severity and drill site geology on the blowout proneness of the system. Accordingly, in addition to being applicable to cost benefit analysis of drilling activities, results of the work can be used to identify areas which need to or can be improved in the systems under consideration, with a consequent decrease in blowout risk. ... (Au)

**BERGERON, R.**

See: 744.

**BIRCH, J.R.**

See: 36, 41.

**BIRCHARD, E.C.**

93

Assessment of the ecological effects of an oil spill in an offshore subarctic environment / Birchard, E.C.

Conover, S.A.M. Greene, G. Telford, A.S.

(The proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 835-855, ill.)

(NTIS AD-A-072 859, p. 835-855, ill.)

References.

ASTIS document number 84271.

ACU

The waters of the eastern Canadian arctic and subarctic, Baffin Bay, Davis Strait, and Labrador Sea hold the potential for large, as yet undiscovered oil and gas formations. Since 1976 a program of field studies and investigations have been undertaken in the Davis Strait region that is intended to gather data to assist in designing the technology of a drilling system and which will be used to assess the ecological implications of drilling in the area. Utilizing this data, and based on oil spill scenarios developed for various hypothetical oil spill situations, an assessment was prepared as part of the development of an environmental impact statement (EIS). (Au)

See also: 77.

**BLACKALL, P.J.**

94

The Baffin Island Oil Spill Project / Blackall, P.J.

Sergy, G.A.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 705-741, map)

References.

ASTIS document number 162884.

This paper outlines the genesis and proposed structure of the BIOS Project. Planned research will focus on physical, chemical and biological fate and effects of marine oil spills, with and without dispersants added. Tests will take place in the Cape Hatt waters off

Baffin Island, N.W.T. (Au)

95

**The BIOS Project - 1980 review** / Blackall, P.J. Sergy, G.A. Thornton, D.E.  
(Spill technology newsletter, v. 6, no. 1, Jan.-Feb. 1981, p. 21-36, map, tables)  
*ASTIS document number 70068.*  
ACU, NFSMO, NSDB

In the November-December 1979 issue of this Newsletter, Volume 4(6), an article entitled "EXPERIMENTAL OIL SPILL: OIL IN ARCTIC COASTAL ENVIRONMENTS" outlined the objectives and general design of what has become known as the Baffin Island Oil Spill (BIOS) Project. Since that article was written the first year of the projected four-year program has been completed successfully. This article provides a brief review of the major, primarily baseline studies carried out during the first year of the project and summarizes some of the preliminary findings. (Au)

96

**The BIOS Project : an update** / Blackall, P.J. Sergy, G.A.  
(Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 451-455, maps)  
*ASTIS document number 160016.*

The Baffin Island Oil Spill (BIOS) Project, formally begun in March 1980, now is entering the fourth and final year of the planned field work. ... This paper provides an overview of studies sponsored by the BIOS Project during the first three field seasons. Highlighted are the major oil releases which involved a total of 40 cubic meters of medium gravity crude oil. In addition, the preliminary results of the pre- and post-spill physical, chemical, and biological studies are presented. The physical program studies predicted the proper time and location for the oil releases and monitored the subsequent physical fate and behavior of the oil. The chemical program studies monitored the pre- and post-spill hydrocarbon levels in the water, sediments, and tissue of selected macrobenthic species, and also the environmental chemistry of the study area. The biological program studies to date have characterized the macrobenthic flora and fauna, the microorganisms, and the shorter-term effects of the oil releases on the subtidal biota. The potential ramifications of the BIOS Project's results on future oil spill countermeasure strategies are discussed. (Au)

97

**The BIOS Project : frontier oil spill countermeasures research** / Blackall, P.J. Sergy, G.A.  
(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 167-172, map)  
*ASTIS document number 161969.*

After 16 months of planning, the Baffin Island Oil Spill (BIOS) Project was formally initiated in March 1980. ... This paper outlines the background and scope of the 4-year project and provides an overview of the first field season's results. Highlighted are the preliminary oil discharges, which took place in August 1980, and which marked the start of studies on the long-term fate of oil on Arctic beaches. In addition, the results of the baseline physical, chemical, and biological studies are presented. ... (Au)

98

**BIOS Project : preliminary results** / Blackall, P.J. Sergy, G.A.  
(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 292-295, map)  
*ASTIS document number 159999.*

The Baffin Island Oil Spill (BIOS) Project, formally initiated in March 1980, is now entering the fourth and final year of the planned field work. The primary objectives of this internationally funded project are: a) to determine if the use of chemical dispersants in the Arctic nearshore will reduce or increase the environmental effects of spilled oil; b) to assess the fate of oil; and c) to compare the relative effectiveness of other shoreline protection and cleanup techniques. This article only touches on the more significant and interesting preliminary results of the BIOS Project. ... [Preliminary results indicate that] neither the dispersant-treated nor the untreated surface oil release had any acute environmental effects. The ultimate impact of both releases is, however, still unknown. (Au)

See also: 685, 687.

**BLACKWELL, J.W.**

See: 260.

**BLASKO, D.P.**

99

**Occurrences of oil and gas seeps : Alaska Peninsula, Alaska : western Gulf of Alaska** / Blasko, D.P.  
Anchorage, Alaska : U.S. Bureau of Mines, Alaska Field Operation Center, 1976.  
1 microfiche : maps ; 11 x 15 cm.  
(Bureau of Mines report of investigations, 8122)  
(NTIS PB-253 013)  
Appendix.  
References.  
Cover title: Oil and gas seeps in Alaska: Alaska Peninsula, western Gulf of Alaska.  
*ASTIS document number 178713.*  
ACU

Two general areas of the Alaska Peninsula (Iniskin Peninsula and Becharof Lake) where oil and gas seeps were known to occur were investigated in an attempt to determine (1) whether the seeps are still active, and (2) the amount of bitumen contained in the drainage leaving the seeps. Samples of the oil, water, oil/water, and gas were taken and analyses performed. Results are provided in the tables accompanying a brief description of the seeps. The more prolific seep occurrences of the Iniskin Peninsula and Becharof Lake areas were also the locations of early day oil exploration. Information is included in this report on the wells drilled near the seep areas. ... [Bitumen content of the water was as high as 9.773 mg/l at one seep, but averaged less than 1 mg/l where the seep-drainage water entered the Gulf of Alaska.] (Au)

100

**Occurrences of oil and gas seeps along the Gulf of Alaska** / Blasko, D.P.  
(Eighth Annual Offshore Technology Conference : 1976 proceedings. - Dallas, Tex. : Offshore Technology Conference, 1976, v. 1, p. 211-220, maps)  
(OTC paper, 2444)

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 172)

#### References.

Appears in Science in Alaska 1976 proceedings as abstract only.

ASTIS document number 176010.

ACU

Oil seeps on portions of the Alaska Peninsula (Iniskin Peninsula and Puale Bay area) and north central Gulf of Alaska (Katalla area, Cape Yakataga to Yakutat Bay area) were investigated to determine (1) whether previously reported seeps are still active, (2) the characteristics of the seeping hydrocarbons, and most importantly (3) the amount of bitumen contained in the drainage leaving the seeps and entering Gulf of Alaska waters. ... (Au)

101

Oil and gas seeps in Alaska : north-central Gulf of Alaska / Blasko, D.P.

Washington, D.C : U.S. Bureau of Mines, 1976.

2 microfiches : ill., maps ; 11 x 15 cm.

(Bureau of Mines report of investigations, 8136)

(NTIS PB-259 325)

Appendix.

ASTIS document number 180785.

OON

Two areas of oil and gas seeps - the Katalla River to Bering River and Cape Yakataga to Yakutat Bay areas - were investigated to determine (1) whether previously reported seeps are still active, (2) the characteristics of the seeping hydrocarbons, and (3) the amount of bitumen contained in the drainage leaving the seeps and entering the Gulf of Alaska waters. Most of the seeps that were previously noted in the literature were found to be active. Thirteen separate oil seeps, 6 bitumen deposits, and 8 gas seeps were located and sampled. Oil and gas were analyzed using standard distillation and gas analysis methods. The oils ranged from 35.2 degrees API gravity to 14.1 degrees API gravity and had sulphur content (wt-pct) ranging from .53 to 1.31. Bitumen samples had API gravities from 2.4 degrees to 14.6 degrees and sulphur (wt-pact) content from .28 to .88. Analyses confirmed that although the water at the oil seep sites sometimes contained high bitumen content, the amount of hydrocarbons actually reaching the Gulf of Alaska waters from the seeps is minimal: (average <0.2 mg/l). (Au)

BLAYLOCK, J.W.

See: 602, 715.

BLISS, L.C.

102

The ecological impact of northern petroleum development / Bliss, L.C. Peterson, E.B.

(Le petrole et le gaz arctiques : problemes et perspectives = Arctic oil and gas : problems and possibilities, rapports scientifiques / Fondation francaise d'etudes nordiques, congres international, 5e, Le Havre, France, 2-5 mai, 1973. Publies sous la direction de Jean Malaurie. Paris : [Mouton & Co., c1975]. Contribution - Paris. Universite. Ecole des hautes etudes en sciences sociales. Centre d'etudes arctiques, no. 12, v. 2, p. 505-537)

(APOA project. no. 37 : Arctic environmental research, tundra and ecological studies on the Mackenzie Delta and Devon Island. Report)

Bibliography: p.530-537.

ASTIS document number 30228.

ACU, NFSMO

... The objective of this paper is to present biological information from land, fresh water, and marine environments on how these systems may react to various perturbations associated with the exploration, development and transportation phases of arctic oil and gas development. This paper will not discuss the ecological effects of northern mining activities. For the petroleum industry most emphasis in this paper will be upon the ecological effects of the exploration phase but much of the information can be extrapolated to the development and transportation phases. (Au)

BOEHM, P.D.

103

Baffin Island Oil Spill Project : chemistry component : report on 1981 oil spill experiment, vol. 2 : summary of analytical biogeochemistry / Boehm, P.D. Fiest, D.L. Hirtzer, P. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.

ix, 334 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 2) Appendix.

Cover title: Chemistry 2 : analytical biogeochemistry : 1981 study results.

#### References.

ASTIS document number 170020.

ACU

[The second year of the Baffin Island Oil Spill Project chemistry component induced the following objectives:] 1. To compare the biogeochemical fates of chemically dispersed versus surface spilled oil. 2. To examine the composition of low and high molecular weight petroleum components in the water column of the four bays, and to examine the changing composition with time (i.e., weathering). 3. To examine the chemical nature and weathering of residual surface oil and beached oil. 4. To explore the compositional fractionation of water-borne oil ... 5. To examine the transport of oil to the bottom sediments ... 6. To examine the acquisition, assimilation, and depuration of petroleum residues by several species of benthic marine organisms .... (Au)

104

Baffin Island Oil Spill Project : chemistry component : volume 2 / Boehm, P.D. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1981.

viii, ca. 130 p. (various pagings) : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 2) Appendices.

Cover title: Chemistry 2 : hydrocarbon chemistry : 1980 study results.

#### References.

ASTIS document number 169994.

ACU

The chemistry component of the Baffin Island oil spill project (BIOS) involved two basic tasks during the first year of the project: (1) to chemically characterize the marine environment of the Ragged Channel bays prior to the experimental oil spills ... and (2) to perform chemical measurements of the oiled shoreline plots to determine the concentration and composition of residual oil in these experimental spills [Hydrocarbon analyses were performed on sediment, sea water, and invertebrate and fish tissue]. (Au)

105

**Baffin Island Oil Spill Project : chemistry component : volume 2 : final report / Boehm, P.D.** Canada.

Environmental Protection Service [Sponsor]. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 271-463, ill.)

References.

ASTIS document number 169250.

ACU

The chemistry component of the Baffin Island oil spill project (BIOS) involved two basic tasks during the first year of the project: (1) to chemically characterize the marine environment of the Ragged Channel bays prior to the experimental oil spills (i.e., the Nearshore Study baseline), and (2) to perform chemical measurements of the oiled shoreline plots to determine the concentration and composition of residual oil in these experimental spills (i.e., the Shoreline Experiment). ... [The project was] designed to create the chemical foundation for a multiyear examination of the chemical fates and biological assimilation of the spilled oils. (Au)

106

**A biogeochemical assessment of the BIOS experimental spills : transport pathways and fates of petroleum in benthic animals / Boehm, P.D. Fiest, D.L.**

Hirtzer, P. Scott, L. Norstrom, R.J.

Engelhardt, F.R.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 581-618, ill., map)

References.

ASTIS document number 164364.

The present study focuses on seen species of benthic marine organisms, sampled and analyzed in detail as part of the assessment of the use of dispersants in Arctic waters as a measure to combat spilled oil. These organisms were selected to represent various feeding niches so as to assess the biogeochemical transport routes, bioaccumulation and depuration of oil released under controlled conditions in different scenarios. This program represents a rare opportunity to study the benthic community from both chemical and biological vantage points, given a considerable amount of pre-spill (i.e. baseline) information. Samples of seawater, offshore sediments, beach sediments, benthic animals, and surface oil were collected from the four experimental bays on Cape Hatt, Baffin Island, during August and September, 1981. (Au)

107

**Comparative fate of chemically dispersed and untreated oil in the Arctic : Baffin Island Oil Spill studies 1980-1983 / Boehm, P.D. Steinhauer, W. Requejo, A.**

Abb, D. Duffy, S. Brown, J.

(Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 561-569, ill., map)

References.

ASTIS document number 162051.

The experimental oil spill studies designed to assess the comparative short and long term fates and effects of chemically dispersed and untreated nearshore discharges in the Arctic were undertaken as part of the Baffin Island Oil Spill (BIOS) Project. The fates of oil in the water column, in subtidal and beach sediments, and in five species of filter- and deposit-feeding animals were investigated. Analytical results indicate that the discharge of chemically dispersed oil caused a large but short-lived chemical

impact on the water column (up to 50 ppm), a significant initial bioaccumulation of oil, and little sediment impact. In contrast, untreated oil, allowed to beach, did not have a significant water column impact, but did result in a large scale landfall, continuing long term erosion of oil off the beach, and increasing oil levels in subtidal sediments and deposit-feeding animals. (Au)

108

**The comparative fate of chemically dispersed and untreated oils in an arctic nearshore environment / Boehm, P.D.**

(Oil spill chemical dispersants : research, experience, and recommendations : a symposium sponsored by ASTM Committee F-20 on Hazardous Substances and Oil Spill Response, West Palm Beach, Fla., 12-13 Oct. 1982 / Edited by T.E. Allen. ASTM special technical publication, no. 840, 1984, p. 338-360, ill.)

References.

ASTIS document number 156205.

ACU

The distribution and environmental fate of petroleum hydrocarbons introduced into the nearshore environment of Cape Hatt, Baffin Island, Canada, during two controlled experimental discharges of a Venezuelan (Lagomedio) crude oil have been studied. An analytical program based on a combination of ultraviolet/fluorescence studies, high resolution gas chromatography, and computer-assisted gas chromatographic mass spectrometry has been used to examine several hundred oil, sea-water, sediment, sediment trap, surface floc, and benthic animal (seven species) samples to determine the distribution, transport, and weathering of oil spilled in two scenarios: as untreated oil on the surface and as chemically dispersed oil discharged below the surface. Conclusions are drawn about the weathering of oil in the two scenarios, transport of low and high molecular weight hydrocarbons into the water column, their persistence, the sedimentation of oil, the incorporation of oil into the sediment via sedimentation onto the surface floc and direct penetration of the sediment/water interface, and the uptake and depuration of untreated and chemically dispersed oils by seven species of filter feeders and deposit feeders in the subtidal benthos. (Au)

109

**Long-term fate of crude oil in the arctic nearshore environment : the BIOS experiments / Boehm, P.D.**

(Proceedings of the Sixth Annual Arctic Marine Oil Spill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 280-291, ill., maps)

References.

ASTIS document number 159972.

A summary of the results from the BIOS 1982 (1 year post-spill) field sampling and chemical analysis program is presented. Petroleum hydrocarbons persist in the offshore sediments of the test bays, with levels increasing at the site of the untreated oil spill (Bay 11) where oil had impacted the beach previously. Levels in the water column are low, but detectable low-molecular-weight alkanes and aromatic hydrocarbons are observed. These compounds, in turn, are being acquired by the filter-feeding benthic animals [Mya truncata, Serripes groenlandicus, Macoma calcaria, and Strongylocentrotus droebachiensis were studied]. Residual levels of oil in the animals are low, 1-60 ppm, 1 year after the spills, but a continuing impact is noted in Bay 11. Possible sources of oil to the water column and benthos of the various bays are discussed. (Au)

See also: 86, 224, 226, 230, 496.



**BOND, B.**

See: 77.

**BORSTAD, G.**

See: 459.

**BOYD, B.D.**

See: 305.

**BRATTBakk, I.**

See: 632.

**BRODERSEN, C.C.**

110

**Sensitivity of larval and adult Alaskan shrimp and crabs to acute exposures of the water-soluble fraction of Cook Inlet crude oil / Brodersen, C.C. Rice, S.D. Short, J.W. Mecklenburg, T.A. Karinen, J.F.**

(Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 575-578)

**References.**

*ASTIS document number 177199.*

NSDB, ACU

The sensitivity of adult and larval Alaskan shrimp and crabs to the water-soluble fraction (WSF) of Cook Inlet crude oil was measured by tests using 96-hour static bioassays at the water temperatures that these animals normally encounter. Larval crustaceans were found to die more slowly than adults, making it necessary to measure sensitivity in terms of concentrations causing moribundity (death imminent) instead of in terms of concentrations causing death during exposure. The cessation of all motion and reaction was found to indicate moribundity in adults, and the cessation of swimming was found to indicate moribundity in larvae exposed for 96 hr. Ninety-six hour LC50's for moribundity for stage I larvae ranged from 0.95 to 1.8 ppm depending on species, while 96-hr LC50's for adults ranged from 1.9 to 4.2 ppm oil. Sensitivities for stage I-VI larvae of coonstripe shrimp ranged between 0.24 ppm and 1.9 ppm. Larvae were more sensitive to oil than adults. The sensitivity of larvae depended on species and developmental stage. Larvae are probably more vulnerable than adults to oil exposure because of greater sensitivity to oil and greater susceptibility to predation. Cold-water species may be particularly vulnerable because of increased time spent as developing larvae. (Au)

See also: 581, 584, 585, 593.

**BROICH, W.A.**

See: 289, 290, 291.

**BROOKS, J.W.**

111

**Environmental influences of oil and gas development in the Arctic Slope and Beaufort Sea / Brooks, J.W.**

Bartonek, J.C. Klein, D.R. Spencer, D.L. Thayer, A.S.

Washington, D.C. : U.S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, 1971.

iv, 24 p. : ill. ; 26 cm.

(Resource publication - U.S. Fish and Wildlife Service, no. 96)

**References.**

*ASTIS document number 180459.*

OOFF

This report describes the environmental characteristics and renewable resources of the Arctic Slope and the Beaufort Sea in relation to oil and gas development. Problems associated with industrial activities are identified, and recommendations for avoiding or minimizing environmental and resource damage are advanced. It is noted that the simplicity of the ecosystems, the slow rate of organic processes, and the presence of permafrost create unique problems in connection with pollution, waste disposal, restoration of vegetation, and all activities which disturb the vegetated surface. In the Beaufort Sea, the shallowness of the continental shelf and the presence of pack ice represent serious physical obstacles to oil development and transportation and heighten the probability of potentially harmful accidents. The risk of serious environmental and resource damage in the Arctic will be greatly lessened by the imposition of high operational and safety standards. There is need for strengthening legal authority to promulgate essential regulations. As an interim substitute, close and effective cooperation between Government and industry must be developed. Both Government and industry have an obligation to support research aimed at providing an adequate understanding of numerous environmental and technical questions. (Au)

**BROWN, D.W.**

See: 434, 437, 438, 440, 457.

**BROWN, G.W.**

See: 374.

**BROWN, H.M.**

112

**Dispersant effectiveness in cold water / Brown, H.M.**

Goodman, R.H. Canevari, G.P.

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985. Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 245-259. ill.)

**References.**

*ASTIS document number 165204.*

ACU

... For oil spill contingency plans in such areas as the Beaufort Sea, the Arctic Islands or the North Atlantic continental shelf, a dispersant is required which is effective in water temperatures of 5 degrees C or less where ice may be encountered. During November 1984, tests of dispersant effectiveness were carried out at Esso Resources' wave basin facility in Calgary, Canada. Two dispersants were used: Corexit 9527 and a new experimental dispersant designated CRX-8. ... On the basis of these measurements, it is estimated that 33% of the spilled oil was effectively dispersed by

the CRX-8 in 20 cm waves. This is significantly better than the 24% dispersed by Corexit 9527. ... (Au)

**BROWN, J.**

See: 62, 86, 107.

**BROWN, P.J.**

See: 307, 309, 479.

**BROWN, R.**

113

**Oil under multi-year ice / Brown, R.**

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 110-111)

Abstract only.

ASTIS document number 177873.

NSDB, OON

The major objective of this project was to determine the path and rate of rise of oil migrating up through multi-year ice. The program was carried out offshore in Griper Bay, on the north side of Melville Island, N.W.T. Approximately 1.5 cubic m of Norman Wells crude oil were spilled in June 1978, beneath a multi-year ice floe. This volume was equally divided between three under-ice depressions which had been located by a diver. ... The preliminary results of the work carried out to date indicate that oil reached the surface above two of the oil polls. A crack is felt to be the path taken at one of the sites, but the migration route at the second site is unknown. It is hoped that the March field work will resolve this question. (Au)

See also: 205.

**BROWN, R.G.B.**

114

**The effects of Kurdistan oil on seabirds / Brown, R.G.B.**

Johnson, B.C.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 203-211)

Appendix.

References.

ASTIS document number 169749.

OON

The oil tanker Kurdistan broke in two off northern Cape Breton on March 15, 1979, releasing ca. 7900 tons of Bunker C fuel oil, most of which did not begin to come ashore until mid-April. As usual with such incidents, seabirds were the animals most directly affected. The preliminary data presented here indicate that several thousand birds were killed - a mortality comparable with that caused by the Arrow and Irving Whale incidents off Atlantic Canada in February 1970 .... (Au)

115

**Impact on sea birds : preliminary comments / Brown, R.G.B.**

(The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and L. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 115-122, ill.) - ASTIS document number 177091.

NSDB

The Atlantic Region of the Canadian Wildlife Service (CWS) was involved immediately and directly as soon as the breakup of the tanker Kurdistan became known. ... Initially there appeared to be little impact or effect on seabirds, either in the Sydney Bight area or on the Scotian Shelf. Certainly there was no massive kill as an immediate result of the tanker breakup, except for some lightly oiled birds that came ashore early on, along the Sydney shoreline. These probably came in with oil entrained in the drifting pack-ice as the ice-fields drifted in through Cabot Strait and closed off the entire Sydney Bight area within a few days after the tanker accident. ... In retrospect the Kurdistan was an unusual tanker accident. Unlike the Arrow incident, which occurred in similar weather under similar conditions in roughly the same area, the Kurdistan spill did not result in immediate bird mortalities. The impact was delayed until the arrival of the oil slick onto the Cape Breton Island shorelines four weeks later. Mortality estimates are low and inaccurate because of (1) the length of time the oil remained at sea, (2) the lack of bird kill counts during the cleanup operation, and (3) general inaccessibility of much of the Cape Breton and Guysborough County shoreline. The incident also pointed out the need to be properly aware of the environmental hazards associated with a spill. In the end the lost oil slick proved to be far more damaging environmentally than the intact cargoes of oil that remained in the two halves of the tanker: the towable stern section, and the untowable bow section which was later sunk off the Scotian Shelf south of Sable Island. Yet most of the attention effort expended was directed to the two tanker halves. The 7,000 tons of Bunker C was put out of mind until it reappeared four weeks later, after the operation had apparently been brought to a successful conclusion. (Au)

**BROWNE, S.M.**

See: 44.

**BRUEGELLER, P.**

116

**Freezing of water in w/o emulsions / Bruegeller, P.**

(Journal of dispersion science and technology, v. 3, no. 4, 1982, p. 395-417, ill.)

Alternate title: Freezing of water in water-in-oil emulsions. References.

ASTIS document number 181382.

OON

A short review is given on the freezing of water in w/o [water-in-oil] emulsions. First the state of supercooled water is discussed. The quantitative treatment of the liquid-solid phase transition in supercooled water is given by the homogeneous nucleation theory. From the experimental methods, which are used to study supercooled water, only few are applicable to the liquid-solid phase transition. From these methods electron microscopy, thermal analysis and EPR are chosen to reveal some characteristic features of freezing of water in w/o emulsions. At the end of the paper the production of vitreous water by jet-freezing of w/o emulsions is reported. It is shown that especially the role of the surface molecules, which are necessary to stabilize emulsions with micrometric sized droplets, is not understood in the liquid-solid transition. The possibility of reaching the homogeneous nucleation temperature of -40 degrees C in w/o emulsions (and also the fact, that water can be vitrified in w/o emulsions using small cooling rates of

... 00.000 - 1,000.000 C/sec compared to the estimated necessary rate (10,000.000.000 degrees C/sec), may not only be caused by a statistical effect leading to the negligibility of heterogeneous nuclei, but also by some surfactant effects influencing the formation of homogeneous nuclei. (Au)

BUCHANAN, R.A.

See: 401.

BUCKLEY, D.E.

See: 716, 717.

BUIST, I.A.

117

Behaviour of and response to a major oil spill from a tanker in arctic waters / Buist, I.A. Belore, R.C. Solsberg, L.B.

(Spill technology newsletter, v. 8, no. 3, May-June 1983, p. 50-77, figures)

References.

ASTIS document number 135143.

ACU, NSDB

... This paper presents a review of techniques available to respond to a major oil spill from a tanker in Canadian Arctic waters. The size of potential oil releases and the behaviour of the spilled oil in a range of Arctic environmental conditions are discussed. Also included is a survey of the applicability of conventional countermeasures to a northern tanker accident. The use of igniters to burn oil contained by a complete ice cover is analyzed, and potential on-board self-help spill control and cleanup techniques for proposed Arctic tankers are reviewed. Finally, conclusions are drawn regarding the state-of-the art, and recommended actions are presented. (Au)

118

Dome Petroleum's oil and gas undersea ice study / Buist, I.A. Pistruzak, W.M. Dickins, D.F.

(Spill technology newsletter, v. 6, no. 3, May-June, 1981, p. 120-146, figures, tables)

References.

ASTIS document number 71366.

ACU, NFSMO, NSDB

... To tie all the previous work on oil migration and in situ burning together, Dome undertook a major oil spill experiment during the winter of 1979/80 in the Beaufort Sea. Dome's objective in this field experiment was to determine how successful burning would be as a countermeasure and to optimize burning techniques for oil and gas released from a Beaufort Sea blowout under ice. ... The experiment took place in three phases, approximately eight kilometres offshore in McKinley Bay in the Beaufort Sea, in first-year sea ice. Approximately 19 cubic m of crude oil were discharged under the ice in conjunction with gas (air). This oil surfaced in the spring in pools thick enough to burn. Some 80% of the oil discharged was removed from the marine environment. (Au)

119

Dome Petroleum's oil and gas undersea ice study / Buist, I.A. Pistruzak, W.M. Dickins, D.F.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. -- Ottawa : EPS, 1981, p. 647-686, figures, tables)

References.

ASTIS document number 80853.

ACU, NFSMO

To tie all the previous work on oil migration and in situ burning together, Dome undertook a major oil spill experiment during the winter of 1979/80 in the Beaufort Sea. Dome's objective in this field experiment was to determine how successful burning would be as a countermeasure and to optimize burning techniques for oil and gas released from a Beaufort Sea blowout under ice. ... (Au)

120

Fate and behaviour of water-in-oil emulsions in ice / Buist, I.A. Potter, S.G. Dickins, D.F.

(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -- [Ottawa : EPS, 1983], p. 263-279, ill., maps)

References.

ASTIS document number 171026.

... The occurrence of stable water-in-oil emulsions could drastically alter past conclusions regarding the fate and behaviour of oil spills under sea ice. A major concern was that emulsions, having viscosities which are orders of magnitude greater than those of crude oil, would not flow upward through the brine channels. Hence, the oil may not appear on the surface until it is too late to mount an effective in situ burning operation. Other theories, similarly untested in the field, predicted that water in-oil emulsions could break when frozen due to internal ice growth. This field experiment was designed to determine the actual behaviour, fate, and cleanup effectiveness when stable water-in-oil emulsions are spilled under first year sea ice. The experiment was deliberately biased in that an extremely well mixed and stable emulsion was placed under sea ice in late winter. The ice was of a thickness such that the sheet would break up in spring prior to the emulsion being exposed by ablation alone. If this emulsion appeared prior to breakup and was amenable to cleanup by in situ burning, then emulsions formed by a subsea blowout under ice, or by any other mechanism, at any prior time would certainly appear and be burnable. (Au)

121

Oil & gas under sea ice study / Buist, I.A. Dickins, D.F. Dome Petroleum Limited.

[Calgary : Dome Petroleum Limited, 1980].

15 microfiches : ill., figures, plates, tables ; 10 X 15 cm.

(COOSRA project report, no. CS04V1-2)

Appendices : volume 2.

References.

ASTIS document number 80470.

ACU, NFSMO

... Dome Petroleum undertook to simulate a sub-sea blowout under first year ice. The major objectives of this experiment were: 1) to further understand how oil and gas behaved when discharged under ice; 2) to field test various clean-up techniques, particularly in situ burning using air-deployable igniters; 3) to assess the capability to cleanup oil spilled from a sub-sea blowout under ice; and 4) to investigate water-in-oil emulsion formation. ... Overall, approximately 80% of the total oil discharged was removed from the marine environment by in situ burning, evaporation and manual cleanup.... Overflights and shoreline surveys subsequent to breakup revealed no traces of the remaining oil. ... (Au)

See also: 207, 216, 416.

## BUNCH, J.N.

122

**Abundance and activity of heterotrophic marine bacteria in selected bays at Cape Hatt, N.W.T. : effects of oil spills, 1981 / Bunch, J.N. Bedard, C. Cartier, T.**

Ste-Anne-de-Bellevue, Que. : Arctic Biological Station, 1983. 2 microfiches : ill. ; 11 x 15 cm.

(Canadian manuscript report of fisheries and aquatic sciences, no. 1708)

(Working report - Baffin Island Oil Spill Project, 81- 5)

Also available in paper.

## References.

"This report has also been issued as: Bunch, J.N., C. Bedard and T. Cartier, 1983. Microbiology: 1. Effects of oil on bacterial activity - 1981 study results. Baffin Island Oil Spill (BIOS) Project Working Report 81-5: xiv + 82 p. Environmental Protection Service, Canadian Department of the Environment, Edmonton, Alberta".

ASTIS document number 173541.

ACU, NSDB

The effects of petroleum crude and a petroleum crude-dispersant mixture on the bacteria of the sediments and water column of nearshore locations at Cape Hatt, N.W.T. were assessed ... before and after experimental oil releases and ... during a baseline study in 1980. In vitro experiments using petroleum crude dispersant (Corexit 9527) or a mixture of both provided additional information concerning oil effects on bacteria. ... It is concluded that the addition of Corexit to spilled petroleum might severely limit biodegradation of the oil. ... No change in either bacterial numbers or activity in the sediments can be definitely related to either of the oil releases. (Au)

123

**Abundance and activity of heterotrophic marine bacteria in selected bays at Cape Hatt, N.W.T. 1980 : first report to the Baffin Island Oil Spill (BIOS) project / Bunch, J.N.**

Harland, R.C. Laliberte, J. Canada.

Environmental Protection Service [Sponsor]. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 557-621, ill., maps)

## References.

ASTIS document number 169277.

ACU

On the basis of bacterial abundance and activity, three bays at Cape Hatt, N.W.T. have been judged to be similar and therefore suitable for comparative microbiological studies during and after experimental petroleum spills in 1981. ... (Au)

124

**Biodegradation of crude petroleum by the indigenous microbial flora of the Beaufort Sea / Bunch, J.N.**

Harland, R.C.

Victoria, B.C. : Beaufort Sea Project, Dept. of the Environment, 1976.

iii, 52p. : graphs, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 10)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 10)

Bibliography: p.42-44.

ASTIS document number 11657.

ACU, NFSMO

... The objectives of this study were to: 1. determine if a

biodegradation potential exists in the south Beaufort Sea. 2. determine rates of degradation at various temperatures including deg. C by various cultures isolated. 3. determine optimum temperatures for oil degradation and the requirements for nitrogen and phosphorus at optimal and sub-optimal temperatures. 4. determine, if possible, in situ rates of biodegradation. (Au)

125

**Biodegradation of crude petroleum by the indigenous microbial flora of the Beaufort Sea / Bunch, J.N.**

Victoria, B.C. : Beaufort Sea Project, 1974.

12 p. : map ; 28 cm.

(Technical report - Beaufort Sea Project, no. B5a)

## References.

"Interim report of Beaufort Sea Project Study B5a".

ASTIS document number 180963.

ACU

Microbiological samplings of the South Beaufort Sea in the summer of 1974 produced mixed cultures of heterotrophic bacteria which demonstrated a capacity for the biodegradation of Norman Wells crude at 5.0 degrees C. Relatively complete degradation of the aliphatic fraction was observed in almost all cultures but analyses have not yet been completed. The first culture to demonstrate degradation after an enrichment procedure was submitted to incubation with petroleum at various temperatures. This culture was found to degrade petroleum at 0 degrees C, but at a much slower rate than at 30 degrees C. Optimum temperatures for degradation by other cultures remain to be determined. (Au)

126

**Degradation of petroleum by a psychrotolerant marine flora from the Eskimo Lakes, N.W.T. / Bunch, J.N.**

Harland, R.C.

(Marine ecology : Mackenzie Delta and Tuktoyaktuk Peninsula. - [S.l.] : Environmental-Social Committee Northern Pipelines, 1974. Task Force on Northern Oil Development (Canada) report, no. 74- 22, p. 1-30, ill., map)

## Appendix.

## References.

ASTIS document number 179493.

ACU

In an initial study of biodegradation of petroleum in Arctic marine waters, efforts were made to quantitate and isolate oil-degrading or oleoclastic bacteria in the Eskimo Lakes [and the south Beaufort Sea], N.W.T. The abundance of this flora in the Eskimo Lakes could not be ascertained with the procedure employed. Marine oleoclastic bacteria were however, isolated by means of an enrichment procedure. In laboratory studies, mixed cultures obtained with the enrichment procedure were found to degrade three petroleum crudes to some extent. Norman Wells crude was degraded at temperatures as low as 2.0 degrees C. Lower temperatures were not evaluated. A preliminary experiment suggested that phosphorus and nitrogen concentrations in seawater might not be limiting for degradation at low temperatures, but further studies are required. (Au)

127

**Oil degradation and heterotrophic capability of marine organisms in the Beaufort Sea / Bunch, J.N.**

(Programme and proceedings of the annual meeting - Canadian Federation of Biological Societies, v. 19, 1976, p. 47)

## Abstract only.

Document not seen by ASTIS.

ASTIS document number 181129.

See also: 81, 82, 143, 144, 145, 146.

**BURBANK, D.C.**

See: 692.

**BUSDOSH, M.**

128

The effects of Prudhoe crude oil fractions on the arctic amphipods *Boeckosimus affinis* and *Gammarus zaddachi* / Busdosh, M.

Louisville, Ky. : University of Louisville, Dept. of Biology, 1978.

xiii, 110 p. : ill. ; 22 cm.

Thesis (Ph.D.) - University of Louisville, Louisville, Kentucky, 1978.

References.

ASTIS document number 177172.

NSDB

Toxic effects of whole crude oil and its fractions on indigenous amphipod crustaceans were examined in field and laboratory experiments. *Boeckosimus* (= *Onisimus*) *affinis* and *Gammarus zaddachi* were the test organisms. *B. affinis* were collected six miles east of Barrow, Alaska, from Elson Lagoon, which was also the site of the recolonization of oiled-sediment field studies. *G. zaddachi* were collected from meromictic Nuwuk Lake. Amphipods were exposed to surface slicks of whole crude oil and paraffinic, aromatic, and asphaltic fractions of Prudhoe crude oil or Arctic diesel oil. High mortalities were associated with the whole crude oil slick (100% mortality in 10 days), the paraffinic fraction slick (100% in 4 days), the water soluble components (WSF) of the aromatic fraction (70% in 20 days), and the Arctic diesel oil slick (100% in 2 days). Low mortalities (10%-15%) were observed with the asphaltic fraction. Six mixtures of WSF portion of aromatic fraction were prepared for test exposures by mixing crude oil and sea water. ... [Varying exposures to the mixtures produced changes in food search success and burrowing behaviour.] (Au)

129

Long-term effects of the water soluble fraction of Prudhoe Bay crude oil on survival, movement and food search success of the arctic amphipod *Boeckosimus* (= *Onisimus*) *affinis* / Busdosh, M.

(Marine environmental research, v. 5, no. 3, 1981, p. 167-180)

References.

ASTIS document number 171760.

OON, NSDB

The arctic amphipod *Boeckosimus* (= *Onisimus*) *affinis* was exposed to the water soluble fraction (WSF) of Prudhoe Bay crude oil. Animals were constantly exposed or one-time exposed for 3 or 10 days and then removed to clean water. In constant exposure experiments mortality was correlated to the strength of the solution for 6 weeks; afterwards animals in all solutions experienced similar mortality. Food search success lessened for 2 weeks, then gradually increased. Distance moved and time spent moving decreased as the concentration of the WSF increased. Animals one-time exposed to the WSF showed initial mortality rates of 15-20 percent with little further mortality. Food search success was lessened relative to the strength of the WSF and duration of exposure, with general recovery within two weeks. Distance moved was decreased, but time spent moving was not. The overall period of testing was four months. (Au)

130

Potential long-term effects of Prudhoe Bay crude oil in Arctic sediments on indigenous benthic invertebrate communities / Busdosh, M. Dobra, K.W. Horowitz, A. Neff, S.E. Atlas, R.M.

(The proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 856-874) (NTIS AD-A-072 859, p. 856-874)

References.

ASTIS document number 84280.

ACU

Laboratory and field experiments were performed to determine the potential toxicity of Prudhoe Bay crude oil to indigenous Arctic benthic invertebrates. Toxicity was measured as mortality and as sublethal behavioral changes in feeding, movement and burrowing activities. ... Weathering of the oil was monitored by gas-liquid chromatography. Given a choice, in laboratory studies with oil contaminated or uncontaminated sediment, the amphipods selectively burrowed into the uncontaminated sediment. Exposure in experimental chambers to sediment contaminated with fresh oil also resulted in decreased movement and feeding activity during the month that the oil underwent initial weathering. Mortality rates were low for amphipods exposed to sediment contaminated with fresh or weathered oil. Behavioral changes in feeding and movement appear to be temporary and associated with the light hydrocarbons present in fresh crude oil. Inhibition of burrowing activities persisted beyond the time of initial oil weathering. Recolonization of in situ oil-contaminated sediment was monitored for 30 weeks. ... Recolonization began within two weeks of oil contamination. The benthic community recolonizing oil contaminated areas was significantly different in species composition from that in unoiled reference areas. ... The preference for burrowing in unoiled substrate shown in the laboratory studies appears to be reflected in the avoidance of oil contaminated sediment in the in situ Arctic benthic community studies. (Au)

131

Toxicity of oil slicks to arctic amphipods / Busdosh, M. Atlas, R.M.

(Arctic, v. 30, no. 2, June 1977, p. 85-92, ill.)

References.

ASTIS document number 103551.

ACU

A study was conducted to measure the toxicity of oil spills to Arctic amphipods. Exposure to oil resulted in death, especially if animals physically entered the slicks. Arctic diesel was more toxic than Prudhoe crude oil. Toxicity of Prudhoe crude oil was associated with the paraffinic and aromatic components. Exposure to the tarry asphaltic fraction of crude oil did not result in amphipod mortality. (Au)

See also: 52, 56, 63, 66, 599.

**BUTLER, R.G.**

See: 375, 376, 695.

**BUTTON, D.K.**

See: 43, 354, 597, 598, 707.

## BYFORD, D.C.

132

Effect of low temperature and varying energy input on the droplet size distribution of oils treated with dispersants / Byford, D.C. Laskey, P.R. Lewis, A. (Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. - [Ottawa : EPS, 1984], p. 208-228, ill.)

## References.

ASTIS document number 164690.

The size of the dispersed oil droplets produced by treating oil slicks with dispersants has been recognized as a parameter of importance for a long time. However, the size range of the dispersed oil droplets achieved in both laboratory and at-sea tests, appears to be in some doubt, to judge by the wide differences reported in various papers. ... In considering the recorded results and the apparent discrepancies between them, it seemed worthwhile investigating the possibility that all the results were correct for the situations in which they were obtained and that it was particular differences in the conditions which could bring about the wide variations observed. We have accordingly measured the dispersed oil droplet size distribution in three established laboratory procedures which were the Labofina, Mackay (sometimes termed the M-N-S after Mackay-Nadeau-Steelman) and Oscillating Hoop Tests, operated over a range of different temperature and energy conditions. During these studies, it became apparent that there were other parameters which considerably affect dispersed oil droplet size distribution and these are also described in this paper. ... (Au)

## CALDARONE, E.M.

See: 134, 135.

## CALDWELL, B.A.

See: 287, 289, 290, 291.

## CALDWELL, R.S.

133

Acute and chronic toxicity of seawater extracts of Alaskan crude oil to zoeae of the Dungeness crab, *Cancer magister* Dana / Caldwell, R.S. United States. Bureau of Land Management [Sponsor].

Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 345-375, ill.)

## References.

ASTIS document number 169625.

## ACU

The objective of the study is to attempt to determine the incipient toxic concentration of a seawater soluble fraction of Alaskan crude oil to larval crabs under conditions of long-term exposure in laboratory culture. The study is emphasizing the commercially important Dungeness crab, *Cancer magister*. The incipient toxicities of benzene and naphthalene, two major aromatic compounds in crude oil, are also being determined under comparable experimental conditions. ... (Au)

134

Effects of a seawater-soluble fraction of Alaskan crude oil and its major aromatic components on larval stages of the Dungeness crab, *Cancer magister* Dana / Caldwell, R.S. Caldarone, E.M. Mallon, M.H.

(Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976. Vol. III, p. 157-168, ill.)

## References.

Volume published 1977.

ASTIS document number 173525.

## ACU

Larval stages of the Dungeness crab, *Cancer magister* Dana, were exposed continuously to dilutions of Alaskan crude oil water-soluble fraction (WSF) or seawater solutions of naphthalene or benzene for periods lasting up to 60 days. Effects on survival, duration of larval development and size were employed as indicators of toxic effects. By these criteria the toxic threshold for exposure to the WSF was estimated as 4.0% of the full strength WSF (0.0049 mg/l as naphthalene or 0.22 mg/l as total dissolved aromatics). The lowest concentration at which toxic effects were observed with naphthalene was 0.13 mg/l and with benzene was 1.1 mg/l. ... (Au)

135

Effects of a seawater-soluble fraction of Cook Inlet crude oil and its major aromatic components on larval stages of the Dungeness crab, *Cancer magister* Dana / Caldwell, R.S. Caldarone, E.M. Mallon, M.H.

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varana. Toronto : Pergamon Press, 1977, p. 210-220, ill.)

## References.

ASTIS document number 174980.

## ACU

Larval stages of the Dungeness crab, *Cancer magister* Dana, were exposed continuously to dilutions of Cook Inlet crude oil water-soluble fraction (WSF) of seawater solutions of naphthalene or benzene for periods lasting up to 60 days. Effects on survival, duration of larval development and size were employed as indicators of toxic effects. The lowest concentration of the WSF at which toxic effects were seen was 4.0% of the full strength WSF (0.0049 mg/l as naphthalene or 0.22 mg/l as total dissolved aromatics). The lowest concentration at which toxic effects were observed with naphthalene was 0.13 mg/l and with benzene was 1.1 mg/l. The concentration of aromatic hydrocarbons in the WSF were inverseley related to the degree of alkylation in each of the benzene and naphthalene families, but the acute toxicity of the 12 compounds was directly related to the degree of alkyl substitution. In addition, naphthalene and its derivatives were more toxic than benzene and its derivatives, but less concentrated in the WSF. Because of these relationships, the individual aromatic compounds, contributed approximately equally to the acute toxicity of the WSF. The collective toxicity of these compounds tested individually accounted for only 8.4% of the WSF acute toxicity. Since benzene contributed a greater fraction of the WSF toxicity in the chronic experiments (approximately 30%) it is suggested that the toxicity of this compound may involve a different mechanism in long term exposures than in acute tests. (Au)

## CALKINS, D.G.

136

**Marine mammals of lower Cook Inlet and the potential for impact from outer continental shelf oil and gas exploration, development, and transport** / Calkins, D.G.  
United States. Minerals Management Service  
[Sponsor].

(Environmental assessment of the Alaskan continental shelf :  
Final reports of principal investigators. Vol. 20, December  
1983, p. 171-263, maps)

### References.

ASTIS document number 168459.

ACU

The objectives of this report are: (1) review: (a) all available data on marine mammals in Cook Inlet; (b) all pertinent information on the physical, chemical and biological properties of Cook Inlet and (c) the known oil operations, probable development scenarios and the fate of oil in the marine environment. (2) synthesize the data into a comprehensive discussion on marine mammal use of Lower Cook Inlet. (3) determine the potential for impact by oil and gas exploration, production and transportation on marine mammals. (Au)

## CALLAWAY, R.J.

137

**Transport of pollutants in the vicinity of Prudhoe Bay, Alaska** / Callaway, R.J. Koblinsky, C.

(Environmental assessment of the Alaskan continental shelf :  
Principal investigators reports for the year ending March  
1976. Vol. 11 : Physical oceanography and meteorology,  
p. 427-755, ill., maps)

### Appendices.

### References.

ASTIS document number 178322.

ACU

... A set of computer runs has been made on a section of the Arctic Coast centered about Prudhoe Bay. Large scale model simulations were reproduced in two fine-grid models interior of the larger area: Prudhoe Bay and Simpson Lagoon. ... The objectives of the study are to determine flushing rates, retention times and pollutant transport in the vicinity of Prudhoe Bay. For this purpose, a single-layer model of circulation was applied in order to compute tidal elevations and surface currents. Inferences were made from the computer output as to probable transport rates and pollutant dispersion. ... The objectives of the study relate to potential drilling operations in a limited section of the Arctic Coast. ... Potential trajectories and the dispersion of pollutants can be estimated from the time series plots of currents presented. Offshore blowouts during low onshore wind conditions could result in wide-spread dispersion of pollutants along the coast. Evidence indicates transport toward the west would be most dominant during the ice-free season, although drift towards Canada could occur with westerly winds. ... Oil spills entering rivers (of the system modeled) would be constrained to remain nearshore. ... (Au)

## CAMERON, J.A.

138

**Ultrastructural effects of crude oil on early life stages of Pacific herring** / Cameron, J.A. Smith, R.L.

(Transactions of the American Fisheries Society, v.109, no. 2,  
1980, p. 224-228, ill.)

### References.

ASTIS document number 178527.

OON

Eggs of Pacific herring, *Clupea harengus pallasii*, collected from Prince William Sound, Alaska were exposed to Prudhoe Bay crude oil for 4-144 hours, then returned to uncontaminated seawater for further development. Newly hatched larvae from both control and experimental groups showed no gross abnormalities. Transmission electron microscopy revealed inter- and intracellular spaces in brain and muscle tissues of exposed organisms but not in those of controls. Many mitochondria in the body muscle of exposed organisms were swollen, some with deteriorating cristae structure (Au)

See also: 658, 659.

## CAMERON, R.E.

See: 57.

## CAMMAERT, A.B.

See: 426, 428, 745.

## CAMPBELL, W.J.

139

**Oil and ice in the Arctic Ocean : possible large-scale interactions** / Campbell, W.J. Martin, S.

(Science, v.181, July 6, 1973, p. 56-58, map)

Reviewed by ASTIS document number 172553, Oil spills in the Arctic Ocean : extent of spreading and possibility of large-scale thermal effects / R.C. Ayers, H.O. Jahns, J.L. Glaeser, in Science, v. 186, Nov. 29, 1974, p. 843-845.

### References.

ASTIS document number 172537.

ACU, NSDB

The diffusion and transport mechanisms generated by the pack ice dynamics of the Beaufort Sea, combined with the slow rate of biodegradation of oil under Arctic conditions, would combine to diffuse an oil spill over the sea and eventually deposit the oil on the ice surface, where it would lower the natural albedo over a large area. (Au)

See also: 454.

## CANADA. ARCTIC MARINE OILSPILL PROGRAM

140

**Experimental oilspills general plan** / Canada. Arctic Marine Oilspill Program [Sponsor].

Ottawa : Environmental Emergency Branch, Research and Development Division, 1979.

iii, 83 p. : 28 cm.

### Appendices.

### References.

ASTIS document number 177121.

NSDB

Scientific and technical work, aimed at improving the response to arctic marine oilspills, has reached a stage where there is a strong need for experimental oilspills. The complexity of obtaining scientific, financial and public support in an acceptable time frame often makes such important and needed experiments impractical. This document describes an integrated program of five "core" studies involving experimental oilspills, which has been developed

through a comprehensive planning process, and which would fill most of the needs expressed by experts. ... [The five projected studies: 1. Oil and gas under Beaufort Sea ice, 2. Oil on cold water, 3. Oil in Arctic nearshore environment, 4. Oil on Arctic shorelines, 5. Oil in east coast pack ice.] With continued public and scientific support, and assuming that additional funds and regulatory approvals can be secured, the first experimental spill in the North will be during the summer of 1980. (Au)

141

**Report - Canada. EPS. Arctic Marine Oilspill Program /**  
Canada. Arctic Marine Oilspill Program.

no. 1 (1978)-

[Ottawa : Fisheries and Environment Canada], 1978-  
maps, charts, tables.

Irregular.

*ASTIS document number 8567.*

ACU

Presents information on the Canadian Arctic to aid in the development of oilspill countermeasures and studies the impact of oil spills on the marine environment in the area. (ASTIS)

See also: 370, 394, 474, 475, 476.

## CANADA. ATMOSPHERIC ENVIRONMENT SERVICE

See: 31.

## CANADA. BAFFIN ISLAND OIL SPILL PROJECT

See: 86, 103, 104, 145, 146, 188, 190, 191, 203, 204, 205, 221, 223, 224, 225, 236, 274, 282, 283, 328, 400, 402, 403, 424, 461, 511, 526, 527, 628, 712, 742, 743.

## CANADA. DEPT. OF FISHERIES AND OCEANS. ARCTIC BIOLOGICAL STATION

142

**Marine mammal studies in southeastern Baffin Island /**  
Canada. Dept. of Fisheries and Oceans. Arctic Biological Station.

Smith, T.G. Hammill, M.H.

Doidge, D.W. Cartier, T. Sleno, G.A.

Ste-Anne-de-Bellevue, Quebec : Arctic Biological Station,  
Dept. of Fisheries and Oceans, 1979.

2 microfiches : ill., figures, tables ; 10x16cm.

(Canadian manuscript report of fisheries and aquatic sciences, no. 1552)

(Eastern Arctic Marine Environmental Studies)

French summary.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES39.

References.

*ASTIS document number 82600.*

ACU

Two camps on Beekman Peninsula, southeastern Baffin Island, were occupied from 3 May to 3 October 1978. Densities of one ringed seal birth lair per 9.7 minutes of searching time were found near Popham Bay. ... Behavioural studies show that ringed seals are site tenacious and aggressive, suggesting territorial partitioning of the fast ice breeding habitat and the possibility of homing in this species. ... The summer paucity of ringed seals is surprising and not

understood. ... Walruses are present throughout the summer at one or more hauling-out sites, and a large influx from Hudson Strait was seen in mid September. ... Beluga, bottlenose whales and bowhead were also observed, the bottlenose whale being the most common summer cetacean in this area. ... The possible impacts of oil well blowouts and disturbance on the various species are discussed. General and specific recommendations are made for other impact-oriented studies. (Au)

143

**Microbiological observations in south Davis Strait / Canada.**  
Dept. of Fisheries and Oceans. Arctic Biological Station.

Bunch, J.N.

Ste-Anne-de-Bellevue, Quebec : Arctic Biological Station,  
Dept. of Fisheries and Oceans, 1979.

2 microfiches : ill., figures, tables ; 10x16cm.

(Canadian manuscript report of fisheries and aquatic sciences, no. 1515)

(Eastern Arctic Marine Environmental Studies)

Appendix.

Bibliography : p. 19-20.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES31.

French abstract.

*ASTIS document number 82597.*

ACU

Microbiological observations were made during three cruises on Davis Strait in April-May 1977, April 1978 and August 1978. Total numbers of bacteria cells, total viable heterotrophs, numbers of oleoclastic bacteria, potential heterotrophic activity, mineralization of hexadecane and concentrations of particulate and dissolved organic carbon were determined from occupied stations. Simultaneous observations of temperature, salinity, reactive nitrate and phosphate, phytoplankton numbers and chlorophyll a were made by MacLaren Marex Inc. ... (Au)

144

**Microbiology 1 : Effects of oil on bacterial activity : 1982 study results / Canada. Dept. of Fisheries and Oceans.**

Arctic Biological Station. Bunch, J.N. Bedard,

C. Canada. Environmental Protection Service

[Sponsor].

Ste-Anne-de-Bellevue, Que. : Arctic Biological Station, 1984.  
viii, 54 p. : ill., map ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 82- 5)

References.

*ASTIS document number 173576.*

OOFF

Microbiological observations were made in a series of four bays at Cape Hatt, N.W.T. before, during and after experimental releases of petroleum in 1981. Similar observations were made in 1982. As expected, no changes in bacterial numbers or in the uptake of glutamic acid by heterotrophic microorganisms were observed in water columns in 1982 and 1981. In the sediments, analysis of variance indicated that changes in bacterial numbers and the Vmax of glutamic acid uptake were not consistent across all four bays between 1981 and 1982. Bacterial numbers and Vmax decreased in bay 7 (the control bay) as well as in bays 10 and 11. In bay 9, where a subsurface release of dispersed petroleum occurred, bacterial numbers increased and Vmax remained approximately constant. These discrepancies were significant ( $p < 0.001$ ) and related to the surface release of petroleum in bay 11. Measurements of hexadecane mineralization in water and sediment samples from the four bays were similar in the two years. This suggested that activity of oleoclasts, those heterotrophic microorganisms capable of degrading fractions of petroleum, was unaffected by the petroleum releases. Numbers of these microorganisms showed considerable variation in the water and sediment of the bays. Although



circumstantial, numbers of oleoclasts appeared to have increased in the sediments of the bays but not the water columns. Such a change in numbers in the sediments, however, could not be ascribed to the petroleum releases. (Au)

145

**Microbiology 1 : Effects of oil on bacterial activity, 1980 study results** / Canada. Dept. of Fisheries and Oceans. Arctic Biological Station. Bunch, J.N. Harland, R.C. Laliberte, J. Canada. Baffin Island Oil Spill Project [Sponsor].  
Edmonton, Alta. : BIOS Project Office, 1981.  
xiii, 68 p. : figures, tables : 28 cm.  
(Working report - Baffin Island Oil Spill Project, 80- 5)  
(Canadian manuscript report of fisheries and aquatic sciences, no. 1611)  
Cover title: Microbiology: 1. Effects of oil on bacterial activity.  
Report also published as: Abundance and activity of heterotrophic marine bacteria in selected bays at Cape Hatt, N.W.T. 1980. Can. MS Rep. Fish. Aquat. Sci. 1611, xiii, 68 p.

References.

ASTIS document number 135755.  
NFSMO, NSDB

On the basis of bacterial abundance and activity, three bays (9, 10, 11) at Cape Hatt, N.W.T., have been judged to be similar and therefore suitable for comparative microbiological studies during and after experimental petroleum spills in 1981. Analyses of variance of total counts of viable heterotrophs (TVH) and concentrations of particulate and dissolved organic carbon in water columns of the three bays did not reveal any differences at the 1.0% level of significance. ... (Au)

146

**Microbiology 1 : Effects of petroleum releases on the microheterotrophic flora of arctic sediments : effects after two years** / Canada. Dept. of Fisheries and Oceans. Arctic Biological Station. Bunch, J.N. Cartier, T. Canada. Baffin Island Oil Spill Project [Sponsor].  
Ste-Anne-de-Bellevue, Que. : Arctic Biological Station, Dept. of Fisheries and Oceans, 1984.  
x, 44 p. : ill., map : 28 cm.  
(Working report - Baffin Island Oil Spill Project, 83- 5)  
Cover title: Baffin Island Oil Spill Project : 1983 study results.

References.

ASTIS document number 164402.  
ACU

The Baffin Island Oil Spill (BIOS) project was initiated to compare the effects of dispersed and nondispersed petroleum in an arctic marine ecosystem. To facilitate this objective, bacterial numbers and microheterotrophic activity (the uptake of glutamic acid by bacteria and other microorganisms such as fungi) were monitored in the water column and sediments of selected bays in Cape Hatt, N.W.T. between 1980 and 1983. Total organic carbon (TOC) was measured in the sediments in some years. ... (Au)

## CANADA. DEPT. OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT

See: 419, 523.

## CANADA. ENVIRONMENT CANADA

See: 239, 711.

## CANADA. ENVIRONMENTAL EMERGENCY BRANCH

147

**Proceedings of the Arctic Marine Oil Spill Program Technical Seminar** / Canada. Environmental Emergency Branch [Sponsor].  
[Ottawa : EPS. Environmental Emergency Branch], 1982.  
viii, 618 p. : ill., maps : 28 cm.  
References.  
ASTIS document number 171727.  
NSDB

41 papers were presented, dealing with arctic and cold-climate marine oil spill detection, behaviour in ice, biological effects, and cleanup techniques (including dispersion, skimming and burning). (ASTIS)

See also: 28, 37, 577, 662.

## CANADA. ENVIRONMENTAL EMERGENCY BRANCH. RESEARCH AND DEVELOPMENT DIVISION

148

**The impact and cleanup of oil spills on Canadian shorelines : a summary** / Canada. Environmental Emergency Branch. Research and Development Division.  
Ottawa : Dept. of the Environment, Environmental Protection Service, Environmental Impact Control Directorate, 1978.  
vii, 25p. : ill., figures, tables, map : 28cm.  
(Training manual - Environmental Protection Service. EPS-6-EC-78 1)  
ISBN 0-662-10051-4.  
ASTIS document number 17990.  
ACU

The structure of Canadian shorelines is described in terms of 10 basic types: rock surfaces, cliffs, coarse sediment beaches, sand beaches, intertidal coarse sediments, intertidal sand, intertidal mud, marshes, backshore areas and man-made structures. The expected impact of oil and cleanup strategies for each type of shoreline are presented. (Au)

149

**Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta** / Canada. Environmental Emergency Branch. Research and Development Division.  
Ottawa : Environmental Protection Service, 1980.  
580p. : ill., figures, tables : 28cm.  
Cover title: Proceedings of the third Arctic Marine Oilspill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta.  
ASTIS document number 73148.  
ACU, NFSMO, NSDB

39 papers presented in these proceedings deal with countermeasures for oil spills in Canadian Arctic waters. Such broad subjects as: the physical behaviour of oil in ice, biological effects of oil spills, oil spill countermeasures, shoreline cleanup and protection, detection, tracking and remote sensing of oil spills, and recent spill

experiments are covered. (ASTIS)

150

Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta / Canada. Environmental Emergency Branch. Research and Development Division.

Ottawa : Environmental Protection Service, 1981.  
741p. : figures ; tables ; 28cm.

References.

ASTIS document number 80713.

ACU, NFSMO, NSDB

31 papers presented in these proceedings deal with, or are applicable to, the problems of oil spills in Canadian Arctic waters. Such broad subjects as : the physical behaviour of oil contamination and ice, biological effects of oil spills, oil spill countermeasures, shoreline cleanup and protection, detection, tracking and remote sensing of oil spills, and recent spill experiments are covered. (ASTIS)

See also: 29, 340, 370.

## CANADA. ENVIRONMENTAL EMERGENCY TECHNOLOGY DIVISION

See: 243.

## CANADA. ENVIRONMENTAL IMPACT CONTROL DIRECTORATE

See: 395.

## CANADA. ENVIRONMENTAL PROTECTION SERVICE

151

Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta / Canada. Environmental Protection Service [Sponsor].

[Ottawa : EPS], 1985.

v. : ill., maps ; 28 cm.

References.

ASTIS document number 175722.

ACU, NSDB

Papers were presented dealing with arctic and cold-climate marine oil spill physical behaviour, biological effects, countermeasures, dispersants, shoreline cleanup, detection, tracking and remote sensing. Current experimental spills and dispersant assessment programs were also covered. (ASTIS)

152

Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta / Canada. Environmental Protection Service [Sponsor].

[Ottawa : EPS], 1984.

vi. 548 p. : ill., maps ; 28 cm.

References.

ASTIS document number 171743.

NSDB

34 papers were presented, dealing with arctic and cold-climate marine oil spill physical behaviour, biological effects, countermeasures, dispersants, shoreline cleanup, detection, tracking and remote sensing. Current experimental spills and dispersant assessment programs were also covered. (ASTIS)

153

Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta / Canada. Environmental Protection Service [Sponsor].

[Ottawa : EPS], 1983.

v. 295 p. : ill., maps ; 28 cm.

References.

ASTIS document number 171735.

NSDB

35 papers were presented, dealing with arctic and cold-climate marine oil spills. Topics covered included physical behaviour, biological effects, shoreline protection and cleanup, countermeasures (combustion, incineration, containment, recovery and dispersants), detection, tracking, remote sensing, and current experimental spills. (ASTIS)

See also: 11, 105, 123, 144, 189, 204, 221, 222, 328, 394, 396, 419, 526, 527, 628, 687.

## CANADA. FATE AND EFFECTS OF OIL WORKING GROUP

154

A selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment / Canada.

Fate and Effects of Oil Working Group.

[Ottawa] : Environmental Protection Service, Dept. of Fisheries and the Environment, 1977.

vii, 174p. ; 28cm.

(Economic and technical review report, EPS 3-EC-77- 23)

ISBN 0-662-01443-X.

Fate and Effects of Oil Working Group is a standing committee composed of government and industry representatives.

ASTIS document number 3093.

ACU, NFSMO

A selected and indexed bibliography is presented on the fate and effects of oil pollution in cold waters. References were selected from the primary and technical scientific literature, both Canadian and otherwise, on the basis of their relevance to the Canadian environment. The bibliography consists of two sections - an alphabetic listing of all references listed, and a KWIC Index, allowing full and rapid access to the listed references by author, key words, and subject. (Au)

## CANADA. FISHERIES AND ENVIRONMENT CANADA

155

Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, 2d, Edmonton, Alberta, March 7-9, 1979 / Canada. Fisheries and Environment Canada.

[Ottawa] : Environmental Protection Service, 1979.

384p. : ill., figures, tables ; 28cm.

Seminar manager: James F. MacLaren Ltd.

Prepared for Supply and Services Canada and Fisheries and Environment Canada.

References.

ASTIS document number 70459.

ACU, NFSMO, NSDB

Papers on oil spills in the Canadian Arctic are presented. Topics include behaviour, fate and effects of oil spills, countermeasures equipment, combustion and incineration, shoreline cleanup, and spill tracking, detection and modelling. (ASTIS)

See also: 336.

CANADA. NORTHERN ENVIRONMENTAL PROTECTION BRANCH

See: 239.

CANADA. SUPPLY AND SERVICES CANADA

See: 403.

CANADA-CITIES SERVICE LTD.

See: 27.

CANADIAN MARINE DRILLING LIMITED

156

A proposed study of oil and gas under ice / Canadian Marine Drilling Limited. Pistruzak, W.M.

(Spill technology newsletter, v. 4, no. 5, Sept.-Oct. 1979, p. 304-313, ill., map)

(Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 37-47, ill., map)

ASTIS document number 31070.

ACU, NFSMO

It is Canmar's objective to conduct a field experiment this coming winter to determine how successful burning would be as a countermeasure and to optimize burning techniques for oil and gas released from a Beaufort Sea Blowout under first year ice, and to optimize burning techniques. The experiment has the following main goals: a) Understand how the oil behaves in the ice, and especially how gas affects the rates of oil migration to the surface in the spring during the melt period. b) Understand how the oil accumulates on the melting ice, i.e. the thickness, degree of weathering, area, and drift due to wind and melt-water flow. c) To elucidate, if possible, the optimum time for burning of oil contained on melt pools so that environmental damage can be minimized. d) Devise and test under realistic conditions, devices which can ignite the oil. e) Measure how much oil is burned, how much remains as a residue, and to obtain data on the chemical nature of the residue. Should Dome/Canmar receive government approval to proceed with the experiment, ... then Canmar would proceed ... to discharge oil and gas under Beaufort Sea ice during two different periods of winter (early December and early March) and to monitor the subsequent results. (Au)

See also: 11, 245, 510.

CANADIAN OFFSHORE OIL SPILL RESEARCH ASSOCIATION

See: 216.

CANADIAN PETROLEUM ASSOCIATION

See: 342.

CANADIAN WILDLIFE SERVICE

See: 515.

CANEVARI, G.P.

See: 112.

CARLS, M.G.

157

Sensitivity of arctic marine amphipods and fish to petroleum hydrocarbons / Carls, M.G. Korn, S.

(Proceedings of the Tenth Annual Aquatic Toxicity Workshop, November 7-10 1983, Halifax, Nova Scotia / Edited by P.G. Wells and R.F. Addison. Canadian technical report of fisheries and aquatic sciences, no. 1368, p. 11-26, ill.)

References.

ASTIS document number 181811.

ACU

We determined the sensitivities of six circumpolar benthic species to water-soluble fractions (WSF) of Cook Inlet crude oil and naphthalene in separate tests. The species tested were the amphipods *Anonyx nugax*, *Boeckosimus nansenii*, and *Gammaracanthus loricatus*, a mysid, *Mysis relicta*, Arctic cod (*Boreogadus saida*), and a sculpin (*Oncocottus hexacornis*). Exposures were flow-through and lasted up to 40 days. Median lethal concentrations (CL50's) of the WSF ranged from 1.6 to 3.8 ppm total aromatics. Naphthalene assays were conducted at several temperatures (1.5 to 9.6 degrees C) to study temperature effects on sensitivity to hydrocarbons. Naphthalene LC50's ranged from 1.35 to 3.35 ppm. General relationships between exposure temperatures and LC50's were not found. In the absence of toxicants, upper lethal temperatures for the crustaceans were surprisingly high: 17-24 degrees C, suggesting the assay temperatures in themselves were not particularly stressful. We compared the sensitivities of these Arctic marine species to the sensitivities of temperate species previously tested at this laboratory (ABL) using the same flow-through procedures and toxicants, and evaluated two alternative hypotheses: (1) marine Arctic animals are adapted to a wide range of environmental parameters, and therefore are unusually resistant to unaccustomed stresses such as petroleum hydrocarbons, or (2) marine Arctic animals are unusually sensitive to hydrocarbon stress because they are already stressed to their limits by the environment in which they live. We conclude that Arctic species are about equal in sensitivity to temperate species. However, their habitat is more vulnerable to the effects of petroleum hydrocarbon pollution than temperate habitats because low temperatures lead to slower losses of hydrocarbons from volatilization and biodegradation, and oil entrapment under sea ice can result in very lengthy exposures. (Au)

See also: 585.

## CARRUTHERS, D.R.

See: 89, 90.

## CARSTENS, T.

158

Oil spill on the shore of an ice-covered fjord in Spitsbergen / Carstens, T. Sendstad, E.

(Meddelelser - Trondheim. Norges Tekniske Hogskole. Vassdrags- og Havnelaboratoriet, nr. 19E, 1980, p. 43-58, ill., figures, photos.)

(POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 2, p.1227-1242, ill., map, photos.)

Paper presented at POAC 79, the 5th International Conference on Port and Ocean Engineering under Arctic Conditions, held at Trondheim.

ASTIS document number 47244.

ACU. NFSMO

A slow leak between 20 April and 16 May 1978 from a tank on the shore at Svea, van Mijenfjorden, deposited 130 cubic m of diesel fuel in the fjord. The spill was invisible until the snowmelt runoff transported oil onto the 1.5 m thick ice, beginning 23 May. In early June snow, ice, water and soil samples were collected and currents were observed under the ice. After breakup in July shore sediment and biological samples were taken throughout the fjord. Inferences are drawn from the observations regarding transport routes and degradation of the oil and of the ecological impact of the spill. The conclusions are that most of the oil was trapped by the ice and transported out of the fjord during breakup. The shore fauna in the immediate vicinity of the tank was wiped out, but the impact on the fjord ecosystem seemed otherwise negligible. (Au)

## CARTER, L.J.

159

Oil drilling in the Beaufort Sea : leaving it to luck and technology / Carter, L.J.

(Science, v.191, Mar. 5, 1976, p. 929-931, map)

ASTIS document number 172588.

ACU. NSDB

The Canadian government has been moving quietly toward a decision to allow exploratory oil drilling to begin in that part of the Arctic Ocean known as the Beaufort Sea, an OCS [Outer Continental Shelf] province so fraught with environmental problems and hazards that the technology necessary for recovery of the oil and gas that might be found is still far from being available. A blowout of an exploratory well could lead to massive losses of fish, ocean mammals, and birds-including tens of thousands of migratory waterfowl-along some 400 miles of the Alaskan coast as well as along the Canadian coast. [This article describes the fate and effects of a Beaufort blowout in the context of an argument for delaying government approval of exploratory drilling in the area]. ... (Au)

## CARTIER, T.

See: 122, 142, 146.

## CASTELLINI, M.A.

See: 358.

## CELIUS, H.K.

See: 69.

## CERNIGLIA, C.E.

160

Aromatic hydrocarbon oxidation by diatoms isolated from the Kachemak Bay region of Alaska / Cerniglia, C.E.

Gibson, D.T. Van Baalen, C. United States.

Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 665-677, ill.)

References.

ASTIS document number 169307.

ACU

... In this investigation, we report on three diatoms isolated from the Kachemak Bay region of Alaska which have the ability to metabolize the aromatic hydrocarbon, naphthalene at low temperatures. Three pure cultures of diatoms, a *Navicula* sp., a *Nitzschia* sp. and a *Synedra* sp. grown in the presence of naphthalene at 6C or 12C oxidized naphthalene to ethyl-acetate soluble and water-soluble metabolites. The major ethyl acetate soluble metabolite was identified as 1-naphthol by chromatographic and mass spectral analysis. Experiments with naphthalene indicated that the extent of naphthalene metabolism ranged from 0.7 to 1.2%. (Au)

## CHABOT, L.

See: 177.

## CHAN, S-L.

See: 434, 437, 440.

## CHATTERJEE, R.M.

See: 626.

## CHAU, E.

See: 712.

## CHEATHAM, D.L.

161

The relative importance of evaporation and biodegradation, and the effect of lower temperature on the loss of some mononuclear and dinuclear aromatic hydrocarbons from seawater / Cheatham, D.L. McMahon, R.S. Way, S.J. Short, J.W. Rice, S.D.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year

ending March 1977. Vol. XII : Effects, p. 44-65)  
References.

ASTIS document number 178330.

ACU

A Cook Inlet crude oil water-soluble fraction, incubated at 5, 8, and 12 degrees C. was analyzed by gas chromatography during a 96-h period to determine the effect of temperature on evaporation and biodegradation of individual mononuclear and dinuclear aromatic hydrocarbons in seawater. The relative importance of evaporation and biodegradation on the loss of these hydrocarbons was assessed at each temperature using combinations of aeration and poison as experimental conditions. Lower temperature reduced the loss of mononuclear and dinuclear aromatic hydrocarbons from seawater. Evaporation was an especially significant factor in the loss of mononuclear aromatics. Biodegradation had little effect on mononuclear aromatics but had a significant effect on dinuclear aromatics, particularly naphthalene. Natural means exist for eliminating toxic aromatic hydrocarbons from seawater, even at low temperature. However, oil and seawater mixtures could be more toxic for longer periods of time at lower temperatures because aromatic hydrocarbons would persist in seawater longer. (Au)

See also: 581.

CHEEK, L.M.

See: 248, 639, 651.

CHEN, E.C.

62

Arctic winter oil spill test : United States Coast Guard /  
Chen, E.C.

Ottawa : Inland Waters Directorate, 1972.

iv, 20 p. : ill. ; 28 cm.

(Technical bulletin - Inland Waters Directorate, no. 68)

Appendix.

References.

ASTIS document number 178225.

ACU

As part of an arctic pollution control program, the U.S. Coast Guard conducted a series of tests off the northern coast of Alaska during the summer of 1970 to investigate the behaviour of crude-oil spills in the Arctic. ... The winter oil-spill test discussed in this report was a supplemental experiment of the summer test mentioned above. Its purpose was to investigate the physical properties of crude oil spilled in an arctic winter environment. The test took place at Port Clarence, a small peninsula on the Bering Strait, January 14 to February 4, 1972. ... (Au)

163

Spreading of crude oil on an ice surface / Chen, E.C.

Overall, J.C.K. Phillips, C.R.

(Canadian journal of chemical engineering, v. 52, Feb. 1974,  
p. 71-74, ill.)

References.

ASTIS document number 180980.

ACU

The gravity-viscous spreading of crude oil on artificially prepared ice surfaces was investigated. Five different types of crudes were studied with three surface roughnesses at -14 degrees C. Crude oil No. 1 was also studied at -8 and -3 degrees C. All spreading experiments were made with an oil volume of 45 and 20 ml. Regardless of temperature, surface roughness, oil type and oil volume, all data may be correlated by [an equation presented in this article, combining density, volume and viscosity of the oil,

radius of the slick plus time and the acceleration at gravity]. ...  
(Au)

CHEW, K.

See: 327.

CHILDERHOSE, R.J.

See: 481, 485.

CHINA (PEOPLE'S REPUBLIC OF CHINA, 1949- ).  
NATIONAL BUREAU OF OCEANOGRAPHY

See: 709.

CHRISTENSEN, P.

See: 741.

CIMBERG, R.L.

164

North Aleutian shelf sea otters and their vulnerability to oil /  
Cimberg, R.L. Costa, D.P.

(Proceedings - 1985 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : February 25-28, 1985, Los  
Angeles, California. - Washington, D.C. : American  
Petroleum Institute, 1985, p. 211-217, ill., maps)

References.

ASTIS document number 162035.

Results of a one-year field investigation on the sea otters of the eastern Bering Sea indicate that this population ranges from approximately 1,000 during the winter to over 10,000 in the summer, apparently due to migration from the Pacific. ... The otters are believed to feed on a variety of prey, including crabs, molluscs, flatfish, and perhaps sand dollars, based on scat analysis. Significant impacts from oil and gas activities on this population would occur if a large spill occurred near Bechevin Bay, along the apparent major migration route. Other impacts would be more localized and are difficult to estimate due to the need for information on the otters' ability to avoid oil slicks and at the same time maintain their feeding regimes. (Au)

CLARK, R.C.

165

Effects of oil spills in arctic and subarctic environments /  
Clark, R.C. Finley, J.S.

(Effects of petroleum on arctic and subarctic marine  
environments and organisms. Volume II : Biological  
effects / Edited by D.C. Malins. - New York : Academic  
Press, 1977, p. 411-491, ill., map)

References.

ASTIS document number 169455.

ACU

General biological effects of marine, land and freshwater oil spills are described. Brief case studies of the major arctic and subarctic spills (primarily marine) are given. (ASTIS)

166

Inputs, transport mechanisms, and observed concentrations of petroleum in the marine environment / Clark, R.C. Macleod, W.D.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume I : Nature and fate of petroleum / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 91-223, ill., map)

References.

ASTIS document number 169358.

ACU

Hydrocarbons enter the environment by three general pathways: biosynthesis, geochemical processes, and anthropogenic activities. The following description of these pathways is drawn largely from the 1975 review by Farrington and Meyers .... Although an attempt was made to emphasize the arctic and subarctic environment, the majority of the data and information relates to the world oceans in the Northern Hemisphere, especially the North Atlantic Ocean and its margins where probably the greatest input of petroleum hydrocarbons has occurred. [This chapter covers inputs of petroleum to the marine environment as well as transport and alteration of the oil by spreading, evaporation, weathering, etc. An extensive list of baseline hydrocarbon levels in marine organisms is presented.] (Au)

167

Occurrence and impact of petroleum on arctic environments / Clark, R.C. Finley, J.S.

(The Arctic Ocean : the hydrographic environment and the fate of pollutants / Edited by L. Rey and B. Stonehouse. - London : Macmillan, 1982, p. 295- 341, ill., map)

References.

ASTIS document number 168572.

ACU

This is a review article on general fates and effects of petroleum from natural and anthropogenic sources, on the Arctic marine environment. (ASTIS)

See also: 434.

CLARKE, A.

168

Aliphatic and aromatic hydrocarbons in benthic invertebrates from two sites in Antarctica / Clarke, A. Law, R.

Marine pollution bulletin, v. 12, no. 1, Jan. 1981, p. 10-14, ill., map)

References.

ASTIS document number 171751.

NSDB

Samples of marine benthic invertebrates collected from two sites in the Antarctic have been analysed for both aliphatic and aromatic hydrocarbons in order to establish baseline concentrations for some classes of hydrocarbons. Samples from Signy Island, a pristine site, contained low concentrations of the hydrocarbons determined, whereas those from King Edward Cove, South Georgia, contained significantly higher concentrations. King Edward Cove has a known history of pollution from whaling operations. Platt & Mackie (1979) have suggested that the hydrocarbons in sediments from King Edward Cove are a result of the world-wide dissemination of the pyrolysis products of fossil fuels. Our work suggests, in contrast, that the hydrocarbons in the benthos are derived from local sources. (Au)

CLEMENT, L.E.

169

Accumulation, fractionation and release of oil by the intertidal clam *Macoma balthica* / Clement, L.E. Steckoll, M.S. Shaw, D.G.

(Marine biology, v. 57, no. 1, 1980, p. 41-50, ill.)

References.

ASTIS document number 170208.

ACU, NSDB

The bivalve mollusc *Macoma balthica* accumulated hydrocarbons during 180 days of continuous exposure to Prudhoe Bay crude oil in seawater dispersions with nominal concentrations of 0.03, 0.3 and 3.0 mg/l. The mollusc's ability to concentrate oil from seawater increased with decreasing oil-in-water concentration. Decreases in oil burden began after 30 to 120 days (depending on the oil concentration) and continued for at least 60 days after exposure to oil ceased. Aliphatic and aromatic hydrocarbons were fractionated in markedly different ways by the bivalve. Branched and cyclic aliphatics in the molecular weight-range dodecane through hexadecane were preferentially retained over straight-chain and their higher homologs. Larger and more substituted aromatic compounds were selectively concentrated. There appeared to be no selective concentration of aromatic sulphur compounds. (Au)

See also: 650, 665.

CLINE, J.D.

170

Distribution and abundance of low molecular weight hydrocarbons and suspended hydrocarbons in Cook Inlet, Alaska / Cline, J.D. Katz, C.N. Young, A. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 264-325, ill., maps) (NTIS PB80-186851, p. 264-325, ill., maps)

References.

ASTIS document number 169862.

ACU

... The purpose [of this study] was to establish the spatial and temporal variations (seasonal and diurnal) in the dissolved hydrocarbon fraction composed of methane, ethane, ethene, propane, propene, isobutane, and n-butane. These data were collected in order to establish baseline levels of naturally occurring hydrocarbons .... During the past two years, emphasis has shifted toward sources of LMW [low molecular weight] hydrocarbons in Cook Inlet, including both natural and anthropogenic sources. Special attention has been devoted to sources of LMW and in-situ production of gases in both the water column and from the underlying sediments. ... (Au)

171

Distribution and abundance of low molecular weight hydrocarbons and suspended hydrocarbons in Cook Inlet, Shelikof Strait, and Norton Sound, Alaska / Cline, J.D. Bates, T. Katz, C.N. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 192-272, ill., maps)

References.

ASTIS document number 168270.

## ACU

... studies were conducted in two site-specific areas, namely Cook Inlet and Norton Sound, Alaska. The objectives were two-fold: to further increase our knowledge of the compositional characteristics of LMW [(low molecular weight)] hydrocarbons associated with thermogenic sources and to evaluate the efficiency of suspended matter transport of heavy hydrocarbons. ... (Au)

172

### Distribution of light hydrocarbons, C1-C4, in the northeast Gulf of Alaska and the southeastern Bering Shelf / Cline, J.D. Feely, R.A.

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 9 : Chemistry and microbiology, p. 443-550, ill., maps)

(NTIS PB-261 408, p. 443-550, ill., maps)

References.

ASTIS document number 176443.

## ACU

... The purpose [of this study] was to establish the spatial and temporal variations (seasonal and diurnal) in the dissolved hydrocarbon fraction composed of methane, ethane, ethylene, propane, propylene, isobutane and n-butane. These data are being collected in order to establish baseline levels of naturally-occurring hydrocarbons in the lease areas prior to exploration, development, and production of fossil fuel preserves. These components have proven to be valuable indicators of petroleum input arising from drilling, production, and transportation of crude oil and refined products. In support of the basic objectives, attention is being given to natural hydrocarbon sources, namely gas and oil seeps, production of hydrocarbons from near-surface sediments, and biogenic sources within the euphotic zone. ... (Au)

173

### Identification of natural and anthropogenic petroleum sources in the Alaskan Shelf areas utilizing low molecular weight hydrocarbons / Cline, J.D. Feely, R.A. Young, A.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VIII : Contaminant baselines, p. 73-198, ill., maps)

(NTIS PB80-130073, p. 73-198, ill., maps)

References.

ASTIS document number 176087.

## ACU

... The purpose [of this study] was to establish the spatial and temporal variations (seasonal and diurnal) in the dissolved hydrocarbon fraction composed of methane, ethane, ethene, propane, propene, isobutane, and n-butane. These data are being collected in order to establish baseline levels of naturally occurring hydrocarbons in the lease areas prior to exploration, development, and production of fossil fuel reserves as these components have proven to be valuable indicators of petroleum input arising from drilling, production, and transportation of crude oil and refined products. In addition to the ease with which these components may be analyzed, they also provide a practical procedure by which the accumulation of petroleum hydrocarbons may be documented. [The study area includes the northwest Gulf of Alaska, southeastern Bering Sea, Norton Sound, southeastern Chukchi Sea, and lower Cook Inlet. As a secondary objective, offshore seeps are being investigated to ascertain their composition.]. (Au)

See also: 252, 349, 350.

## COBB, D.

See: 86, 107.

## COHEN, M.H.

See: 735.

## COLBY, L.

See: 571.

## COLLIER, T.K.

See: 437.

## COLONELL, J.M.

174

### Environmental studies of Port Valdez, Alaska / Colonell, J.M.

(POAC 77 : proceedings / Edited by D.B. Muggeridge. - St. John's, Nfld. : Ocean Engineering Information Centre, Memorial University of Newfoundland, 1977, v. 2. p. 872-884, maps)

References.

ASTIS document number 181447.

## ACU

As a condition of its permit to discharge treated tanker ballast water into Port Valdez, Alyeska Pipeline Service Company was required to embark upon a program to monitor the receiving water in order to determine the changes which might occur and the effect, if any, that the permitted discharge would have upon the water quality and biota of Port Valdez. ... [The program consists of seven different projects: 1. Physical oceanographic studies, 2. Baseline hydrocarbon studies, 3. Benthic biology of Port Valdez, 4. Intertidal flora and fauna of Port Valdez, 5. Hydrocarbon biodegradation in Port Valdez waters, 6. Trace element survey, and 7. Phytotoxicity studies.] ... Described herein are the study objectives for each project, and also the operational considerations for overall management of the program. ... (Au)

175

### Port Valdez environmental studies, 1976-1978 / Colonell, J.M.

(Journal of the Environmental Engineering Division, Oct. 1980, p. 907-917, ill., maps)

References.

ASTIS document number 170348.

## ACU

All oily ballast water from the holds of tankers arriving at the Trans-Alaska Pipeline terminus in Valdez, Alaska is pumped ashore for treatment before being discharged into Port Valdez. A multidisciplinary study program was required by regulatory agencies for the purpose of monitoring the possible impact of that discharge on the Port Valdez marine environment. ... The purpose of this paper is to present an overview of the Port Valdez studies by providing a capsule view and summary of results for each of the eight projects that comprised the program. (Au)

## COMFORT, G.

176

An investigation of the behaviour of crude oil spilled under multi-year ice at Griper Bay, N.W.T. / Comfort, G. Purves, W.F.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 62-86, ill., map)

### References.

ASTIS document number 174696.

### ACU

... a field program consisting of a crude oil discharge under a multi-year ice cover in Griper Bay, NWT, was undertaken by Environment Canada on June 1, 1978 .... A total of 1.84 cubic m (405 gallons) of Norman Wells crude oil was discharged under the ice at three different sites .... This report describes site conditions ... in detail and attempts to draw some conclusions as to the behaviour and fate of oil spilled under multi-year ice. (Au)

177

Oil behaviour under multi-year ice at Griper Bay, N.W.T. / Comfort, G. Roots, T. Chabot, L. Abbott, F. (Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 14-19, ill., map)

### References.

ASTIS document number 159875.

The interaction of oil released under multi-year ice has been the subject of an ongoing field program carried out by Environment Canada. ... a field program consisting of a crude oil discharge under a static multi-year ice cover in Griper Bay, N.W.T., was undertaken .... A total of 1.84 cubic meters (405 gallons) of Norman Wells crude oil was discharged under the ice on June 1, 1978, at three different sites (i.e., 0.61 cubic meters at each site). The ice thickness varied from 2.5 to 2.9 m and was at least second year in age. This paper reviews the behaviour and fate of the oil released at the site to date and presents the results of a site investigation made during September, 1982, to determine the quantity of oil still remaining on site. ... From the results of this study, it is apparent that a small crude oil spill under multi-year ice will surface quickly and be acted upon by the forces of dispersion and evaporation so as to reduce the concentration of oil in the environment to be visually undetectable, within at the most five melt seasons. (Au)

See also: 28.

## CONOVER, S.A.M.

See: 93.

## CONSOLIDEX MAGNORTH OAKWOOD JOINT VENTURE

See: 35, 42, 401.

## COOK, F.D.

See: 733.

## COON, M.D.

178

The transport and behavior of oil spilled in and under sea ice / Coon, M.D. Pritchard, R.S. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 341-347)

ASTIS document number 169480.

### ACU

The objective of this work is to write twelve scenarios to describe the fate of oil spilled under the sea ice cover near Prudhoe Bay, Alaska. ... A second objective of the proposed work is to determine whether ice containing oil from the Prudhoe area which has been transported to the Chukchi Sea can pass through the Bering Strait into the Bering Sea. ... (Au)

179

The transport and behavior of oil spilled in and under sea ice / Coon, M.D. Pritchard, R.S. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 354-569, ill., maps)

(NTIS PB80-186885, p. 354-569, ill., maps)

### References.

Contents: Beaufort Sea ice motion : part 1. Pack ice trajectories. — Beaufort Sea ice motion : part 2. Onset of large scale Chukchi Sea ice breakout / R.W. Reimer R.S. Pritchard and M.D. Coon. — Ice breakout in Bering Sea / R.W. Reimer. — Arctic oil spill scenario outline / M.D. Coon.

ASTIS document number 169510.

### ACU

The objective of the proposed work is to determine the locations to which oil spilled in or under the ice cover near Prudhoe Bay, Alaska, would be transported, and to determine the behavior of the oil as the ice cover moves and deforms. ... (Au)

See also: 257.

## CORLETT, R.F.

See: 455.

## COSTA, D.P.

180

Effects of oil contamination in the sea otter, *Enhydra lutris* / Costa, D.P. Kooyman, G.L. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 10 : Biological studies, [1981], p. 65-107, ill., maps)

### References.

ASTIS document number 167908.

### ACU

The objective of this study was to measure effects of crude contamination on sea otters [from Constantine Harbor, Alaska] through studies on the changes in the animal's physiology and



havior before and after contact with oil. A second objective was attempt to rehabilitate the otters after crude oil contamination. ... The study has shown that small amounts of crude oil contamination have large effects on the metabolic rate of sea otters. ... It is probable that death may follow from pneumonia or hypothermia depending upon the amount of the animal's fur fouled. ... (Au)

See also: 164, 356.

## COWELL, E.B.

181

**Problems in ecological monitoring in Port Valdez, Alaska /**  
Cowell, E.B. Monk, D.C.

(Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 713-717, ill., maps)

### References.

ASTIS document number 177202.

### NSDB

The technical and scientific problems of ecological monitoring at Port Valdez, Alaska are discussed. Particular attention is given to the lack of understanding of the processes of the Alaskan Rocky Shore ecosystem and the paucity of data on the natural stresses controlling temporal and spatial variation in populations. In addition, taxonomic difficulties, particularly in the littoral macroalgae, further compound survey problems. The paper suggests some possible approaches that could be applied and is illustrated by data taken on baseline surveys made in 1977. Particular attention is given to unexpected age size distributions in the limpet *Collisella pelta*. (Au)

## COWLES, C.J.

182

**Types of potential effects of offshore oil and gas development on marine mammals and endangered species of the northern Bering Sea and Arctic Ocean /** Cowles, C.J.  
Hansen, D.J. Hubbard, J.D. United States.  
Bureau of Land Management [Sponsor].

Anchorage, Alaska : Bureau of Land Management, Alaska OCS Office, 1981.

1 microfiche ; 11 x 15 cm.

(United States. Bureau of Land Management. Alaska Outer Continental Shelf Office technical paper, no. 9)

(United States. Bureau of Land Management report no. BLM-YK-TE-81-006)

(NTIS PB83-146142)

### References.

Cover title varies slightly for this report. Alternate title: Types of potential effects of offshore oil and gas development on marine mammals and endangered species of the northern Bering, Chukchi and Beaufort seas.

ASTIS document number 175749.

### ACU

... [This paper] summarizes information on the types of potential effects on marine mammals, endangered species, and rare plants which may be associated with oil and gas lease sales pending for the northern Bering Sea and arctic regions. The discussion does not imply that any specific level of impact will be sustained but rather identifies the various potential effects associated with offshore exploration, development, and production of petroleum hydrocarbon resources in the Alaska arctic regions. (Au)

## COX, J.C.

183

**The containment of oil spilled under rough ice /** Cox, J.C.  
Schultz, L.A.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 203-208)

### References.

ASTIS document number 171662.

This paper outlines the results of a laboratory study of the behavior of oil spilled beneath ice having various roughness characteristics in the presence of a current. It was found convenient to categorize ice conditions and ice features by addressing the problem in terms of oil interaction with smooth ice, ice having small roughness features, and ice having large roughness features. The small or large designation is determined by whether the height of the roughness elements is less than, or greater than, the equilibrium slick thickness of the oil beneath smooth ice. Further, large roughness elements can act individually, or they can act in combination, forming a cavity. In general terms, oil spilled beneath ice cover will remain stationary until the current velocity relative to the ice reaches 15 to 25 cm/sec. This holds true even for oil trapped upstream of large roughness elements. At the higher velocities, cavities have a somewhat greater oil containment capability than individual large roughness elements. The paper includes a procedure for quantitatively determining the transport or containment of oil spilled beneath ice in deep water. (Au)

184

**The mechanics of oil containment beneath rough ice /** Cox, J.C. Schultz, L.A. Arctec, Inc.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 3-44, figures, tables)

### References.

ASTIS document number 80721.

### ACU, NFSMO

The current and future expansion of oil exploration into offshore Arctic waters must go hand in hand with the capability to respond effectively should an accidental oil spill occur. To provide this capability a basic understanding of spill behaviour particularly, as related to ice-infested conditions, must be developed. With the guidance of the Arctic Project Office of the Outer Continental Shelf Environmental Assessment Program (OCSEAP), ARCTEC, Incorporated was tasked with developing a description of oil spill behaviour in ice. (Au)

185

**The transport and behaviour of spilled oil under ice /** Cox, J.C. Schultz, L.A.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 45-61, ill.)

### References.

ASTIS document number 174734.

### ACU

... The behaviour of oil spilled under an ice cover in the presence of an under-ice current was examined experimentally. The results of the research are applicable in predicting the extent of under-ice spreading of oil from an offshore spill or blowout. In addition, when this oil/ice interaction is combined with an ice dynamics model, the likely long-term trajectory and fate of the spilled oil in ice-infested waters can be predicted. Initially, the objectives of the program were to determine the possible extent of oil trapping by ice ridges, ice roughness, and undulations on the bottom face of the ice. As

the problem was being formulated in more elementary terms, these distinctions were discarded in favor of definitions which only specified whether or not an oil slick was able to move beneath the ice. This approach leads to a restatement of objectives as follows: 1. Determine the kinds of roughness and the range of ocean current velocities for which oil can be driven under sea ice having different underside roughness characteristics. 2. Determine the kinds of roughness and the range of ocean current velocities for which oil can be constrained beneath ice so that the oil may become frozen into place or migrate into the ice and ultimately become incorporated therein. (Au)

See also: 33, 34, 265, 619, 620.

### CRADDOCK, D.R.

186

Acute toxic effects of petroleum on arctic and subarctic marine organisms / Craddock, D.R.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 1-93)

References.

ASTIS document number 169374.

ACU

... The objectives of this chapter are to review the literature on acute toxicity bioassay techniques using aquatic (mainly marine) organisms and to review the results of bioassays of petroleum relative to the toxicity of the various products tested and the sensitivity of the various marine organisms used (mainly arctic and subarctic species). [Included is an extensive listing of marine organisms and their petroleum toxicities]. (Au)

See also: 260.

### CRECELIUS, E.A.

See: 24, 25.

### CRETNEY, W.J.

187

Biodegradation of a chemically dispersed crude oil / Cretney, W.J. Macdonald, R.W. Wong, C.S. Green, D.R. Whitehouse, B. Geesey, G.G.

Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 37-43, ill.)

References.

ASTIS document number 171700.

The n-alkane fraction of Prudhoe Bay crude oil dispersed with Corexit 9527 disappeared rapidly from the water column directly beneath a seawater surface slick contained by an enclosure. Biodegradation appeared to be more important than nonbiological volatilization or photooxidation processes. Extracellular polysaccharides, synthesized by floc-forming bacteria, accumulated in the water column of the enclosures during n-alkane degradation. The study demonstrates the possible usefulness of Corexit 9527 in accelerating the conversion of this crude oil fraction by the indigenous microflora of coastal marine waters. (Au)

See also: 740, 741.

### CROSS, W.E.

188

Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island : I. Results of 1980 pre-spill studies / Cross, W.E. Thomson, D.H.

Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1981.

81 p. : figures, tables ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 3)

Appendix.

Bibliography: p. 76-80.

Cover title: Macrobenthos: Baffin Island Oil Spill Project.

"Correct citation for this publication: ... Macrobenthos - 1980 Study Results".

ASTIS document number 135739.

NFSMO

... the macrobiological component of the BIOS project ... assessed the effects of oil and dispersed oil on the macrophytic algae, the relatively immobile benthic infauna (e.g. bivalves, polychaetes) and the motile epibenthos (e.g. amphipods, urchins) in shallow arctic waters. ... The present report provides baseline data from the first of two pre-spill sampling periods (September 1980, August 1981). These data, together with post-spill data from an uncontaminated (control) bay, will be used as a basis of comparison with post-spill data from the experimental bays. (Au)

189

Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island : I. Results of 1980 pre-spill studies / Cross, W.E. Thomson, D.H.

Canada. Environmental Protection Service [Sponsor].

United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 465-555, ill., map)

Appendix.

References.

ASTIS document number 169269.

ACU

This report consists of the preliminary marine fauna sampling results for the baseline portion of the BIOS project. Pre-spill species composition and trophic relationships were analyzed via systematic transect sampling. (ASTIS)

190

Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. II. Results of 1980 and 1981 pre- and post-spill studies / Cross, W.E.

Thomson, D.H. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.

xvi, 105 p. : ill., map ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 3)

Appendices.

References.

Cover title: Macrobenthos : 1981 study results.

ASTIS document number 169897.

ACU

This report covers the effects of oil and dispersed oil on macrophytic algae and benthic and epibenthic fauna (bivalves, polychaetes, amphipods, urchins) of shallow arctic waters. Effects

on distribution, abundance, biomass, population age structure and length-weight relationships of dominant species are discussed. (ASTIS)

191

Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. III. Results of 1980, 1981 and 1982 pre- and post-spill studies / Cross, W.E. Thomson, D.H. Maltby, A.R. Canada.

Baffin Island Oil Spill Project [Sponsor].  
Edmonton, Alta. : BIOS Project Office, 1983.  
xviii, 135 p. : ill., map ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 82- 3)  
Appendices.

Cover title: Macrobenthos : 1982 study results.

References.

ASTIS document number 169900.

ACU

... The objectives of the macrobiological component of the BIOS project are to assess the effects of oil and dispersed oil on the macrophytic algae, the relatively immobile benthic infauna (e.g. bivalves, polychaetes), and the motile epibenthos (e.g. amphipods, urchins) in shallow arctic waters. Variables to be examined include total abundance, total biomass, population age structure and length-weight relationships of dominant species in these communities. [This report details the work carried out from 1980-1982]. ... (Au)

See also: 400, 402, 403.

CROW, J.H.

192

Distribution and ecological characteristics of *Zannichellia palustris* L. along the Alaska Pacific coast / Crow, J.H. (Bulletin of the Torrey Botanical Club, v.106, no. 4, Oct./Dec. 1979, p. 346-349, ill.)

References.

ASTIS document number 38717.

ACU

... *Zannichellia palustris* L. is found in many locations along the Alaska Pacific coast from Cook Inlet to Juneau in ponds and on bare mud where the influence of fresh water is significant. ... Successionally, *Z. palustris* decreases markedly as *Carex lyngbyei* increases and it is very sensitive to a substrate of *Carex* peat; also it appears to be sensitive to sedimentation and showed dramatic decreases in the vicinity of construction at Port Valdez from 1970-1974. This species is suggested for inclusion in baseline ecological studies because of its rapid response to environmental change. (Au)

CROW, S.A.

193

Degradation of oil by yeast and filamentous fungi in arctic environments / Crow, S.A. Ahearn, D.G.

Chicago, Ill. : Office of Naval Research, 1979.  
1 microfiche ; 11 x 15 cm.

(NTIS AD-A-078 892)

References.

ASTIS document number 181102.

ACU

The principle objective of this study was to evaluate low temperature degradation of oil by yeasts and to examine their potential for facilitating the biodegradation of oil at low temperatures. ... Approximately 200 yeast isolates from Alaskan

tundra, Arctic regions of the North Atlantic and other low temperature environments were screened for low temperature metabolism of hydrocarbons. None of the cultures examined were comparable to *Candida lipolytica* or *Candida maltosa* at elevated or low temperatures. Studies of these two yeasts have demonstrated that both are capable of oxidizing a range of aromatic hydrocarbons including naphthalene and benzopyrene. *Candida maltosa* generally grows better on hydrocarbons than *C. lipolytica*. However, *C. lipolytica* appears to immobilize large quantities of hydrocarbon. Differences in the uptake of non-growth supporting hydrocarbons have been observed between these two yeasts. (Au)

CUNDELL, A.M.

194

Microbial degradation of petroleum at low temperature / Cundell, A.M. Traxler, R.W.

(Marine pollution bulletin, v. 4, no. 8, Aug. 1973, p. 125-127)

ASTIS document number 173770.

ACU, NSDB

Bacteria were isolated from littoral sediments collected in Chedabucto Bay, Nova Scotia, and from soil-contaminated soil adjacent to a natural oil seep at Cape Simpson, Alaska. Data are presented on the change of hydrocarbon utilization and growth temperature of two bacteria, which suggest that bacteria existing in these environments play a significant role in the biodegradation of pollutant hydrocarbons. (Au)

CUNDY, D.F.

See: 361, 363.

CUYPERS, L.E.

See: 41.

DAMES AND MOORE (FIRM)

195

Beaufort Sea monitoring program : proceedings of a workshop (September 1983) and sampling design recommendations / Dames and Moore (Firm). Houghton, J.P. Segar, D.A. Zeh, J.E. United States. Outer Continental Shelf Environmental Assessment Program [Sponsor].

Juneau, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984.  
xi, 111 p. : ill., maps ; 28 cm.

Appendices.

References.

ASTIS document number 156612.

ACU, NSDB(NTIS)

This document attempts to describe a long-term monitoring program for assessing potential effects of anticipated oil and gas development on the United States Beaufort Sea continental shelf. ... To assist in development of a longer term monitoring program for the Beaufort Sea ... [U.S. National National Oceanic and Atmospheric Administration (NOAA)] ... and [U.S. Minerals Management Service (MMS)] ... sponsored a workshop in September 1983 ... NOAA issued a contract to Dames & Moore, consultants in the environmental and applied earth sciences, to: Provide a summary and synthesis of the workshop proceedings ...; Perform statistical analyses of monitoring approaches suggested by the workshop to optimize the statistical sampling design applied ...; and Detail ... optimum approaches to Beaufort Sea monitoring that meet the prescribed goals ... (Au)

196

Conceptual oil dispersion modeling, lower Cook Inlet-Shelikof Strait / Dames and Moore (Firm). Schleuter, R.S. Rauw, C.I. United States. Minerals Management Service [Sponsor].

(Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 27, December 1984, p. 389-469, ill., maps)

References.

ASTIS document number 168394.

ACU

This report describes a study of conceptual oil dispersion modeling for Lower Cook Inlet and Shelikof Strait, Alaska. [Specific elements are as follows:] (1) Evaluation of Eulerian and Lagrangian spreading algorithms. (2) Establish techniques to be used to model the selected weathering phenomena. (3) Evaluation of wind field models applicable to Lower Cook Inlet and Shelikof Strait. (4) Investigate the need for depth averaged or layered hydrodynamic models for Lower Inlet and Shelikof Strait. (Au)

DANIELEWICZ, B.

See: 82.

DAVIDSON, L.W.

197

An overview of the Canadian Arctic in relation to oil spill countermeasures / Davidson, L.W.

(Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 1- 1- 1- 11, ill., map)

References.

ASTIS document number 179078.

OON. ACU

As an initial element of AMOP, Fenco Consultants Ltd., with F.F. Stanley & Company, have compiled "An Arctic Atlas: Background Information for Developing Marine Oilspill Countermeasures". ... this atlas is intended to provide baseline input to current and future projects addressing the Arctic oilspill problem. ... The variety of environmental parameters which could in some circumstances be of significance in oil spill countermeasures operations is broad. For the purposes of this compilation, the selected parameters of importance have been grouped into five principal categories: (1) Geology and Petroleum Development (2) Meteorology and Oceanography (3) Ice (4) Biology (5) Social .... (Au)

See also: 506.

DAVIS, R.A.

198

Report of a workshop on Arctic marine mammals / Davis, R.A.

Winnipeg, Manitoba : Fisheries and Aquatic Sciences, 1981. iv, 13p. : figure ; 28cm.

(Canadian technical report of fisheries and aquatic sciences, no. 1005)

ASTIS document number 66745.

ACU

A workshop of experienced biologists examined the potential effects of offshore hydrocarbon development and transportation on marine mammals in the Canadian Arctic. Important data gaps and research priorities to address these gaps are presented in this report.

The workshop also examined the data needed to effectively manage arctic marine mammals. This analysis and the research needed to begin to establish the required data base are reported. (Au)

See also: 399, 401.

DAVIS, R.W.

See: 358.

DAWE, B.R.

199

Satellite data on the Kurdistan spill / Dawe, B.R.

Parashar, S.K. Ryan, J.P. Worsfold, R.D. (Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 455-478, ill., maps)

References.

ASTIS document number 175765.

ACU

On March 15, 1979, the oil tanker "Kurdistan" was damaged in ice and subsequently broke into two sections. Approximately 7,000 metric tons of Bunker "C" oil was spilled into the Cabot Strait. At the time large areas were ice covered and there was ice cover in a number of bays around Cape Breton Island. ... A major problem at the beginning of this operation was the location and tracking of the oil. ... One aspect of the oil spill tracking program was the use of satellite imagery from the Shoe Cove Satellite Receiving Station (SCSRs). This included the use of both LANDSAT and TIROS-N data. The purpose of the study was to analyze the satellite data available from SCSRS and provide immediate information on the disposition and location of any oil slick detected. The second purpose was to analyze the data after the spill period to determine the requirements for satellite tracking and monitoring oil spills both in the open ocean and in ice. (Au)

See also: 474, 533, 577.

DAY, T.

200

Emissions from in situ burning of crude oil in the Arctic /

Day, T. Mackay, D. Nadeau, S. Thurier, R. (Water, air and soil pollution, v. 11, no. 2, 1979, p. 139-152, ill.)

References.

ASTIS document number 172669.

ACU, NSDB

The results of an exploratory study of the effects of in situ crude oil spill burning on air quality in the Beaufort Sea region of the Arctic are presented. A scenario is postulated defining the amounts of oil released, the size and number of burnable oil pools, and the duration of the burning period. Estimates are made of the likely emissions of soot, CO, SO<sub>2</sub> and metals based on literature and some experimental work. Assumptions are made about plume rise and dispersion which permit downwind concentrations of emissions to be calculated and compared with air quality objectives. Although the calculated concentrations may contain significant error because of the many assumptions, it is believed that the data demonstrate that concentrations of SO<sub>2</sub> and CO will be acceptably low, concentrations of soot and metals will often be undesirably high within 10 km of the fires, but will be acceptably low at greater distances. It is concluded that burning may be a method of

substantially reducing the adverse environmental impact of oil spills in the Arctic. (Au)

DE OLIVEIRA, C.

See: 540, 542, 543.

DEBORD, F.W.

See: 446.

DECOFF, G.

See: 363.

DENBESTE, J.

See: 27.

DEVRIES, A.L.

201

The effect of naphthalene on synthesis of peptide antifreeze in the Bering Sea sculpin *Myoxocephalus verrucosus* / Devries, A.L.

(Marine pollution : functional responses : proceedings of the Symposium "Pollution and Physiology of Marine Organisms", held on November 14-17, 1977 at Hobcaw Barony, Georgetown, South Carolina / Edited by W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J. Vernberg. - New York : Academic, 1979, p. 53-67, ill.)

References.

ASTIS document number 175226.

ACU

... Because of its toxicity and relatively high concentration in certain petroleum, we decided to investigate the toxic effects of naphthalene on the physiology and biochemistry of selected Bering Sea fishes at lethal and sublethal concentrations. The fact that naphthalene is rapidly taken up and appears to accumulate in the liver, at low levels of exposure ... suggested to us that this toxicant might affect liver protein synthesis. The liver protein synthetic systems selected for study were the secreted plasma proteins (albumins and globulins) and the biological antifreeze peptides which have been demonstrated to be present in certain members of the fish families Gadidae and Cottidae which inhabit the Bering Sea. ... The species selected for this study was the cottid, *Myoxocephalus verrucosus* (Bean) because it was found to be a very hardy fish which survives with few problems in captivity. ... The biological antifreeze which protects this fish at subfreezing temperatures consists of small peptides which are composed of approximately 40% alanine .... (Au)

202

The physiological effect of acute and chronic exposure to hydrocarbons of petroleum on the near-shore fishes of the Bering Sea / Devries, A.L.

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 1-14, ill.)

(NTIS PB-261 407, p. 1-14, ill.)

References.

Alternate title: The physiological effect of acute and chronic

exposure to hydrocarbons and of petroleum on the near-shore fishes of the Bering Sea.

ASTIS document number 175838.

ACU

... This study is concerned with the physiological effects of acute and chronic exposure to the water soluble hydrocarbons of Alaskan crude oils on the near shore Bering Sea fishes [arctic flounder, saffron cod, and sculpins.] Much of our attention has been directed towards the aromatic hydrocarbons because they are extremely toxic, concentrations as low as 2 parts per million naphthalene killing some fishes in 48 hours. Special emphasis is being put on studies of the effects of the aromatic hydrocarbons on the antifreeze systems of these fishes because the aromatics such as the naphthalenes have been shown to concentrate in the liver where they are presumably detoxified. Because the liver is also the site of the synthesis of the peptide and glycopeptide antifreezes, accumulation could cause damage to the protein synthetic machinery. Such damage could lead to reduced levels of antifreeze causing these fishes to freeze during the winter. (Au)

DIAMANT, I.

See: 663.

DICKINS (D.F.) ASSOCIATES LTD.

203

Baffin Island Oil Spill Project : Cape Hatt ice conditions / Dickins (D.F.) Associates Ltd. Canada. Baffin Island Oil Spill Project [Sponsor].

Vancouver, B.C. : D.F. Dickins Associates Ltd., 1981.

41 p. ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 8)

Appendices.

Cover title: Ice conditions: Baffin Island Oil Spill Project, 1981 study results.

"Correct citation for this publication: ... Ice Conditions - 1981 Study Results ...".

References.

ASTIS document number 131806.

NFSMO

The Baffin Island Oil Spill (BIOS) Project is a program of research into arctic marine oil spill countermeasures. It consists of two main experiments or studies. The first of these, referred to as the Nearshore Study, was designed to determine if the use of dispersants in the nearshore environment would decrease or increase the impact of spilled oil. The second of the two experiments in the BIOS Project is referred to as the Shoreline Study. It was designed to determine the relative effectiveness of shoreline cleanup countermeasures on arctic beaches. The project was designed to be four years in length and commenced in 1980. ... Beginning in June [till September 1981] ... five time lapse camera stations were operated on Cape Hatt to document ice break-up, summer movements, freeze-up and ice/shoreline interaction processes. ... Summer open-water conditions at Cape Hatt were extended in 1981 by 27 days over 1980 and 17 days over the normal for the Cape Hatt/Eclipse Sound region. (Au)

204

Baffin Island Oil Spill Project oil discharge systems / Dickins (D.F.) Associates Ltd. Canada. Environmental Protection Service [Sponsor]. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.

iv, 29 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 9)

Appendices.

Cover title: Discharge systems : 1981 study results.

References.

ASTIS document number 170097.

ACU

Two oil discharge systems were designed, constructed and operated as part of the 1981 Baffin Island Oil Spill Project. A dispersant/oil discharge system combined Lagomedio Crude and Corexit 9527 in a 10:1 mix with seawater at a 5:1 water to oil volume ratio, and discharged the resulting emulsion through 100 m of perforated pipe laid on the seabed perpendicular to shore in test Bay 9 of Ragged Channel, Cape Hatt, N.W.T. ... The report describes the design objectives, system components and field operation of both the diffuser (dispersed oil) system and the spill plate used for the surface oil spill in Bay 11. ... (Au)

See also: 216.

## DICKINS (D.F.) ENGINEERING CONSULTING

205

Baffin Island Oilspill Project Cape Hatt ice conditions /  
Dickins (D.F.) Engineering Consulting. Dickins, D.F.  
Brown, R. Canada. Baffin Island Oil Spill  
Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1981.

vii, 86 p. ; ill., figures, tables ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 8)  
Appendices.

Cover title: Ice conditions: Baffin Island Oil Spill Project.

"Correct citation for this publication: ... Ice Conditions -  
1980 Study Results ...".

ASTIS document number 135780.

NFSMO

Up to nine time lapse camera stations were operated with a greater than 80% reliability factor, on Cape Hatt, between July 23 and October 20, 1980, to document ice break-up, summer movements, freeze-up, and ice/shoreline interaction processes. This program, combined with 20 days of field observations, showed that while dynamic ice thrust events do not occur in the Ragged Channel test bays, a great deal of ice layering within the beach face overturns and redistributes material in the intertidal zone. Also bottom sediment and animal life is potentially stripped clean each spring out to a depth of about 3 m by ice adfreeze nearshore. Most of this material is carried offshore, but the potential exists for minor cross contamination of the test bays by loose ice floes, at break-up in 1982. This study examines historical ice conditions in the Cape Hatt, Pond Inlet area. Variations of up to two weeks are possible in break-up dates. Summer incursions of old ice fragments will likely be associated with steady NW winds down Navy Board Inlet. A maximum open water operating "window" of 6 weeks can be expected between August 10 and September 20. ... (Au)

206

Return to Balaena Bay : long term effects of a large scale  
crude oil spill under arctic sea ice 1975 to 1981 / Dickins  
(D.F.) Engineering Consulting. Arctic Laboratories  
Limited. Hellebust, J. Gulf Canada Resources  
Inc. [Sponsor].

[S.l.] : D.F. Dickins Engineering, 1981.

3 microfiches : ill., figures, tables ; 11 X 16 cm.

(COOSRA project report, no. CS07)

Appendices.

References.

ASTIS document number 115711.

ACU, NFSMO

A combined chemical/biological study was conducted during July,

1981 at Balaena Bay, N.W.T. with the aim of assessing the degree of environmental impact as the result of the experimental oil spills conducted there over the winter of 1974/75. The study included an analysis of benthic, beach and salt marsh sediments for non-polar and polyaromatic hydrocarbons, an histopathological examination of the polychaete *Pectinaria hyperborea* and the clam *Macoma calcaria*, an assessment of the benthic invertebrate community and a study of effects on vegetation in the contaminated areas. The site investigation revealed the presence of weathered oil residues coating rocks in a narrow strip of the intertidal along about 900 m of shoreline. Total volume remaining was estimated at 0.2 cubic m, with area coverage ranging from 0.1% to 5% in the worst areas. Heavily oiled salt marsh experimental sites showed grass recovery rates of less than 13%, with about 5% of the original oil concentration remaining in upper soil layers. [The findings of the chemical/biological analyses are indicated.] ... In general it appears that detectable impacts of the 1974/75 under-ice spills on sediment hydrocarbon content, histopathological condition of *Pectinaria hyperborea* and *Macoma calcaria*, and benthic community structure are small. (Au)

## DICKINS, D.F.

207

Dome's Petroleum [sic] study of oil and gas under sea ice /  
Dickins, D.F. Buist, I.A. Pistruzak, W.M.

(Proceedings - 1981 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : March 2-5, 1981, Atlanta,  
Georgia. - Washington, D.C. : American Petroleum  
Institute, 1981, p. 183-189, ill., maps)

References.

ASTIS document number 160598.

To tie all the previous work on oil migration and in-situ burning together, Dome Petroleum Ltd. undertook a major oil spill experiment during the winter of 1979/80 in the Beaufort Sea. The objective of this field experiment was to determine the efficiency of burning as a countermeasure and to optimize burning techniques for oil and gas released from a Beaufort Sea blowout under ice. The experiment took place in three phases, approximately 8 kilometres offshore from McKinley Bay in the Beaufort Sea, in first-year sea ice. Approximately 19 cubic metres of crude oil was discharged under the ice in conjunction with gas (air). This oil surfaced in the spring in pools thick enough to burn. Some 80 percent of the oil discharged was removed from the marine environment. (Au)

See also: 118, 119, 120, 121, 205, 216.

## DICKMAN, M.

208

Preliminary notes on changes in algal primary productivity  
following exposure to crude oil in the Canadian Arctic /  
Dickman, M.

(Canadian field naturalist. v. 85, no. 3, July-Sept. 1971, p.  
249-251)

References.

ASTIS document number 172677.

ACU

Mackenzie Valley Crude oil which had been exposed for 2 months to natural arctic summer conditions was added to bottles containing algae taken from a marsh near Inuvik, N.W.T. Carbon 14 primary productivity was ten times lower in the oil treated samples ( $0.59 \pm 0.30$  mgC/cu m/hr.) than in the untreated control samples ( $5.12 \pm 1.2$  mgC/cu m/hr.) after a four hour incubation period. Small flagellates such as *Cryptomonas* spp. and *Chlamydomonas* spp. comprised nearly 80% of the primary producers in the Inuvik marsh samples. Some implications of the significance of these preliminary findings are discussed in view of the proposed 800 mile Mackenzie

Valley Pipeline route. (Au)

DMITRIEV, F.A.

209

Raspredelenie urlevodorodov v svezhevypavshem snege i vo l'du na stantsii "Severnyi polius-22" (po nabliudeniiam 1977-1978 gg.) = [The distribution of hydrocarbons in a fresh-fallen snow and in ice at the "North Pole-22" station from observations during 1977-1978] / Dmitriev, F.A. Pivovarov, S.V.

(Meteorologiya i gidrologiya, 1981, no. 5, p. 65-69, ill.)

English abstract.

References.

Text in Russian.

ASTIS document number 84425.

ACU, NSDB

Techniques of selection and analysis of ice samples are described as well as the content and distribution of hydrocarbons in underlying surface objects in the areas of "North Pole" drifting stations. (Au)

210

Uglevodorody v snezhno-ledianom pokrove i vode v severnoi Karskogo moria = [Hydrocarbons in the snow-ice cover and water of the North Kara Sea] / Dmitriev, F.A. Pivovarov, S.V.

(Meteorologiya i gidrologiya, 1983, no. 5, p. 87-91, figure, table)

References.

ASTIS document number 132667.

CU, NSDB

On the basis of gas-chromatographic analysis data, the distribution of hydrocarbons in samples of ice, water and snow, derived during the first cruise of the research icebreaker "Otto Schmidt" is discussed. The qualitative composition of aliphatic hydrocarbons is considered, as well as their total concentrations and the n-alkenes content. The aliphatic hydrocarbons concentration is in the range 10-20 mg/L. An assumption is made on possible sources (technogenic and biogenic) of formation of the composite hydrocarbon mixture composition. (Au)

DOBRA, K.W.

See: 130.

DOIDGE, D.W.

See: 142.

## DOME PETROLEUM LIMITED

211

Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 3A : Beaufort Sea - Delta setting / Dome Petroleum Limited. Esso Resources Canada. Gulf Canada Resources Inc.

Calgary, Alta. : Dome Petroleum Limited, 1982.

1 v. (various pagings) : ill., figures, tables ; 28 cm.

Cover title: Hydrocarbon development in the Beaufort Sea - Mackenzie Delta region: Environmental impact statement. Volume 3A: Beaufort-Delta setting.

References.

ASTIS document number 92207.

ACU, NFSMO, NSDB

Volume 3A of the Environmental Impact Statement covers the marine region extending from the Bering Strait in the west through the Beaufort Sea to Amundsen Gulf in the east, and the onshore coastal area from the Yukon-Alaska border through the Mackenzie Delta to Cape Parry. The various aspects of the marine and terrestrial physical environments and marine and terrestrial plants and animals are discussed, presenting an overview of the ecology of this region. (ASTIS)

212

Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 3B : Northwest Passage setting / Dome Petroleum Limited. Esso Resources Canada. Gulf Canada Resources Inc.

Calgary, Alta. : Dome Petroleum Limited, 1982.

1 v. (various pagings) : ill., figures, tables ; 28 cm.

Cover title: Hydrocarbon development in the Beaufort Sea - Mackenzie Delta region: Environmental impact statement. Volume 3B: Northwest Passage setting.

References.

ASTIS document number 92215.

ACU, NFSMO, NSDB

Volume 3B of the Environmental Impact Statement provides the environmental setting for the marine shipping corridor which lies to the east of the Beaufort Sea. The region extends from approximately Banks Island through Viscount Melville Sound, Lancaster Sound, Baffin Bay and Davis Strait, to 60 degrees north latitude in the Labrador Sea. Emphasis has been placed on those subjects deemed to be most relevant for the purposes of assessing possible impacts of shipping operations on the environment .... (Au)

213

Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 4 : Biological & physical effects / Dome Petroleum Limited. Esso Resources Canada. Gulf Canada Resources Inc.

Calgary, Alta. : Dome Petroleum Limited, 1982.

1 v. (various pagings) : ill., figures, tables ; 28 cm.

Cover title: Hydrocarbon development in the Beaufort Sea - Mackenzie Delta region: Environmental impact statement. Volume 4: Biological & physical effects.

References.

ASTIS document number 96350.

ACU, NFSMO, NSDB

The purpose of this volume is to assess the possible physical and biological impacts associated with proposed Beaufort Sea-Mackenzie Delta hydrocarbon developments .... Major emphasis is placed on examining the possible impacts of developing the first four offshore oil fields (assumed to be Tarsiut, Koakoak, Issungnak and Kopanoar) and two onshore oil fields (Adgo and Atkinson). ... To transport the oil from the region to markets, two modes of transportation, namely icebreaking tankers and overland pipelines, are under active consideration. Since both have merit, and eventually both may actually be employed, the possible impacts of each are examined. As suggested in the Environmental Assessment and Review Panel (EARP) guidelines, this volume discusses the potential impacts by region .... the Offshore Beaufort Sea Production Region (Chapter 2), the Onshore Mackenzie Delta Production Region (Chapter 3), the Northwest Passage Transportation Region (Chapter 4) and the Mackenzie Valley Overland Pipeline Region (Chapter 5). ... (Au)

214

**Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 6 : Accidental spills / Dome Petroleum Limited. Esso Resources Canada. Gulf Canada Resources Inc.**

Calgary, Alta. : Dome Petroleum Limited, 1982.

1 v. (various pagings) : ill., figures, tables ; 28 cm.

Cover title: Hydrocarbon development in the Beaufort Sea - Mackenzie Delta region: Environmental impact statement. Volume 6: Accidental spills.

References.

ASTIS document number 92231.

ACU, NFSMO, NSDB

The purpose of this volume of the Environmental Impact Statement is to describe the potential for and the fate, cleanup and effects of accidental spills of oil and hazardous materials. The geographical regions addressed in this volume are within Canadian lands and waters north of 60 degrees N latitude, and include the Beaufort Sea - Mackenzie Delta region, the Mackenzie Valley and the Northwest Passage, the regions potentially involved in hydrocarbon development .... The focus in this volume is on large crude oil spills, as these are perceived to be a potential major impact associated with the proposed development. Smaller, minor spills of other refined and waste oils and spills of hazardous materials are also discussed at the end of the volume. (Au)

215

**Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 7 : Research and monitoring / Dome Petroleum Limited. Esso Resources Canada. Gulf Canada Resources Inc.**

Calgary, Alta. : Dome Petroleum Limited, 1982.

1 v. (various pagings) : ill., figures, tables ; 28 cm.

Cover title: Hydrocarbon development in the Beaufort Sea - Mackenzie Delta region: Environmental impact statement. Volume 7: Research and monitoring.

References.

ASTIS document number 96369.

ACU, NSDB

The main purpose of this volume of the Environmental Impact Statement is to bring together and present in summary form, the activities (both environmental and socio-economic) being conducted or envisaged to satisfy the research and monitoring needs identified in Volumes 2, 3, 4, 5 and 6. [The geographical regions addressed in this volume are primarily] the Beaufort Sea - Mackenzie Delta region, the Northwest Passage, and the Mackenzie Valley - the regions potentially involved in Arctic hydrocarbon development. ... Chapter 1 addresses topics related to the division of responsibility for conducting studies; the relevance of studies to development needs and to the assessment of development effects; and the means for reviewing and modifying current and future studies in a manner satisfactory to both industry and regulatory authorities. ... Chapter 2 ... describes the major relevant programs carried out over the past approximately 25 years in the Canadian Arctic. ... Chapter 3 begins by outlining the types of existing environmental operating conditions (EOCs) placed on the various facilities and operations in the Beaufort Sea region by government. Many of these EOCs include research and monitoring programs. This discussion is followed by descriptions of present and future environmental projects being undertaken or proposed by the proponents in conjunction with associated companies, government agencies or other groups. These include physical, biological, spill clean-up and socio-economic programs. Chapter 4 consolidates, by field of study, the proposed future programs as envisaged by the proponents at this time. ... (Au)

216

**Fate and behaviour of water-in-oil emulsions in ice / Dome Petroleum Limited. Buist, I.A. Dickins (D.F.) Associates Ltd. Dickins, D.F. Canadian Offshore Oil Spill Research Association [Sponsor].**

Calgary, Alta. : Dome Petroleum Ltd., 1983.

2 microfiches : ill., figures, tables ; 11 x 15 cm.

(COOSRA project report, no. CS11)

Appendices.

References.

ASTIS document number 120669.

ACU

In 1982, in McKinley Bay, N.W.T., an experimental spill was conducted to investigate the cleanup of water-in-oil emulsions spilled under first year sea ice. The experiment involved the discharge of 192 litres of a 60% water-in-oil emulsion beneath the ice at each of two test sites and the discharge of 192 litres of straight crude oil at a third site for comparison. The ice was 165 cm thick at the time of the discharge. ... During the time that the oil and emulsion were frozen in the ice no significant changes in the physical or chemical properties of the oil were noted. In particular the emulsion did not separate back into its components of oil and water. By mid June, when the ice sheet was melting, the crude oil began to appear on melt pools on the ice surface. The oil was migrating up through open brine channels in the ice. This process continued and by July 8, one day prior to the breakup of the ice sheet, only some 9% of the original oil was left trapped in the ice. In comparison, significant quantities of emulsion did not appear on the ice surface until about July 5. This was because the high viscosity of the emulsion prevented it from flowing up the open brine channels. ... By July 8 the same small percentage of emulsion as oil was left trapped in the ice. In-situ burning of the emulsion floating on melt pools proved to be an effective technique for cleaning up the spills. About half the emulsion was removed by burning compared to that of 57% for the crude oil. The remainder of the surface oil emulsion was either cleaned up using sorbent pads, evaporated dissolved. ... The implications of the findings of this experiment for offshore oil spill countermeasures are [reported] .... (Au)

See also: 39, 40, 41, 121, 240, 241, 242, 266, 398, 405, 412, 459.

DOSTER, J.F.

See: 327.

DUERDEN, F.C.

217

**Kurdistan : an unusual spill successfully handled / Duerden, F.C. Swiss, J.J.**

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 215-219, ill., maps)

References.

ASTIS document number 171654.

On March 15, 1979, the 30,000 dwt British tanker Kurdistan split in two in the ice-infested waters of Canada's Cabot Strait. Approximately 7,000 tons bunker C spilled from the ruptured tanks, but the rest remained in the floating bow and stern sections. ... Eventually, in a precedent-setting action, the stern was towed through stormy seas and ice and offloaded at Port Hawkesbury, Nova Scotia, and the bow was sunk by naval gunfire in a pre-designated area off the Scotian Shelf. Twelve days after the accident, oil started coming ashore and eventually contaminated over 700 miles of shoreline, requiring cleanup efforts lasting over 6



months. The response was difficult for a number of reasons: the oil often trapped in ice and could not be recovered; it floated on the surface, making it almost impossible to locate even with sophisticated remote-sensing techniques; it emerged unexpectedly, oiling and reoiling shorelines for several months; and environmental and socioeconomic concerns became increasingly significant. Finally, over a million bags of oily debris were collected, requiring the development of an environmentally acceptable disposal method. All of these problems made the Kurdistan spill difficult and unique from both a response and cleanup point of view. (Au)

## DUFFY, S.

See: 86, 107.

## DUNBAR, M.J.

218

Oil and gas / Dunbar, M.J.

(Marine transportation and high arctic development : a bibliography : scientific and technical research relevant to the development of marine transportation in the Canadian north / M.J. Dunbar. - Ottawa : Canadian Arctic Resources Committee, 1980, p. 141-150)

References.

ASTIS document number 182044.

OON

... The papers listed in [this section of] the bibliography can be classified under the headings of: (1) conferences; (2) oil and ice interaction; (3) general pollution effects of oil; (4) specific effects of oil on organisms; (5) environmental recovery from oil spills; and (6) presence and development of oil and gas resources. The last category is not represented here, belonging as it does to the technological subject matter .... Most of the rest of the approximately one hundred references are concerned with the effects of oil in the sea, both in general environmental terms and on specific animals, and with environmental recovery from oil spills. ... (Au)

## DUNN, B.P.

See: 666.

## DUTTON, C.R.

See: 425.

## DUVAL, W.S.

219

The sublethal effects of hydrocarbons on the bioenergetics and productivity of selected marine fauna / Duval, W.S.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 83-86)

ASTIS document number 181390.

OON

Investigations are in progress to determine the bioenergetic cost of exposure of selected marine fauna to sublethal concentrations of the water-soluble fraction of the Prudhoe Bay crude oil. Emphasis is directed toward elucidation of the interactive effects of hydrocarbon concentration and duration of exposure on bioenergetic processes contributing to the secondary productivity of zooplankton and

epibenthic invertebrates. ... In the case of marine invertebrates, the bioenergetic cost of exposure to water soluble hydrocarbons is being examined through the construction of detailed daily carbon budgets. Studies have also been conducted with juvenile coho salmon (*Oncorhynchus kisutch*) and rainbow trout (*Salmo gairdneri*), although carbon budgets were not determined for these test organisms. The research is focused on resolution of the differences between short-term adaptive responses of test organisms subjected to hydrocarbon exposure and relatively long-term sublethal effects which could be deleterious to the growth and productivity of aquatic communities. ... (Au)

See also: 81, 242, 244, 255, 256.

## DWERNYCHUK, W.

See: 89, 90.

## EHRHARDT, M.

See: 383.

## EIMHJELLEN, K.

220

Baffin Island Oil Spill Project : microbial degradation of oil - measurements in Ragged Channel, Z-lagoon and Eclipse Sound, Cape Hatt 1980, a baseline assessment /

Eimhjellen, K. Sommer, T. Sendstad, E.

Norway. Royal Ministry of Environment [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1980.

vii, 33 p. : figures, tables ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 6)

Appendix.

Cover title: Microbiology: 2. Biodegradation of oil.

"Correct citation for this publication: ... Microbiology: II.

Biodegradation of Oil - 1980 Study Results".

References.

ASTIS document number 135763.

NFSMO

During the period 26 August to 9 September 1980 analyses of baseline parameters related to microbial degradation of oil were determined in samples from the nearshore waters and sediments of Ragged Channel (Bay 9, 10 and 11) and in shoreline sand and sediments inside and outside the Z-lagoon of Cape Hatt. Most probable number techniques were used to assess counts of oildegrading microorganisms (fungi). An experimental laboratory technique was used to determine rates of mineralization of generally tritiated Lago Medio crude oil and <sup>14</sup>C-labelled n-hexadecane, naphthalene and benz(a)pyrene. ... (Au)

221

Baffin Island Oil Spill Project : microbial degradation of oil : measurements in Ragged Channel test bays and enhanced biodegradation experiments in Z-Lagoon : a postspill survey /

Eimhjellen, K. Nilssen, O. Sommer, T.

Sendstad, E. Norway. Royal Ministry of

Environment [Sponsor]. Canada. Environmental

Protection Service [Sponsor]. Canada. Baffin Island

Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1983.

ix, 41 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 82- 6)

Cover title: Microbiology 2 : biodegradation of oil.

"Correct citation for this publication: ... Microbiology: 2. Biodegradation of Oil - 1982 Study results".

## References.

ASTIS document number 170062.

ACU

This report summarizes the results from the first postspill sampling after the experimental oilspills in 1981 with the objective to monitor the possible longterm effects of oil on the activity of the microbial degradation of petrogenic hydrocarbons in the nearshore waters and sediments. At the same time the results from a number of experiments on enhanced biodegradation of oil in backshore sediments are reported. ... (Au)

222

**Baffin Island Oil Spill Project : microbial degradation of oil : measurements in Ragged Channel, Z-Lagoon and Eclipse Sound, Cape Hatt 1980 : a baseline assessment /** Eimhjellen, K. Sommer, T. Sendstad, E. Norway. Royal Ministry of Environment [Sponsor]. Canada. Environmental Protection Service [Sponsor]. United States. Bureau of Land Management [Sponsor]. (Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 623-660, ill., map)

## Appendix.

## References.

ASTIS document number 169285.

ACU

... analyses of baseline parameters related to microbial degradation of oil were determined in samples from the nearshore waters and sediments of Ragged Channel and in shoreline sand and sediments inside and outside the Z-lagoon of Cape Hatt. Most probable number techniques were used to assess counts of oildegrading microorganisms (bacteria), generally heterotrophic bacteria and antibiotic resistant oildegrading microorganisms (fungi). An experimental laboratory technique was used to determine rates of mineralization of generally tritiated Lago Medio crude oil and C14-labelled n-hexadecane, naphthalene and benz(a)pyrene. As a measure of general biological activity in shoreline sand and sediments a field method [was used] for determining CO<sub>2</sub>-production. ... (Au)

223

**Microbial degradation of oil : measurements in Ragged Channel test bays and Bay 102, Cape Hatt 1981 /** Eimhjellen, K. Nilssen, O. Josefsen, K. Sommer, T. Sendstad, E. Sveum, P. Hoddo, T. Norway. Royal Ministry of Environment [Sponsor]. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.

ix, 57 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 6)

Cover title: Microbiology 2 : biodegradation of oil.

"Correct citation for this publication: ... Microbiology: II. Biodegradation of Oil - 1981 Study Results".

## References.

ASTIS document number 169935.

ACU

... During the 3 to 4 weeks of post spill sampling no drastic changes in the population of TVH [total viable heterotrophic bacteria] and ODB [oil degrading bacteria] could be recorded. ... The bacterial populations in the sediment samples were very similar to last year, and no effects of the oil spill could be found. ... The supralittoral test plots oiled in 1980 still had enhanced levels of TVH, ODB and respiratory carbon dioxide production compared to unoiled plots. The crude oil plot had less remaining oil than the oil-emulsion plot. ... (Au)

See also: 511, 630.

EKKER, M.

See: 338.

ELSE, P.

See: 641, 643.

ENDAL, L.J.

See: 632.

## ENERGY RESOURCES CO.

224

**Baffin Island Oil Spill Project : chemistry component 2, analytical biogeochemistry : report on 1982 field experiments /** Energy Resources Co. Boehm, P.D. Canada. Baffin Island Oil Spill Project [Sponsor]. Edmonton, Alta. : BIOS Project Office, 1983.

xv, 210 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 82- 2)

## References.

Cover title: Chemistry 2 : analytical biogeochemistry.

ASTIS document number 173720.

OOFF

The third year of the analytical biogeochemistry program as part of the BIOS experiments was conducted. The program focused on the persistence of oil in the benthic system, its weathering, and its transport. Water column samples were taken as well to examine possible movement of low levels of water-borne oil through the system. The results indicate that oil is being transported from the Bay 11 beach and impacting this bay and perhaps the others as well at low levels. Significant biodegradation, as evidenced by an enhanced degradation of n-alkanes relative to the isoprenoid alkanes, was occurring on Bay 11 beach, but not in the offshore sediments. The presence of biodegraded residues in the heavily impacted (>10 ppm oil) offshore sediments and sediment floc of Bay 11 was due to offshore transport of beached residues. Levels in benthic animals decreased overall, the filter-feeders depurating oil to a greater extent than the deposit feeders due to the continued oil in Bay 11 and the increased presence of oil in these sediments. Low levels (parts per trillion) of low molecular weight aromatics and saturates are apparently being introduced into the system as evidenced by the changing chemistry of the oil in benthic animals and by direct measurements of the water column and beach sediments. Possible transport mechanisms that are responsible for persistent and some increasing oil levels in the various environmental compartments are discussed. (Au)

## ENGELHARDT, F.R.

225

**Behavioural responses of benthic invertebrates exposed to dispersed crude oil /** Engelhardt, F.R. Mageau, C. Canada. Baffin Island Oil Spill Project [Sponsor]. Edmonton, Alta. : BIOS Project, 1983.

1 microfiche : ill. ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 82- 7, Part III)

proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 32-51, ill.)

#### References.

Fiche heading title: Baffin Island Oil Spill Program : special studies : 1982 study results.

ASTIS document number 159743.

#### ACU

A series of experiments were carried out with the purpose of defining behavioural responses in three species of benthic invertebrates. *Strongylocentrotus droebachiensis* (STR), *Serripes groenlandicus* (SER) and *Mya truncata* (MYA), when exposed to Lago medio crude oil. The dosing protocol was designed to correlate with the 1981 BIOS experimental spill program but relied on tank exposures using a flow-through seawater system on site at Cape Hatt, N.W.T. ... MYA responded to the addition of dispersed oil by ostial closure and siphon retraction. ... SER also exhibited sensitivity to oil by ostial closure and siphon retraction. ... STR showed a rapid onset of behavioural changes at 5 ppm and greater. ... Spines became rigid at low doses and drooped at higher doses even after removal of the oil. ... The behavioural data are interpreted in the context of individual survival, of potential for hydrocarbon loading, and generally in relation to the BIOS experimental spill data. (Au)

#### 226

Effects of acute and long-term exposure to dispersed oil in benthic invertebrates / Engelhardt, F.R. Mageau, C. Gilfillan, E.S. Boehm, P.D.

(Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. - [Ottawa : EPS, 1984], p. 367-392)

#### References.

ASTIS document number 159824.

[This document is based on] ... research undertaken as part of the Baffin Island Oil Spill (BIOS) project. ... A study on differential hydrocarbon loading of critical body tissues of animals exposed to chronic doses of dispersed oil was carried out concurrently with the study of behavioural effects of the low level exposure. In particular, this was oriented to an examination of the contribution of the gut of bivalves to total hydrocarbon burden, and to possible in vivo biodegradation. A subsample of two bivalve species, *Serripes groenlandicus* and *Mya truncata* ... yielded information on filtration, respiration assimilation rates, and scope for growth, as well as protein and carbohydrate metabolism. ... [The report specifically addresses two questions:] ... 1. Are the observed behavioural differences between the two species related to differences in their respective filtration rates? 2. To what extent are the accumulated hydrocarbons affecting the physical well-being of the two species? [A third species included in the results is *Strongylocentrotus droebachiensis*]. (Au)

#### 227

Effects of petroleum on marine mammals / Engelhardt, F.R. (Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 217-244)

#### References.

ASTIS document number 168661.

This paper is a review of the effects of oil spills on arctic cetaceans, pinnipeds, otters and polar bears. (ASTIS)

#### 28

Environmental issues in the Arctic / Engelhardt, F.R. (POAC 85 : the Eighth International Conference on Port and Ocean Engineering under Arctic Conditions, Narssarsuaq, Greenland, September 7-14, 1985,

proceedings. - [Copenhagen, Denmark] : Danish Hydraulic Institute, 1985, v. 1, p. 60-69)

#### References.

ASTIS document number 178500.

This paper presents an overview of environmental issues unique to the Arctic, in relation to concerns over impacts on the natural environment from ongoing and planned industrial activities, with emphasis on the petroleum industry. The major components of the arctic ecosystem are addressed to review the extent of the concerns and to evaluate their validity with respect to the significance of impacts. Microbial, benthic and plankton populations tend to be not vulnerable, while fish, seabirds and marine mammals may be vulnerable to varying degrees. In general, environmental effects pose a problem in distinct situations which can be defined in space and time. (Au)

#### 229

Hydrocarbon metabolism and cortisol balance in oil-exposed ringed seals, *Phoca hispida* / Engelhardt, F.R.

(Comparative biochemistry and physiology. Part C: Comparative pharmacology, v. 72, no. 1, 1982, p. 133-136)

#### References.

ASTIS document number 167789.

#### ACU, NSDB

1. Ringed seals were exposed experimentally to oil contamination, by feeding of a [<sup>14</sup>C] naphthalene marked crude oil in fish for up to 4 days at a rate of 5 ml/day. 2. Mixed function oxygenase (MFO) activity, measured as aryl hydrocarbon hydroxylase in liver and kidney, was found to be induced, in particular in kidney tissue where the activity increased 3-fold. 3. MFO induction correlated with a high degree of conversion of crude oil hydrocarbons to water-soluble metabolites. Most of the radioactivity was found in the polar fraction of plasma and urine. 4. Plasma cortisol levels were somewhat elevated by captive holding, and increased markedly after oil-exposure. Cortisol half-life decreased after oil exposure from 1 3/4 to 1 hr. (Au)

#### 230

Metabolic effects and hydrocarbon fate in arctic bivalves exposed to dispersed petroleum / Engelhardt, F.R.

Gilfillan, E.S. Boehm, P.D. Mageau, C.

[S.l. : s.n.], 1985?.

[7] p. ; 28 cm.

Marine environmental research paper in press.

#### References.

ASTIS document number 178551.

A number of experiments were carried out in the Canadian Arctic on Baffin Island with the purpose of defining the short- and long-term effects of exposure to dispersed crude oil on marine benthic invertebrates. The study reported here assessed metabolic responses by physiological and biochemical indices, and evaluated these in relation to exposure concentration. The overall objective of the study was to evaluate the potential for long-term survival of benthic communities in the Arctic following an oil spill. This objective was consistent with the goals of the larger Baffin Island Oil Spill (BIOS) program, which was implemented to evaluate the relative mitigating effectiveness of chemical dispersants, as compared to conventional oil spill countermeasures. (Au)

#### 231

Oil pollution in polar bears : exposure and clinical effects / Engelhardt, F.R.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 139-179, figures, tables)

#### References.

ASTIS document number 80748.

ACU, NFSMO

Polar bears exposed to simulated oil spills were found to be deeply coated by the oil. Grooming activities in particular resulted in extensive and prolonged uptake of petroleum from the gut. Blood and tissue samples showed the presence of oil. High residue levels, up to several hundred  $\mu\text{L/kg}$  were found in bone marrow, brain, and kidney; while other tissues, including fat reserves, showed only trace or low concentrations. ... Clinical toxicity effects were assessed by a broad spectrum of assays for hematological disorders, electrolyte balance, serum biochemistry, and hormonal changes. (Au)

232

Perceptions of biological impact / Engelhardt, F.R.

(Proceedings : Offshore Goteborg 83, International Conference on Offshore and Marine Technology : Technology for the Arctic. - Goteborg, Sweden : Svenska Massan Stiftelse, 1983, [11] p.)

References.

ASTIS document number 178497.

This paper ... [presents] an overview of the biological concerns generated by an increased interest and activity in arctic hydrocarbon development. ... The focus of this paper will be the effects of hydrocarbons on biota, in particular from accidental oil discharges. ... [There is] a broad spectrum of individual studies which examine the effects of oil on arctic organisms, ranging from bacteria to marine mammals. Conclusions of impact have to be extrapolated from such studies and from the more extensive background of material available for temperate environments. These form the framework of the discussion to follow, interpreted in the light of conditions unique to the arctic environment. (Au)

233

Petroleum effects in the arctic environment / Engelhardt, F.R. [Editor].

London ; New York : Elsevier Applied Science Publishers, 1985.

[xiv], 281 p. ; 22 cm.

References.

ASTIS document number 168599.

ACU, NSDB

... [This is] an up-to-date and coordinated overview of the subject [of Arctic petroleum pollution], encompassing the spectrum of biological systems from microbes to man. ... Extrapolations from temperate species and spill events were often necessary. It will also be found that the majority of the information in this volume is for crude or processed oils, very few data exist for gas and gas condensates as related to the arctic environment. The contributors to this book have presented reviews of the current state of knowledge with respect to the fate and effects of petroleum in the arctic environment. ... (Au)

234

Petroleum effects on marine mammals / Engelhardt, F.R.

(Aquatic toxicology, v. 4, no. 3, 1983, p. 199-217)

References.

ASTIS document number 172987.

OON, NSDB

Interest in the effects of petroleum on marine mammals has been stimulated both by the general presumption of impact of oil spills on marine mammals and by some recent experimental evidence which better delineates the sensitivity to oil of this varied group of mammals. ... Contact with viscous oils can lead to long-term coating of the body surface, which may interfere with swimming ability in seals, with filtering capabilities by baleen whales, and with thermoregulation in the furred marine mammals. Thermal stress as a result of increased conductance in oil-fouled fur is a

primary threat to sea otters and polar bears, resulting in decreased body temperature and an increased metabolic rate. ... A limited comparative data base suggests that seals, cetaceans and polar bears differ in their susceptibility to clinical damage following oil exposure. Ringed seals and bottlenosed dolphins were little affected in hematological, plasma chemistry or histopathological measures after oil immersion and ingestion. Localized treatment of the skin of several cetaceans resulted in transient skin damage. In polar bears, however, contact and ingestion resulted in severe but latent hematological and renal abnormalities, along with related pathological changes. This review demonstrates that while the marine mammal species tend to be grouped as one because of their unique life habits, their susceptibility to petroleum toxicity is less general, showing species-specific responses in the major effects indices. At the present level of knowledge, prediction of the effects of petroleum on a given species will require much correlation and inference from what is known about the natural history and physiology of the species, and about the characteristic toxicities of oil in mammalian systems. (Au)

235

Petroleum hydrocarbons in arctic ringed seals, *Phoca hispida*, following experimental oil exposure / Engelhardt, F.R.

(The proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 613-628, ill.)

(NTIS AD-A-072 859, p. 613-628, ill.)

References.

ASTIS document number 84263.

ACU

Ringed seals, *Phoca hispida*, showed rapid absorption and clearance of hydrocarbons from Norman Wells crude oil in body tissues and fluids when exposed experimentally by immersion and ingestion. Measured fluorometrically, relatively low but significant levels were found in tissues, blood, and plasma following external exposure. Levels in bile and urine were higher, indicating these to be routes of excretion. (Au)

236

Petroleum hydrocarbons in two benthic invertebrates, the urchin *Strongylocentrotus droebachiensis* and the polychaete *Pectinaria granulosa* / Engelhardt, F.R. Norstrom, R.J. Simons, M. Canada. Baffin Island Oil Spill Project [Sponsor].

(Working report - Baffin Island Oil Spill Project, 81- 10, p. 1-81, ill.)

References.

Cover title: Special studies : 1981 study results.

ASTIS document number 169919.

ACU

This paper reports on petroleum hydrocarbon concentration and composition in the sea urchin *Strongylocentrotus droebachiensis* and the tube-dwelling polychaete *Pectinaria granulosa*, before and after the BIOS project oil spills in Ragged Channel, Cape Hatt, N.W.T. (ASTIS)

237

Uptake and clearance of petroleum hydrocarbons in the ringed seal, *Phoca hispida* / Engelhardt, F.R. Geraci, J.R. Smith, T.G.

(Journal of the Fisheries Research Board of Canada, v. no. 8, Aug. 1977, p.1143-1147, ill.)

References.

ASTIS document number 173495.

ACU

Ringed seals, *Phoca hispida*, showed rapid absorption of hydrocarbons from Norman Wells crude oil into body tissues and fluids when exposed by both immersion and ingestion. Relatively low but significant levels were found in tissue, blood, and plasma. Levels in bile and urine were high, indicating these to be routes of excretion. (Au)

See also: 106, 367, 424, 523.

## ENGELMANN, R.J.

238

Content of the NOAA/BLM Alaskan OCS research effort / Engelmann, R.J.

(Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Meiteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77-8, p. 7-32, ill.)

(NTIS PB-277 060, p. 7-32, ill.)

Alternate title: Content of the National Oceanic and Atmospheric Administration/Bureau of Land Management Alaskan Outer Continental Shelf research effort.

References.

ASTIS document number 177318.

NSDB

This general article reviews the general background National Oceanic and Atmospheric Administration and U.S. Bureau of Land Management-sponsored research in the Alaskan outer continental shelf. The collection of baseline information in order to later assess possible effects of petroleum development on local biota is discussed. The effects of oil on biota, and the interactions of oil with ice and sea water are outlined. Approaches to condensing the output of OCSEAP researchers into a form usable by decision makers, such as synthesis meetings, are discussed. (ASTIS)

## ENVIRONMENTAL RESEARCH LABORATORIES (U.S.)

See: 738.

## ERICKSON, G.A.

See: 455.

## ESL ENVIRONMENTAL SCIENCES LIMITED

239

Beaufort Environmental Monitoring Project, 1984-85 final report / ESL Environmental Sciences Limited. LGL Limited, Environmental Research Associates. ESSA Ltd. Arctic Laboratories Limited. Arctic Sciences Limited. Stone, D.P. [Scientific Authority]. Canada. Northern Environmental Protection Branch [Sponsor]. Canada. Environment Canada [Sponsor].

Ottawa : DIAND, 1985.

xxi, 162 p. : ill. ; 28 cm.

Appendices.

References.

ASTIS document number 181862.

ACU

The Beaufort Environmental Monitoring Project (BEMP) was initiated in 1983 by Indian and Northern Affairs Canada and Environment Canada. The program is to provide the technical basis for the design, operation and evaluation of a comprehensive and defensible environmental research and monitoring program to accompany phased hydrocarbon development in the Beaufort Sea. This document is the report of the activities during the second year of the project and contains recommendations for future environmental studies. The primary activities during 1984-85 were a pre-workshop review of studies initiated since December 1983, preparation of project overviews describing the purpose of these investigations and their relationship to existing BEMP hypotheses, the conduct of a workshop in early February 1985, and the preparation of this report. [The hypotheses relate to the effects of the petroleum industry, including ice-breaker transportation, offshore structures, and oil spills, on the biota of the Beaufort Sea and region, including whales, seals, polar bears, seabirds, and fish.] ... (Au)

240

The biological effects of hydrocarbon exploration and production related activities, disturbances and wastes on marine flora and fauna of the Beaufort Sea region / ESL Environmental Sciences Limited. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1982.

xv, 450 p. : figures, tables, 28 cm.

(Beaufort E.I.S. support document, no. BEISSD01)

References.

ASTIS document number 92002.

ACU, NSDB(ENV.)

This report summarizes existing information on the potential biological effects of activities, disturbances and wastes associated with petroleum hydrocarbon exploration and production. Since this is a supporting document to the Dome/Esso/Gulf Environmental Impact Statement for Beaufort Sea Hydrocarbon Production, primary emphasis has been placed on the biological resources of this region as well as the activities, wastes and disturbances which may be associated with this development. Major sections of the report discuss the biological effects of (1) common disturbances, activities and wastes, (2) wastes and disturbances associated with both exploration and production drilling, (3) production, storage and transportation-related sources of disturbance, and (4) environmental emergencies including gas blowouts, crude oil spills or blowout, and refined fuel spills. A separate section describing the biological effects of chemically dispersed oil has been included within the discussion of environmental emergencies since this cleanup measure, if approved and undertaken, could result in significantly different biological effects than those which may be associated with crude or refined oils alone. ... (Au)

241

Biological impacts of three oil spill scenarios in the Beaufort Sea / ESL Environmental Sciences Limited. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1982.

1 v. (various pagings) : figures, tables ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD12)

References.

ASTIS document number 92070.

ACU, NSDB(ENV.)

The following sections discuss the potential local and regional impacts of a hypothetical tanker collision on the marine resources of the southeastern Beaufort Sea. Information regarding the marine flora and fauna which could be affected by an oil spill in this area was obtained from LGL and ESL (1981), Volume 3A (Chapter 3.0) as well as original literature cited in these overviews. Primary sources of information regarding the biological effects of petroleum were a recent summary and evaluation of 100 oil spill case histories ... and several reviews of laboratory research concerning the effects

of petroleum hydrocarbons. ... (Au)

242

**A prospectus on the biological effects of oil spills in marine environments /** ESL Environmental Sciences Limited.

Duval, W.S. Martin, L.C. Fink, R.P. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1981.

1 v. (various pagings) : figures, tables ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD13)

Appendix A: Data sheet spill files: 1-53, 55-108 / L.C. Martin and R.P. Fink.

References.

*ASTIS document number 92088.*

ACU, NSDB(ENV.)

... One of the best predictive tools for analysis of the biological consequences of oil spills are the case histories and followup studies associated with past spills. This study examines the documented effects of oil spills as a function of the circumstances surrounding past spills and the biological resources affected. The overall purpose of this investigation was to summarize our current state of knowledge regarding the biological effects of oil spills on coastal marine environments. Literature sources and methods used during the completion of this study are described in Section 1.3. An overview of the location, season, type and size of spills that have occurred during the last two decades is presented in Section 2, while Section 3 discusses the documented or suggested biological effects of past spills as a function of oil type, size of spill, time of year, type of environments affected, cleanup response and latitude. Section 3 also discusses the long-term impacts of oil spills and subsequent recovery of various community types, where this information is available. The text of the report is concluded with a summary which identifies dominant biological effects of oil spills (Part 4), as well as probable impacts of spills or blowouts on arctic marine ecosystems (Part 5). Oil spill case history summary data sheets are provided in Appendix A and B, respectively. (Au)

243

**A review of the biological fate and effects of oil in cold marine environments /** ESL Environmental Sciences Limited.

S.L. Ross Environmental Research Ltd. Arctic Laboratories Limited. Sergy, G.A.

Canada. Environmental Emergency Technology Division [Sponsor].

[Edmonton, Alta.] : EPS, Environmental Emergency Technology Division, 1985.

233 p.

Draft copy.

*Document not seen by ASTIS.*

*ASTIS document number 180580.*

244

**The sublethal effects of dispersed oil on an estuarine isopod /** ESL Environmental Sciences Limited.

Hardwood, L.A. Fink, R.P.

Ottawa : Environmental Protection Service, Dept. of the Environment, 1982.

xvi, 72 p. : figures, tables ; 28 cm.

(Technology development report, EPS 4-EC-82-1)

ISBN 0-662-112075-2.

Appendix.

References.

*ASTIS document number 110205.*

ACU

The sublethal effects of physically and chemically (Corexit 9527) dispersed Prudhoe Bay crude oil on the physiology and behaviour of the estuarine isopod *Gnorimosphaeroma oregonensis* were examined

in a minicomputer controlled flow-through system. Test organisms received oil concentrations approximating 0.3 and 20% of the calculated 48-h LC 50 for periods of 24 and 48 hours for a dispersion type. The effects of exposure concentration, exposure duration and dispersed oil type on both critical and subcritical sublethal parameters (Percy, 1980) were investigated, as well as the rate and extent of recovery responses. In general, exposure to both physically and chemically dispersed oil caused a significant increase in oxygen consumption of treated isopods and a concomitant decrease in carbon assimilation rates and efficiencies. In addition, isopods exposed to oil dispersions accumulated naphthalenes in their tissues, and in some cases showed altered moulting patterns and mating responses. The magnitude and persistence of sublethal effects were usually dependent upon oil concentration and exposure duration. In most cases, exposures to chemically dispersed oil resulted in more pronounced sublethal effects than comparable treatments with physically dispersed oil. ... The significance of the sublethal effects and subsequent recovery responses observed in the test populations are discussed. (Au)

See also: 397.

ESSA LTD.

See: 239, 397.

ESSO RESOURCES CANADA

See: 27, 211, 212, 213, 214, 215, 710.

EVERITT, R.

See: 81, 82.

F.F. SLANEY & COMPANY

245

**The oil sinking ability of Mackenzie River borne suspended sediments in the Beaufort Sea : a literature review /** F.F. Slaney & Company. Canadian Marine Drilling Limited [Sponsor].

Vancouver, B.C. : F.F. Slaney and Company Limited, 1978.

2 microfiches : figures, tables ; 11 x 15 cm.

(Beaufort E.I.S. reference work, no. RWE08)

*ASTIS document number 107190.*

ACU, NSDB(ENV.)

... The primary objective of this study was to establish if there is sufficient evidence to suggest that suspended sediments carried by the Mackenzie River and discharged in the form of a plume in the Beaufort Sea could contribute to the dispersal of an oil slick originating from an oil well blowout. Specific questions relating to temporal and spatial differences in Mackenzie River sediment discharge and oil sinking potentials were posed by Canadian Marine Drilling Ltd., Calgary, Alberta, and are addressed in subsequent sections of this report. Two other study objectives were to 1). attempt to establish a formula relationship between the volume of suspended sediments and their ability to sink oil, and 2). if probable oil sinking effects were expected, to provide recommendations for future laboratory and field studies that would substantiate the sinking hypothesis and supplement the results of the present literature review in relation to a Beaufort Sea oil well blowout. Implicit to both examination of oil-sediment interactions and derivation of a formula relationship was an examination of a number of factors such as sediment type, particle size, temperature and salinity which could conceivably affect oil sedimentation rates

in the Beaufort Sea. (Au)

See also: 253.

**FABIJAN, M.F.**

See: 400.

**FALCONER, R.K.**

See: 407.

**FARLOW, J.S.**

See: 409.

**FEDER, H.M.**

246

The arctic coastal environment of Alaska, Vol. 2 : A compilation and review of scientific literature of the arctic marine environment / Feder, H.M. Shaw, D.G. Naidu, A.S.

Fairbanks, Alaska : University of Alaska, Institute of Marine Science, 1976.

iv, 200 p. ; 28 cm.

(Institute of Marine Science report, R76- 5)

(Sea grant report, College, 76- 9)

(NTIS PB-261 993)

References.

ASTIS document number 179175.

ACU

This publication is volume two of a report on the arctic coastal environment of Alaska. It is a compilation and review of scientific literature of the arctic marine environment. This reference, for convenience of the user, is divided into eleven chapters as follows: (1) Physical Oceanography (2) Chemical and Geological Oceanography (3) Plankton (4) Benthic Algae (5) General Ecological and Biological Studies (6) Ice Algae, Benthic Microalgae and Primary Production (7) Benthic Invertebrates (8) Fishes (9) Marine Birds and Mammals (10) Environmental Impact (11) Oil Pollution: Environmental Effects of an Oil Spill at Prudhoe Bay. Each chapter consists of a short narrative reviewing key literature. All chapters except chapter two contain a table of important annotated references. Each chapter closes with a reference section which includes citations, and supplemental references. (Au)

247

The results of a survey of the amounts of aliphatic hydrocarbons in selected intertidal bivalve mollusks from Prince William Sound, Alaska / Feder, H.M. Paul, A.J.

(Biological cruises of the R/V Acona in Prince William Sound, Alaska (1970-1973) / H.M. Feder and A.J. Paul. - Fairbanks : Institute of Marine Science, University of Alaska, 1977. Institute of Marine Science report, R77- 4, p. 70-76)

(Sea grant report, College, 77- 14, p. 70-76)

References.

ASTIS document number 179167.

ACU

... The biological resources of Prince William Sound may in the

near future be subjected to petroleum contamination from oil transportation and production. Should a major petroleum spill occur, baseline data on the naturally occurring hydrocarbon levels is necessary in order to properly assess damage to the resource. ... The work reported here is the result of an initial effort to develop data on the ambient concentrations of hydrocarbons in selected bivalve mollusks from Prince William Sound. A total of fifteen hydrocarbon analyses of seven species have been made. All organisms were collected in 1973 and 1974. Six of the species are of present or potential fisheries importance. The seventh, *Macoma balthica* is of interest as an indicator species .... (Au)

248

The sediment environment of Port Valdez, Alaska : the effect of oil on this ecosystem / Feder, H.M. Check, L.M.

Flanagan, P. Jewitt, S.C. Johnston, M.H.

Naidu, A.S. Norrell, S.A. Paul, A.J.

Scarborough, A. Shaw, D.G.

(Report - United States. Environmental Protection Agency, EPA-600/3-76-086, p. 1-292)

(NTIS PB-259 972)

Document not seen by ASTIS.

ASTIS document number 181099.

See also: 495.

**FEDORAK, P.M.**

249

Microbial degradation of aromatics and saturates in Prudhoe Bay crude oil as determined by glass capillary gas chromatography / Fedorak, P.M. Westlake, D.W.S.

(Canadian journal of microbiology, v. 27, no. 4, Apr. 1981, p. 432-443, ill.)

References.

ASTIS document number 180840.

ACU

Water samples obtained from three different marine environments (including a commercial harbor, a pristine area, and an oil tanker dock area) from the coast of Washington State were challenged with Prudhoe Bay crude oil under shake-flask conditions at 8 degrees C. Replicate cultures were grown with and without nitrogen (NO<sub>3</sub>-NH<sub>4</sub><sup>+</sup>) and phosphate supplementation. After varying incubation periods, the residual oil was extracted and separated on silica gel columns into saturate and aromatic fractions and these were analyzed by glass capillary gas chromatography to detect the degradation of various compounds. After 27 days of incubation, both the aromatic and saturate fractions were extensively degraded by the microorganisms from these environments when supplemented with nitrogen and phosphorus. Without nutrient supplementation, the aromatics were more readily attacked than the saturates by the populations from the pristine environment and from the commercial harbor area. Under these limited nutrient conditions, samples from near oil tanker docks showed moderate degradation of both the saturate and aromatic fractions. Time course studies, using nutrient-supplemented marine samples, showed that the simple aromatics (e.g., naphthalene and 2-methylnaphthalene) were more readily degraded than the n-alkanes. However, once the breakdown of these saturates commenced, these were quickly removed from the oil. The aromatic degradation continued to progress from lower molecular weight, less complex molecules to larger, more complex molecules in the approximate series C<sub>2</sub> naphthalenes; phenanthrene and dibenzothiophene; C<sub>3</sub> naphthalenes and methylphenanthrenes; C<sub>2</sub> phenanthrenes. (Au)

250

**Microbial degradation of organic sulfur compounds in**

**Prudhoe Bay oil / Fedorak, P.M. Westlake, D.W.S.**  
(Canadian journal of microbiology, v. 29, no. 3, Mar. 1983,  
p. 291-296, figures, table)

**References.**

*ASTIS document number 113255.*

ACU, NSDB

Water samples from three different marine environments in Washington State were challenged with Prudhoe Bay crude oil and incubated at 8 degrees C with aeration. Some cultures were supplemented with  $\text{NH}_4\text{NO}_3$  and phosphate and after various lengths of time, up to 27 days, the residual oil was extracted and fractionated using silica gel columns. The aromatic fraction was analyzed by capillary gas chromatography using a sulfur-specific flame photometric detector. The oil contained alkylbenzo[b]thiophenes, dibenzothiophene, and C1- and C2-dibenzothiophenes and the degradation of these was monitored. Many of the sulfur heterocycles were metabolized without nutrient supplementation although the number and extent of the compounds degraded increased with nutrient addition. The order of susceptibility of the sulfur heterocycles in homologous series was found to be the following: C2-benzo[b]thiophenes > C3-benzothiophenes; dibenzothiophene > C1-dibenzothiophenes > C2-dibenzothiophenes. With nutrient supplementation, the microbial population from a harbor area metabolized the sulfur compounds more readily than those from near an oil tanker dock or from a pristine state park beach. Without supplementation, the population from the tanker dock area degraded many fewer sulfur heterocycles than the other two populations. (Au)

251

**Selective degradation of biphenyl and methylbiphenyls in crude oil by two strains of marine bacteria / Fedorak, P.M.**

**Westlake, D.W.S.**  
(Canadian journal of microbiology, v. 29, no. 5, May 1983,  
p. 497-503, ill.)

**References.**

*ASTIS document number 180858.*

ACU

Bacterial isolates were obtained from marine sediment and water enrichment cultures which had been maintained for 3 years by monthly transfers on artificial seawater with Prudhoe Bay crude oil as the sole carbon source. Capillary gas chromatographic analyses showed that two isolates selectively degraded only biphenyl, 3-methylbiphenyl, 4-methylbiphenyl, and three other minor, unidentified compounds in the aromatic fraction. No degradation was detected in the saturate fraction, nor in the sulfur heterocyclic component of the oil. When grown on any of the pure biphenyls, these isolates produced a transient, yellow intermediate which had the spectrophotometric characteristics of alpha-hydroxymuconic semialdehydes. Growth on either methylbiphenyl compound produced a methylbenzoic acid, indicating that the nonmethylated ring was the first to be cleaved. The isolates, identified as *Alcaligenes* sp. and *Acinetobacter* sp., were also able to grow on benzoic acid, 3-, and 4-methylbenzoic acids, indicating that they could further metabolize the aromatic acid intermediates. (Au)

**FEELY, R.A.**

252

**Transport mechanisms and hydrocarbon adsorption properties of suspended matter in Lower Cook Inlet / Feely, R.A.**

**Cline, J.D. Massoth, G.J.**  
(Environmental assessment of the Alaskan continental shelf :  
Annual reports of principal investigators for the year  
ending March 1978. Vol. VIII : Contaminant baselines, p.  
11-72, ill., maps)  
(NTIS PB80-130073, p. 11-72, ill., maps)

**References.**

*ASTIS document number 176060.*

ACU

The seasonal distributions and elemental composition of suspended particulate matter in Lower Cook Inlet were studied and compared with current patterns and bottom sediment distributions. In general, the suspended matter distributions appear to follow the pattern of circulation in Lower Cook Inlet and Shelikof Strait. ... Comparisons of physical characteristics of suspended matter and sediments from the central basin indicates that net sedimentation of the fine grained suspended particles is minimal. However, sedimentation may be occurring in the numerous embayments along the coast. Chemical analysis of the particulate matter reveals that fine grained aluminosilicate minerals comprise about 80-95% of the suspended matter with biogenic material making up the rest. Analysis of seasonal variations of the C:N ratio of the particulate organic matter indicates that organic matter of marine origin is dominant in summer whereas terrestrially derived organic material predominates in winter when productivity is low. Laboratory experiments involving the interactions between Cook Inlet crude oil and suspended matter from Lower Cook Inlet show that the accommodation capacity of suspended matter for crude oil increases with the concentration of added oil. ... (Au)

See also: 54, 172, 173.

**FELLINGHAM, G.W.**

See: 23, 73.

**FENCO CONSULTANTS LIMITED**

253

**An Arctic atlas : background information for developing marine oilspill countermeasures / Fenco Consultants Limited. F.F. Slaney & Company.**

[Ottawa : Fisheries and Environment Canada], 1978.  
1v. (various pagings) : maps, charts, tables ; 29x48cm.  
(Arctic Marine Oilspill Program report, EPS-9-ED-78- 1)  
Submitted to Research and Development Division,  
Environmental Research Branch, Environmental Impact  
Control Directorate, Environmental Protection Service.

**References.**

*ASTIS document number 8575.*

ACU, SSU, NFSMO

... Five principal categories of information relevant to oilspill countermeasures have been treated, these being: Geology and Petroleum Development, Meteorology and Oceanography, Ice, Biology, and Social. Generally a mapped format has been employed, with explanatory graphs and tables inserted where necessary. ... (Au)

**FIEST, D.L.**

See: 103, 106.

**FINCHAM, C.F.**

See: 744.



## FINGAS, M.F.

254

**Preliminary results of remote sensing overflights during the Kurdistan operation** / Fingas, M.F. O'Neil, R.A. Thomson, V. Neville, R.A.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 58-73, maps)

Appendices.

References.

*ASTIS document number 169650.*

CON

... [This paper documents remote sensing operations carried out during the Kurdistan oil spill incident.] The remote sensing missions were initially activated to locate and map the oil spill, of which at the time little was known both as to its extent and its location. In addition, the spill afforded a unique opportunity to test the Arctic Marine Oilspill Program (AMOP) sensor package on a heavy oil spill in ice-infested waters under real field conditions. In the later phases of the study, another objective of the program was to provide imagery to those groups studying the behavior of oil in ice. ... (Au)

See also: 279, 345.

## FINK, R.P.

255

**The sublethal and lethal effects of the water-soluble fraction of Prudhoe Bay crude oil on juvenile coho salmon**

(*Oncorhynchus kisutch*) / Fink, R.P. Duval, W.S.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 158-181, ill.)

References.

*ASTIS document number 174866.*

ACU

... The present study examines the sublethal physiological and behavioural, and to a lesser extent, the acute lethal effects of water-soluble hydrocarbons from Prudhoe Bay crude oil on juvenile coho salmon *Oncorhynchus kisutch*. In the studies described in the present paper, test fish were exposed to relatively high concentrations (>0.5 ppm) of a Prudhoe Bay crude oil water-soluble fraction for short periods of time (12-96 h), and the effects on various sublethal parameters compared before, during and following treatment. ... [Measurements of respiration, assimilation, behaviour, and hydrocarbon uptake were taken.] ... (Au)

256

**The sublethal effects of dispersed crude oil on an estuarine isopod** / Fink, R.P. Harwood, L.A. Duval, W.S.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 115-138, ill.)

References.

*ASTIS document number 171417.*

ACU

The sublethal effects of physically and chemically (Corexit 9527) dispersed Prudhoe Bay crude oil on the physiology and behaviour of the estuarine isopod, *Gnorimosphaeroma oregonensis* were examined

in a mini-computer controlled flow-through system. Test organisms received oil concentrations approximating 3 and 20% of the calculated 48-h LC50 for periods of 24 and 48 h for each dispersion type. The effects of exposure concentration, exposure duration and dispersed oil type on both critical and subcritical sublethal parameters. ... were investigated, as well as the rate and extent of recovery responses. ... (Au)

See also: 242, 244.

## FINLEY, J.S.

See: 165, 167, 434.

## FISSEL, D.B.

See: 38, 41.

## FLAGG, L.B.

See: 692.

## FLANAGAN, P.

See: 248.

## FLOW RESEARCH COMPANY

257

**The transport and behavior of oil spilled in and under sea ice** / Flow Research Company. Pritchard, R.S. Coon, M.D.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. VI : Transport, p. 1-328, figures)

Partial contents: [1.] Ice motion in the Chukchi Sea. - [2.] Behavior of oil spills under sea ice, Prudhoe Bay. - [3.] Prudhoe Bay oil spill scenarios. - [4.] Harrison Bay sea ice conditions relation to oil spills.

*ASTIS document number 136646.*

NFSMO, ACU

Research conducted during FY80 was directed towards improving our understanding of the fate of crude oil spilled as a result of petroleum development in the coastal waters off the north coast of Alaska. A considerable literature exists on the climatology, meteorology, oceanography and ice character of the Prudhoe Bay lease area. Work has been completed by RU562 on the potential for oil pooling under sea ice and by RU568 on under-ice transport of oil by currents. A major objective of our work this year was to synthesize this information into a meaningful set of oil spill scenarios for the Joint Lease Sale area at Prudhoe Bay and also for the Sale 71 area of Harrison Bay. Results indicate that an oil spill under the ice from November through April would become incorporated rapidly into the ice. Subsequent transport of the ice then determines the point at which oil is released, essentially unweathered, during spring breakup. Ice inside the barrier islands remains in place through the winter so the oil will be released to the water in essentially the same spot in spring. The stable concentration of oil may aid in cleanup operations. ... Very little is known about the behavior of oil after its release from the ice. A preliminary study has been carried out to determine the interaction of oil with low to medium concentrations of ice. Transport of oil

appears to be controlled by herding of oil by ice floes with the result that the ice drift controls oil slick drift. Dispersion of the oil is controlled by turbulence in ice motions. (Au)

See also: 678, 679, 681.

## FOGELQVIST, E.

258

**Petroleum hydrocarbons in the Arctic Ocean surface water /**  
Fogelqvist, E. Lagerkvist, S. Lindroth, P.  
(Marine pollution bulletin, v. 13, no. 6, June 1982, p.  
211-213, ill., map)

References.

ASTIS document number 166707.

ACU, NSDB

The concentration of petroleum hydrocarbons in Arctic surface water under the ice north of Svalbard has been determined by fluorescence spectrofluorometry using three different excitation/emission wavelength combinations. With Kuwait crude oil as a reference, the concentration range is 0.1-0.6 micrograms/litre crude oil equivalents with respect to light molecular weight components and 0.05-0.2 micrograms/litre heavy molecular weight components. (Au)

## FOGET, C.R.

See: 525, 526, 527, 528, 531.

## FOGHT, J.M.

259

**Effect of the dispersant Corexit 9527 on the microbial degradation of Prudhoe Bay oil / Foght, J.M.**

Westlake, D.W.S.

(Canadian journal of microbiology, v. 28, no. 1, Jan. 1982, p.  
117-122, figures, table)

References.

ASTIS document number 83810.

ACU, NSDB

A marine oil-degrading population grown at 8 degrees C showed a selective sensitivity regarding utilization of compounds in Prudhoe Bay oil in the presence of the dispersant Corexit 9527. The response was dependent on the nitrogen and phosphate levels of the medium and on the concentration of dispersant used. In the presence of a nitrogen-phosphate solution and a Corexit 9527 - crude oil substrate, degradation of the n-alkanes of the saturate fraction was temporarily retarded in proportion to the concentration of Corexit 9527 present. This retardation was overcome with extended incubation time. In the absence of nitrogen-phosphate supplementation, the effect of Corexit 9527 was pronounced, retarding n-alkane degradation even with extended incubation time. Corexit 9527 had less effect on the degradation of the aromatic fraction and may indeed be stimulatory in the case of select compounds. The development and testing of dispersants containing nitrogen and phosphate is recommended. (Au)

## FOLMAR, L.C.

260

**Effects of petroleum exposure on predatory behavior of coho salmon (Oncorhynchus kisutch) / Folmar, L.C.**

Craddock, D.R. Blackwell, J.W. Joyce, G.  
Hodgins, H.O.

(Bulletin of environmental contamination and toxicology  
27, 1981, p. 458-462, ill.)

References.

ASTIS document number 178578.

ACU

... The purpose of the present study was to determine the influence of crude oil in seawater on salmonid predatory behavior. Coho salmon (Oncorhynchus kisutch) were chosen as predators. This species has been identified as a primary predator of juvenile salmonids in seawater .... The coho predators were exposed to the seawater soluble fractions of Cook Inlet crude oil. ... In general, the oil-exposed predators appeared lethargic and showed little or no interest in the prey presented to them ... (Au)

See also: 437.

## FORD, R.G.

261

**Modelling the sensitivity of colonially breeding marine birds to oil spills : guillemot and kittiwake populations on the Pribilof Islands, Bering Sea / Ford, R.G. Wiens, J.A.**

Heinemann, D. Hunt, G.L.

(Journal of applied ecology, v. 19, no. 1, 1982, p. 1-31, ill., maps)

References.

ASTIS document number 166200.

ACU, NSDB

... simulation and analytic models [are developed] to estimate responses of colonially breeding marine birds to environmental perturbations such as oil spills occurring within the foraging area of the populations. Short-term impacts are considered through a demographic sub-model, which simulates changes in population size and age structure through a breeding season, and a foraging sub-model, which simulates the daily foraging activities of individuals and estimates their daily energy intake and mortality from direct contact with a spill. ... Applications of the model to populations of guillemots and kittiwakes breeding on the Pribilof Islands in the Bering Sea suggest that guillemot mortality is greatest following perturbations located in shallow inshore areas about the breeding islands, while kittiwakes are less severely affected by localized perturbations but are sensitive to spills occurring over a wider area about the islands. ... (Au)

See also: 736, 737.

## FORTIER, S.H.

See: 327.

## FOSTER, C.R.

See: 39, 40.

## FOUREMAN, G.L.

See: 547.

## FOWLER, B.M.

262

Visual observations on the behaviour and fate of oil on shorelines in the Cape Breton area, Nova Scotia, contaminated after the Kurdistan oil spill / Fowler, B.M. Noll, C.J.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 132-154, ill., maps)

### References.

ASTIS document number 169706.

OON

... [In March 1979] ice and oil ... [from the Kurdistan spill] began to come ashore on the south shore of Cape Breton Island and in Chedabucto Bay on Isle Madame. Tightly-packed first-year ice floes were stranded on the shores until mid to late April 1979. A preliminary investigation was carried out on Isle Madame and south-east Cape Breton shorelines primarily to determine the physical fate and behaviour of the oil on various shore types, and to make preliminary observations on the distribution of the oil in the intertidal sediments. ... (Au)

See also: 283, 284.

## FOY, M.G.

263

Acute lethal toxicity of oil/dispersant mixtures to selected arctic species / Foy, M.G. Sekerak, A.D.

(Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 10- 1- 10- 10, ill.)

### References.

ASTIS document number 179086.

OON, ACU

The following discussion briefly describes research on the acute toxicity, as measured by 96 h bioassays, of Prudhoe Bay crude oil and Prudhoe Bay crude oil/Corexit 9527 mixtures on four Arctic invertebrates [Onisimus littoralis, Boeckosiemus edwardsi, Anonyx nugax, and Calanus hyperboreus]. Due to the difficulties in transporting to and maintaining Arctic animals in southern laboratories, the work was performed in Resolute, N.W.T. in December 1977 and January 1978. [Of the species tested, Anonyx nugax seemed to be the most sensitive to Prudhoe Bay crude oil .... In summary, it was found that Corexit 9527 itself was not toxic to the Arctic animals tested but that it increased the amount of oil that remained in the oil-water mixtures by as much as eight times at the highest oil concentration used. When Corexit was added to oil the increased amount of oil in the mixtures appeared to cause greater mortality as opposed to the purely mechanically dispersed oil mixtures.] (Au)

264

Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 to arctic marine invertebrates and fish from Frobisher Bay, N.W.T. / Foy, M.G.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 72-82, ill.)

### References.

ASTIS document number 177830.

## NSDB, OON

In the summer of 1978, a study was performed to determine the acute toxicity of Prudhoe Bay crude oil and the dispersant, Corexit 9527, alone and in combination, to several species of arctic marine invertebrates and one species of fish. The research was carried out in the Ikaluit Research Laboratory in Frobisher Bay, N.W.T., with locally collected test species. This study was conducted as part of the Arctic Marine Oil Spill Program (AMOP) and was intended to verify and expand on results obtained in an earlier study (Foy 1978). It is emphasized that studies of this nature have limitations and that great care must be taken in using 96 h LC50 values to predict the effects of contamination in a natural situation. The main values of such studies are in establishing the relative sensitivities of different species and life stages, in determining relative toxicities of different contaminants and in defining concentrations of toxicants to be used in subsequent studies of sublethal effects. (Au)

See also: 324, 393, 394, 395, 396.

## FRAKER, M.A.

See: 405.

## FREE, A.P.

265

Laboratory studies of oil spill behavior in broken ice fields / Free, A.P. Cox, J.C. Schultz, L.A.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS, Environmental Emergency Branch], 1982, p. 3-14, figures)

(NTIS AD-A-114 178)

### References.

ASTIS document number 131016.

NFSMO, NSDB(NTIS)

... This paper addresses the behavior of oil spilled in a broken ice field, particularly on a small-scale, short-term level. This small-scale, short-term situation would be required to mount the proper containment and cleanup efforts in the event of an oil spill in a broken ice field. The spill trajectory and behavior are analyzed with direct consideration of forecasting behavior and oil/ice interaction. The major thrust of the laboratory test program was an experimental determination of the spread rate of oil spilled in broken ice fields; these fields were either restrained from movement or free flowing. The experimental variables were oil type, broken ice piece size, ice coverage, current velocity, and wind velocity (Free et al., 1981). (Au)

## FRESHWATER INSTITUTE (CANADA)

266

Preliminary report : laboratory responses to Dome Nektoralik oil / Freshwater Institute (Canada). Lockhart, W.L. Dome Petroleum Limited [Sponsor].

Winnipeg, Man. : Freshwater Institute, 1981.

1 microfiche : figures, tables ; 11 X 15 cm.

(Beaufort E.I.S. reference work, no. RWZ08)

### References.

ASTIS document number 108537.

ACU, NSDB(ENV.)

A sample of Dome's Nektoralik K-59 crude oil was supplied for testing, and this report will summarize our experience with that oil to date. This report is a preliminary presentation only; it does not contain all data gathered and it contains little reference to existing literature. Studies included: (a) chromatographic analysis of oil, (b)

preparation of a 'water soluble fraction', (c) uptake and clearance of oil components, (d) volatilization of oil components from water, (e) toxicity of water soluble fraction to larval fish, (f) toxicity of oil to aquatic plants, (g) anatomical effect of oil on larval fish, (h) induction of fish enzymes by oil. [Results for each study are presented]. (Au)

**FRYDRYCH, M.**

See: 541.

**GAEGEL, R.**

See: 542, 543.

**GALBRAITH, P.**

See: 369.

**GALLAWAY, B.J.**

See: 388.

**GALT, J.A.**

267

The use of a diagnostic circulation model for oil trajectory analysis / Galt, J.A. Pease, C.H.

(Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 447-454, ill., maps)

References.

ASTIS document number 181692.

OON, ACU

A diagnostic circulation model designed for the continental shelf region was used to study water parcel trajectories. The model assumes a combination of geostrophic plus Ekman dynamics and diagnostic in that it uses fluid density data (obtained from a typical oceanographic cruise; i.e., STD stations) and wind stress data to specify the baroclinic and surface Ekman modes of the flow. The model then solves for the remaining barotropic and bottom Ekman modes subject to the constraints imposed by continuity and bathymetry. Variations in the boundary conditions correspond to variations in the mean inflow/outflow surface currents, or barotropic mode. Using this correspondence, the model was keyed to the measurements obtained from a moored current meter array and a time stepping procedure was developed. This allows the model to generate a continuous time- and space-varying representation of the regional flow field. Field data for the Northeast Gulf of Alaska were used in the model equations which were solved using finite element techniques. The predicted currents and trajectories for a variety of runs were compared against observational data. (Au)

**GANTCHEFF, G.S.**

See: 571, 744.

**GARSHELIS, D.L.**

See: 654.

**GEESEY, G.G.**

See: 187.

**GENTRY, R.L.**

268

Physiological impact of oil on pinnipeds / Gentry, R.L. McAlister, W.B.

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 15-23)

(NTIS PB-261 407, p. 15-23)

References.

ASTIS document number 175897.

ACU

The objectives of this project are (1) to determine the effects of crude oil fouling that are measurable by changes in metabolic rate and diving ability in the northern fur seal, and (2) to determine the effect of crude oil fouling on heat transfer properties of the skin and pelage of the sea otter and as many pinnipeds as possible. [Field studies were carried out on St. George Island in the Bering Sea.] ... (Au)

See also: 357.

**GEORGHIOU, P.E.**

See: 652.

**GERACI, J.R.**

269

Behavior and pathophysiology of seals exposed to crude oil / Geraci, J.R. Smith, T.G.

(Sources, effects and sinks of hydrocarbons in the aquatic environment : proceedings of the symposium, American University, Washington, D.C. - Washington, D.C. : American Institute of Biological Sciences, 1976, p. 447-462, ill.)

References.

ASTIS document number 179205.

OON

Ringed seals, *Phoca hispida* and harp seals, *Phoca groenlandica* were exposed to oil both in the field and in the laboratory. They were either placed into crude-oil-covered water, brush-coated with oil, or given oil by mouth. Twenty-four hour surface exposure to light crude oil was damaging only to the eyes of healthy seals, whereas stressed seals died within 71 minutes of exposure. Oil in quantities reasonably expected to be ingested during an oil spill was not irreversibly harmful. Evidence is presented to show that the consequences of an oil spill ultimately depend on the season of spill, productivity of the area, and the variable health status of a seal population. (Au)

270

Consequences of oil fouling on marine mammals / Geraci, J.R. Smith, T.G.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biologic effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 399-410, ill.)

References.

**ASTIS document number 169447.**

ACU

A review of the literature on the effects of petroleum exposure on marine mammals is presented, focussing mainly on seal thermoregulation, behaviour, eye and general physiological effects. (ASTIS)

271

**Direct and indirect effects of oil on ringed seals (*Phoca hispida*) of the Beaufort Sea / Geraci, J.R. Smith, T.G.**

(Journal of the Fisheries Research Board of Canada, v. 33, no. 9, Sept. 1976, p.1976-1984, ill., map)

References.

**ASTIS document number 172979.**

ACU

Ninety-six ringed seals (*Phoca hispida*) were taken from nets at Brown's Harbour, Northwest Territories in the fall of 1974. ... Six seals immersed in Norman Wells crude oil for 24 h at the field netting site suffered only transient eye problems and minor kidney and possibly liver lesions; no permanent damage was observed. Three seals transported to the University of Guelph all died within 71 min after oil was introduced into their pool. Hematologic and blood chemical studies indicate that death was caused by oil superimposed on the stress of captivity. Six, 3-4 wk-old wild whitecoat harp seal (*P. groenlandica*) pups at the Magdalen Islands, Quebec, were coated with crude oil. No significant differences in core body temperatures were noted and no deleterious effects were observed. Five captive ringed seals at Guelph were subjected to a cumulative dosage of Norman Wells crude oil fed with their fish food. High dosage (75 ml) and low dosage (25 ml) of crude oil were also fed to two groups of six harp seal pups. No significant lesions or behavioral changes were noted. These experiments were of an acute nature and reflect the effects of a brief contact with oil only. Effects of longer contact as would probably be the case in an offshore oil well blowout situation are discussed. Possible effects of large-scale offshore oil fields are also considered. (Au)

See also: 237, 660.

**GETTER, C.D.**

272

**Mapping the distribution of protected and valuable, oil-sensitive coastal fish and wildlife / Getter, C.D.**

Thebeau, L.C. Ballou, T. Maiero, D.J.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 325-329, ill., maps)

References.

**ASTIS document number 162027.**

An approach has been developed to produce a map series that displays known, pertinent information concerning the distribution, seasonality, and habits of protected and valuable coastal fish and wildlife that are sensitive to oil spill impacts. ... Distribution and abundance data are then evaluated for each species, and all point localities, aggregations, and home ranges are shown on maps. These data include marine mammal haul-out and pupping areas, terrestrial mammal feeding areas, marine bird rookeries, salmon and herring streams and intertidal spawning sites, marine turtle nesting beaches, and intertidal shellfish beds. ... Information on the species, their distribution and ecological type, their habits, and seasonality is color coded on the maps. This approach has been applied to coastal areas in Shelikof Strait (Alaska), Puget Sound (Washington), southeastern Florida, and Massachusetts, and is underway for South Carolina and Norton Sound (Alaska). (Au)

**GARRET, J.A.**

See: 585.

**GIBSON, D.T.**

See: 160, 713.

**GILFILLAN, E.S.**

273

**Feeding, respiration and excretion of the copepod *Calanus hyperboreus* from Baffin Bay, including waters contaminated by oil seeps / Gilfillan, E.S.**

Vandermeulen, J.H. Hanson, S.

In press: Arctic, 1986.

References.

**ASTIS document number 179477.**

Metabolic processes in eastern Arctic *Calanus hyperboreus* were analyzed during the post-bloom period (August-September). Mixed adult and subadult copepods were collected from 12 stations in Baffin Bay (Davis Strait to Lancaster Sound) by trawling from 0-300 m. Measurements were made of clearance rate, O<sub>2</sub> consumption, and NH<sub>3</sub> excretion. The cruise track included 6 stations in oil-seep contaminated waters of Scott Inlet and Buchan Gulf. Physiological parameters for populations of *C. hyperboreus* from the latter stations were compared with those from non-seep stations. ... Most of the non-feeding values came from the Scott Inlet-Buchan Gulf region of western Baffin Bay. At those stations in this region a strong negative correlation ( $P < .01$ ) exists between clearance rate and hydrocarbon contamination. This suggests that, in the oil-seep region of Baffin Bay, feeding may be suppressed in *Calanus hyperboreus* by low concentrations of petroleum hydrocarbons derived from sub-sea seepage. (Au)

274

**Observations of scope for growth, aspartate aminotransferase activity and glucose-6-phosphate dehydrogenase activity in *Mya truncata* and *Serripes groenlandicus* exposed to various concentrations of chemically dispersed crude oil in the DIAND/BIOS 1983 tank study / Gilfillan, E.S.**

Vallas, D.L. Canada. Baffin Island Oil Spill Project

[Sponsor].

Ottawa : EPS, 1984.

2 microfiches : ill. : 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 83- 7, [Part I])

References.

Fiche heading title: Baffin Island Oil Spill Project : toxicology : 1983 study results.

**ASTIS document number 160105.**

ACU

Observations made during the 1981 field season of the BIOS program showed that both *Mya truncata* and *Serripes groenlandicus* accumulated spill-derived petroleum hydrocarbons to high levels (300-500 ppm). It was apparent that *Serripes groenlandicus* was more profoundly affected by the accumulated petroleum as evidenced by their leaving their burrows even when exposed to relatively low concentrations of chemically dispersed petroleum. ... Two major questions emerge from this data: (1) Are the observed differences between the two species related to differences in their respective filtration rates; (2) To what extent are the accumulated hydrocarbons affecting the physiological well-being of the two species. [Study results show among other things that the different filtration rates do affect the rate at which hydrocarbons are taken up]. (Au)

See also: 226, 230.

GILMAN, A.P.

See: 546.

GIOVANDO, L.F.

275

A discussion of factors influencing dispersion of pollutants in the Beaufort Sea / Giovando, L.F. Herlinveaux, R.H. Sidney, B.C. : Institute of Ocean Sciences, 1981. (Pacific marine science report, 81-4) *ASTIS document number 74969.* ACU, NSDB

A brief history is given of the geographic, hydrographic and oceanographic investigations that were carried out in the Beaufort Sea area during the past 150 years and culminated in the Beaufort Sea Project of 1974-75. The information obtained is utilized to prepare a description of the general physical environment of the area, emphasis being placed on the physical oceanography. This description provides the basis for the consideration of four environmental situations (scenarios), each of which could strongly influence in its own way, the general destiny of crude oil or other pollutants discharged into the Beaufort Sea. The advantages and disadvantages of the cold-region use of some oil-spill countermeasure techniques presently available are discussed. A summary of the expected general behaviour of pollutants entering the Beaufort Sea is given, together with some suggestions for further studies necessary to refine our insight into this behaviour. (Au)

GLAESER, J.L.

276

A discussion of the future oil spill problem in the arctic / Glaeser, J.L.

(Proceedings of Joint Conference on Prevention and Control of Oil Spills, June 15-17, 1971, Sheraton Park Hotel, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1971, p. 479-484, ill.)

References.

*ASTIS document number 174939.*

ACU

Future oil production in Arctic regions will present the opportunity for oil pollution as a result of human error and equipment failures. In order to attain an insight into what may be expected, an assessment of the magnitude of future oil spillage is presented. In addition, factors affecting the fate and behavior of spilled oil are discussed based on the results of the U.S. Coast Guard's Arctic Oil Spill Test Program. (Au)

277

A study of the behavior of oil spills in the Arctic / Glaeser, J.L. Vance, G.P.

(1972 Offshore Technology Conference, May 1-3 - Houston, Texas : preprints. - [Dallas, Tex.] : Offshore Technology Conference, 1972, v. 1, p.1- 390-1- 402, ill.)

(OTC paper, 1551)

References.

Includes: A comparison of the heat budget over oil-covered and clean ice in the arctic environment / T.C. Johnson.

*ASTIS document number 175676.*

ACU

... The Arctic Oil Spill Test Program [was designed] ... to

determine the most basic nature of spilled crude oil in an arctic environment and to develop an understanding of the problems that must be dealt with. The general areas of investigation were (1) the behavior and spreading rates of Prudhoe Bay crude oil when spilled on water and ice, (2) the interaction of spilled crude oil with ice over a period of time, (3) the physical and chemical changes that occur in the crude as a result of aging, (4) the effectiveness of burning as a method of oil removal and (5) the effectiveness of natural absorbents when used on a crude oil spill. The experiments contained in this report were performed in July, 1970, in the Chukchi Sea. ... (Au)

278

A study of the behavior of oil spills in the Arctic / Glaeser, J.L. Vance, G.P.

Washington, D.C. : U.S. Coast Guard, Office of Research and Development, 1971.

[32] p. : ill. ; 28 cm.

(NTIS AD-717 142)

*ASTIS document number 178195.*

ACU

A program to investigate the behavior of oil spills in the Arctic was conducted off the northern coast of Alaska in July 1970. Numerous small oil spills were made to obtain data on the following subjects: the spreading behavior of crude oil on ice and water surfaces; the interaction characteristics of crude oil with ice; the aging characteristics of crude oil which has been spilled on ice, on water, and under ice; and the effectiveness of burning and absorption as methods of removal. Both Prudhoe Bay ("Sag" River) crude oil and diesel fuel were used in the test program. Results quantify spreading and interaction characteristics in addition to presenting qualitative information on each area of interest. Promise is shown for both burning and absorption as methods of oil removal in summer. Data is presented on both the physical and chemical characteristics of aged crude oil. (Au)

See also: 74.

GOERING, J.J.

See: 653.

GOLDEN, P.

See: 468.

GOODMAN, R.H.

279

Detection of oil under ice, a joint ESSO/EPS project / Goodman, R.H. Fingas, M.F.

(Spill technology newsletter, v. 7, no. 6, Nov.-Dec. 1982, p. 150-158, figures, table)

References.

*ASTIS document number 132519.*

ACU, NSDB

Studies conducted as part of the Beaufort Sea Project (NORCOR, 1975) have demonstrated that oil deposited under ice would become encapsulated in the ice for significant periods of time, moving with the ice and rising to the surface of spring melt pools. Experiments have shown that it was only necessary to monitor the ice in order to track the oil. A system of micro and macro buoys recommended by an early AMOP program, has been developed (McGonigal and Wright, 1977; Roddis, 1980) and is routinely used for ice motion monitoring. However, oiled ice could become separated from the

buoys if the ice floes should break or diverge, as might occur in the shear zone. It's relocation would require the capability to detect the presence of oil in or under the ice. Such a system would also enable the routine monitoring of subsea under-ice pipelines and the detection of pollution near northern loading terminals and production platforms. The difficulties of detecting pipeline leaks under ice were identified as a concern of the Norman Wells Environmental Assessment Review Panel. This paper presents a background and overview of the limitation of oil-under-ice detection systems and indicates possible improvements. ... (Au)

See also: 112, 423.

GRABACKI, S.

See: 333.

GRAU, C.R.

See: 14, 15.

GRAY, J.S.

280

**On experimental spills : a reply / Gray, J.S.**  
(Spill technology newsletter, v. 6, no. 2, Mar.-Apr. 1981, p. 44-45)

Reply to ASTIS document number 62065, On experimental oil spills / D. Mackay in Spill technology newsletter, v. 5 no. 5, Sept.-Oct. 1980, p. 131-136.

ASTIS document number 174947.

ACU, NFSMO, NSDB

... Like Mackay I too am concerned about the time and money that is wasted on so-called biological base-line studies, but unlike Mackay I am an ecologist. ... [The author is concerned with the volume of effort spent on biological base-line studies and subsequent experimental spills. He refers to the Norwegian system of responding to spills of opportunity and comparing mortality and other spill-effects measurements with data already obtained from nearby pre-selected sites]. (Au)

GREEN, D.R.

281

**Baffin Island Oil Spill experiment : chemistry component : final report on baseline year activities, volume 1 : field work, environmental chemistry, hydrocarbon infrared data / Green, D.R.** United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 172-269, ill., maps)

References.

ASTIS document number 169242.

ACU

[This] report summarizes the activities of Seakem Oceanography Ltd. for the baseline year of the Baffin Island Oil Spill Project. Our role, in partnership with Energy Resources Co., Cambridge, Mass., was to provide a broad spectrum of chemical services which can be divided into four categories: a field program, environmental chemistry analyses, hydrocarbon baseline analyses, and hydrocarbon analyses for the shoreline oil spill plots. ... (Au)

282

**Baffin Island Oil Spill experiment : chemistry component : final report on baseline year activities, volume 1 : field work, environmental chemistry, hydrocarbon infrared data / Green, D.R.** Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1981.

iv, 93 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 1)

Cover title: Chemistry 1 : field sampling and environmental chemistry : 1980 study results.

References.

ASTIS document number 169978.

ACU

... [This] report summarizes the activities of Seakem Oceanography Ltd. for the baseline year of the Baffin Island Oil Spill Project. ... a field program, environmental chemistry analyses, hydrocarbon baseline analyses, and hydrocarbon analyses for the shoreline oil spill plots [were carried out.]. (Au)

283

**Baffin Island Oil Spill Project : chemistry component : report on the 1981 oil spill experiments, volume 1 : summary of field work / Green, D.R. Humphrey, B. Fowler, B.M.** Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.

vii, 111 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 81- 1)

Appendices.

Cover title: Chemistry 1 : field sampling and measurements : 1981 study results.

References.

ASTIS document number 170003.

ACU

During the 1981 summer field season, three oil spill experiments were undertaken at the B.I.O.S. Cape Hatt site: a 200 m stretch of shoreline was oiled for testing various shoreline countermeasures, and two major near-shore oil spills were conducted, one of which was dispersed and one left as a surface oil spill. This report is the first of two volumes dealing with the chemistry program. It summarizes the field sampling work and the field measurements of total oil concentrations in water and in beach sediment. ... For the surface oil spill, virtually all of the spilled oil was either on the beach or was collected by mechanical means. Evaporation was the dominant weathering process. For the dispersed oil spill, nearly all of the oil remained in the water column and dispersion was the dominant weathering process. The chemical dispersant was very effective at promoting dispersion and preventing oil from reaching the shoreline. (Au)

284

**The use of flow-through fluorometry for tracking dispersed oil / Green, D.R. Humphrey, B. Fowler, B.M.**

(Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 473-475, ill., maps)

ASTIS document number 160024.

At the Baffin Island Oil Spill experimental site in the Canadian Arctic, four flow-through fluorometers were used to monitor a dispersed oil cloud over several days, providing real-time and continuous data on oil concentrations. The measurements so obtained were verified by a variety of laboratory analyses of check samples. The movements of the dispersed oil cloud were deduced, and exposures of the benthos to oil in the experimental area were calculated. (Au)

See also: 187, 344, 345.

GREEN, G.

See: 413.

GREENE, C.R.

See: 399.

GREENE, G.

See: 93.

GREENE, G.D.

285

An exploratory study of the behaviour of crude oil spills under ice / Greene, G.D. Leinonen, P.J. Mackay, D. (Canadian journal of chemical engineering, v. 55, Dec. 1977, p. 696-700, ill.)

References.

ASTIS document number 172685.

ACU

An experimental spill of 0.38 cu m of warm (55 degrees C) crude oil under the ice cover of a fresh water pond with an underwater viewing port is described. Temperatures, dissolved hydrocarbon concentrations and oil slick behaviour and areas were determined. Some oil recovery and disposal methods were tested. An attempt has been made to quantify the rates of heat and mass transfer from the oil using reported values for transfer coefficients. The results indicate that the oil slick adopted a thickness of about 2 cm under the ice, that heat transfer from the oil was relatively fast and complete, that dissolution mass transfer is slow resulting in oil concentrations in the water of only 18 to 287 micro g/l in the vicinity of the spill. Some recommendations are made for further studies to elucidate the nature and rates of the relevant physical processes and thus assist in assessing the environmental impact of under-ice oil spills. (Au)

286

The probable nature and behaviour of oil spills in the Beaufort Sea, and the feasibility of cleanup / Greene, G.D. Mackay, D.

(Oil under the ice / D.H. Pimlott, D. Brown, K.P. Sam. - Ottawa : Canadian Arctic Resources Committee, 1976, p. 161-178)

At head of title: Appendix 6.

References.

ASTIS document number 181420.

ACU

This review is an attempt to assemble and comment on the existing information on Arctic oil spills on water and ice. The emphasis is on the probability, nature, and consequences of a major oil spill in the Beaufort Sea, resulting from an oil well blowout during exploration. ... (Au)

GRIFFITHS, R.P.

287

Field observations on the acute effect of crude oil on glucose and glutamate uptake in samples collected from arctic and subarctic waters / Griffiths, R.P. McNamara, T.M.

Caldwell, B.A. Morita, R.Y.

(Applied and environmental microbiology, v. 41, no. 6, June 1981, p.1400-1406, ill., maps)

References.

ASTIS document number 168157.

ACU, NSDB

The acute effects of crude oil on glucose uptake rates by marine microorganisms were studied in 215 water and 162 sediment samples collected from both arctic and subarctic marine waters. The mean percentage reduction of glucose uptake rates ranged from 37 to 58 in the water samples exposed to crude oil and from 14 to 36 in the sediment samples. Substrate uptake kinetic studies indicated that the observed reductions by microbial populations exposed to crude oil were caused by metabolic inhibition. The effect of crude oil was less in sediments than in the water samples. ... (Au)

288

The importance of measuring microbial enzymatic functions while assessing and predicting long-term anthropogenic perturbations / Griffiths, R.P.

(Marine pollution bulletin, v. 14, no. 5, May 1983, p. 162-165, ill.)

References.

ASTIS document number 169579.

ACU, NSDB

... The studies ... were an attempt to quantify the impact of pollutant (crude oil) on the microbial activities associated with major nutrient cycling in arctic and subarctic sediments. In addition, an assessment was made concerning the potential impact of this pollutant in a prospective lease area for offshore drilling. The general approach taken and a brief summary of the results are described to illustrate the feasibility of this approach in application to other pollution impact studies. ... (Au)

289

The long-term effects of crude oil on microbial processes in subarctic marine sediments / Griffiths, R.P. Caldwell, B.A. Broich, W.A. Morita, R.Y.

(Estuarine, coastal and shelf science, v. 15, no. 2, 1982, p. 183-198, ill., maps)

References.

ASTIS document number 170321.

NSDB

Subarctic marine sediments were exposed to fresh and 'weathered' crude oil from Cook Inlet, Alaska. The crude oil was thoroughly mixed with the sediment at various concentrations and some of the oil-sediment mixtures were placed on top of unamended sediments. ... The sediments were exposed to crude oil for periods up to 1.5 years. Sediments exposed to 50 per mille fresh crude oil showed significant decreases in nitrogen fixation and denitrification rates and redox potentials. Also observed were increases in CO<sub>2</sub> production rates and methane concentrations. These same changes were observed in sediments exposed to 1 per mille. When 'weathered' crude oil was added to the sediments, the same changes were observed except there was no reduction in nitrogen fixation activity. In most cases, the observed effects were less marked when the sediments were amended with 'weathered' crude oil than when the same concentration of fresh crude oil. ... (Au)



290

**Long-term effects of crude oil on microbial processes in subarctic marine sediments : studies on sediments amended with organic nutrients / Griffiths, R.P. Caldwell, B.A. Broich, W.A. Morita, R.Y.**

(Marine pollution bulletin. v. 13, no. 8, Aug. 1982, p. 273-278, maps)

References.

*ASTIS document number 166685.*

ACU, NSDB

Subarctic marine sediments amended with various organic compounds were exposed to fresh Cook Inlet crude oil at a concentration of 50 ppt for either 6 or 8 months. ... As a result of crude oil treatment, the activities of the enzymes that hydrolyse structural polysaccharides were reduced and the activities of the enzymes that hydrolyse storage polysaccharides were stimulated. In addition to these changes, we observed changes in phosphatase activity, nitrogen fixation rates, potential denitrification rates, methane concentrations, CO<sub>2</sub> production rates, and the glucose uptake and mineralization rates. ... The results of this study suggest the effect of crude oil on microbial processes may be affected by the type of organic material present in the impacted marine sediment. ... (Au)

291

**Long-term effects of crude oil on uptake and respiration of glucose and glutamate in arctic and subarctic marine sediments / Griffiths, R.P. Caldwell, B.A. Broich, W.A. Morita, R.Y.**

(Applied and environmental microbiology, v. 42, no. 5, Nov. 1981, p. 792-801, ill., maps)

References.

*ASTIS document number 168149.*

ACU, NSDB

The effects of crude oil on uptake and respiration (mineralization) of glucose and glutamate in marine sediments were investigated. After the sediments were treated with crude oil, they were replaced at or near the collection site by scuba divers. ... Glucose and glutamate uptakes rates were found to decrease, and the percent respired was found to increase in Arctic and subarctic marine sediments that had been exposed to fresh crude oil. These same changes were also observed when "weathered" crude oil was used and when untreated sediments were overlaid with oiled sediments. ... Our data suggest that secondary productivity in the marine environment could be adversely affected by the presence of crude oil in marine sediments. (Au)

292

**Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea / Griffiths, R.P. Morita, R.Y. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. II : Receptors, Microbiology, Ecological processes, p. 224-464, maps)

(NTIS PB80-186851, p. 224-464, maps)

References.

*ASTIS document number 168122.*

ACU

... [This study carried out in the Beaufort Sea and Cook Inlet showed] that crude oil alters microbial function in marine sediments. This altered function will have three major impacts on normal biological activity. (1) It will reduce overall productivity by interfering with the normal flow of food through the detrital food chain. ... (2) Crude oil will interfere with the process that converts the nitrogen and phosphorous that is tied up in organic material into inorganic nitrogen and phosphorous that is required for plant

growth. ... (3) Crude oil changes microbial activity in the sediments so that the chemical environment of the sediment surface is changed. ... This will greatly alter the normal recruitment of animals back into the impacted area. ... (Au)

293

**Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea / Griffiths, R.P. Morita, R.Y. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 10 : Biological studies, [1981]. p. 417-784, ill., maps)

References.

*ASTIS document number 169544.*

ACU

... [This report describes] ... the effects of crude oil microbial function as it affects productivity in the marine environment. [It covers effects on microbial respiration, nitrogen fixation and carbon cycling, and discusses petroleum weathering]. ... (Au)

294

**Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea / Griffiths, R.P. Morita, R.Y. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 62-142, maps)

References.

*ASTIS document number 169854.*

ACU

Our main objective has been to study the natural levels of relative microbial heterotrophic activity, respiration percentages and nitrogen fixation rates in natural microbial populations found in the Beaufort Sea and Cook Inlet under contrasting seasonal conditions. Our other objectives have been to evaluate the effects of crude oil [and oil dispersant] activity and nitrogen fixation rates. ... (Au)

295

**Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea / Griffiths, R.P. Morita, R.Y.**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VI : Receptors, Microbiology, p. 85-178, ill., maps)

(NTIS PB80-130057, p. 85-178, ill., maps)

References.

*ASTIS document number 175714.*

ACU

In general terms, our main objectives during the last year were to obtain information about marine microbial function in the Beaufort Sea and Cook Inlet, Alaska and to obtain information about the effects of crude oil on specific processes. The microbial functions that we were primarily concerned with were, relative microbial activity and respiration in surface waters and sediments and rates of nitrogen fixation in the sediments. By both field and laboratory observations, we were to estimate the effects of crude oil on these processes. (Au)

See also: 53, 54, 300, 490.

**GRIFFITHS, W.B.**

See: 405.

**GRITZ, R.**

See: 643.

**GRONLUND, W.D.**

See: 437, 457.

**GRUGER, E.H.**

See: 437, 439.

**GUIMONT, F.**

See: 81.

**GULF CANADA RESOURCES INC.**

See: 206, 211, 212, 213, 214, 215.

**GULLIKSEN, B.**

296

**Effect of an oil spill in Spitzbergen in 1978 / Gulliksen, B. Taasen, J.P.**

(Marine pollution bulletin, v. 13, no. 3, Jan. 1982, p. 96-98, ill., map)

References.

*ASTIS document number 168840.*

ACU, NSDB

The oil content in the sediment and the marine life along the arctic shores of Van Mijenfjord, Spitzbergen, were investigated about two years after a spill from diesel storage tanks. High values of oil were recorded in the sediment along the shore near the tanks. The shore fauna is generally poor in these areas and the only biological effect detected was the disappearance of the amphipod *Gammarus setosus* from the surface layers. (Au)

**GUNDLACH, E.R.**

297

**The oil spill Environmental Sensitivity Index applied to the Alaskan coast / Gundlach, E.R. Hayes, M.O.**

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 311-323, figures, maps)

References.

*ASTIS document number 131075.*

NFSMO

The oil spill Environmental Sensitivity Index (ESI) is a means of collecting and synthesizing diverse resource data onto one set of easily readable maps for use in oil spill planning and response. Types of data included in the ESI are: (a) geomorphic - relating to shoreline types, (b) biologic - indicating the location and seasonability of spill-sensitive coastal wildlife, (c) socioeconomic - indicating the sites of high socioeconomic importance, and (d) spill

response - noting the location of staging sites and equipment needed. The ESI is presented on a set of maps at the most detailed scale available (for Alaska primarily 1:63 360) accompanied by a descriptive text. ... (Au)

**GUSEV, M.V.**

298

**Petroleum-oxidizing microflora of arctic seas of the USSR / Gusev, M.V. Koronelli, T.V. Sentsova, O.Yu. Stoeva, S.**(Microbiology, v. 47, no. 4, Jul.-Aug. 1978, p. 616-618, ill.)  
Translation from *Mikrobiologiya*, v. 47, no. 4, Jul.-Aug. 1978, p. 762-764.

References.

*ASTIS document number 178160.*

ACU

Active petroleum-oxidizing bacteria of Arctic seas are represented by the species *Mycobacterium mucosum* (colorless form) and red-orange mycobacteria (*M. phlei* and *M. brevicale*). Representatives of both mycobacteria groups were found in the Yenisei Bay and in the Kara and Laptev seas. A typical characteristic of the vertical distribution of petroleum-oxidizing mycobacteria was the replacement of colorless forms by pigmented forms with an increase in depth (presence of "white" strains primarily in the surface layer and red and yellow-orange strains in deep and benthic water layers). (Au)

**GUSTAJTIS, K.A.**

See: 370.

**GUTTMAN, M.**

See: 327.

**HADLEY, D.**

See: 668.

**HAINES, J.R.**

299

**Biodegradation of petroleum hydrocarbons in continental shelf regions of the Bering Sea / Haines, J.R. Atlas, R.M.**  
(Oil and petrochemical pollution, v. 1, no. 2, 1983, p. 85-96, ill., maps)

References.

*ASTIS document number 180416.*

OON

Rates of petroleum hydrocarbon biodegradation were measured in water and sediment samples collected from the Bering Sea. Radiolabelled hydrocarbons, hexadecane, pristane, 9-methyl anthracene, and benz(a)anthracene were used to measure most probable numbers of hydrocarbon degraders and biodegradation potentials for various classes of hydrocarbons. Additionally, a six week flow through experiment in the laboratory was conducted to determine biodegradative capacities of sediment microorganisms for aliphatic and aromatic components of Cook Inlet crude oil. Results indicated low populations of hydrocarbon degraders in both water and sediments of the Bering Sea, low mineralization of hydrocarbons, but some modification of the composition of crude oil exposed to the indigenous microorganisms of the Bering Sea. Some differences were observed between ice covered and ice free areas.

with higher rates of microbial oil degradation associated with ice covered areas. Flow-through experiments demonstrated very low biodegradation of crude oil by sediment microorganisms even when supplied with nutrients. For trajectory modelling purposes our studies indicate that conservation of hydrocarbons must be assumed for at least three weeks, providing sufficient time for oil spilt into the Bering Sea to impact coastal regions. (Au)

300

**Denitrification and nitrogen fixation in Alaskan continental shelf sediments** / Haines, J.R. Atlas, R.M. Griffiths, R.P. Morita, R.Y.

(Applied and environmental microbiology, v. 41, no. 2, Feb. 1981, p. 412-421, maps)

References.

ASTIS document number 171867.

ACU, NSDB

Rates of nitrogen fixation and denitrification were measured in Alaskan continental shelf sediments. In some regions, rates of nitrogen fixation and denitrification appeared to be equal; in other areas, rates were significantly different. Potential rates of denitrification were found to be limited primarily by the available nitrate substrate. Major regional differences in rates of denitrification were not statistically significant, but significant differences were found for nitrogen fixation rates in different regions of the Alaskan continental shelf. Estimated net losses of nitrogen from Bering Sea sediments were calculated as  $1.8 \times 10,000,000,000$  g of N/yr. Experimental exposure of continental shelf sediments to petroleum hydrocarbons reduced rates of nitrogen fixation and denitrification in some cases but not others. Long-term exposure was necessary before a reduction in nitrogen fixation rates was observed; unamended rates of denitrification but not potential denitrification rates (NO<sub>3</sub> added) were depressed after exposure to hydrocarbons. (Au)

301

**In situ microbial degradation of Prudhoe Bay crude oil in Beaufort Sea sediments** / Haines, J.R. Atlas, R.M.

(Marine environmental research, v. 7, no. 2, 1982, p. 91-102, ill.)

References.

ASTIS document number 169463.

OON, NSDB

This study examined the fate of Prudhoe Bay crude oil in nearshore sediments of the Beaufort Sea, in situ, with emphasis on the role of microorganisms in the weathering process. The results indicate that oil is degraded in Arctic sediments very slowly; only after 1 year's exposure was biodegradation evident. Several factors probably contributed to the slow rate of microbial weathering, including limited populations of hydrocarbon utilising microorganisms; localised high oil concentrations; low temperatures; limiting nutrient concentrations (unfavorable C:N and C:P ratios); low oxygen tensions and limited circulation of interstitial waters in fine-grained sediments. Abiotic weathering of the oil was also slow, with limited loss of low molecular weight aliphatic and aromatic hydrocarbons during 2 years exposure. ... The results of this study indicate that hydrocarbons will persist relatively unaltered for several years if Beaufort Sea sediments are contaminated with petroleum. (Au)

HALLETT, D.J.

See: 480, 547.

HAMEEDI, M.J.

302

**Proceedings of a synthesis meeting : the St. George Basin Environment and Possible Consequences of Planned Offshore Oil and Gas Development, Anchorage, Alaska, April 28-30, 1981** / Hameedi, M.J. [Editor]. United States. Bureau of Land Management [Sponsor].

Juneau, Alaska : U.S. National Oceanic and Atmospheric Administration, Office of Marine Pollution Assessment, 1982.

xxii, 162 p. : ill., maps : 28 cm.

Contents: Introduction / J.M. Hameedi -- Transport and fate of spilled oil / J.D. Schumacher -- Environmental hazards to petroleum industry development / W.M. Sackinger and R.A. Combellick -- Marine mammals / H.W. Braham, G.W. Oliver, C. Fowler, K. Frost, F. Fay, C. Cowles, D. Costa, K. Schneider and D. Calkins -- Marine birds / J.G. Strauch and G.L. Hunt, Jr. -- Finfish resources / F.V. Thorsteinson and L.K. Thorsteinson -- Shellfish resources / H.E. Curl, Jr. and C.A. Manen.

References.

ASTIS document number 168548.

This report is based on the proceedings of the meeting and covers potential effects of petroleum development in the area, including physical fates of oil, biological effects on marine fauna and seabirds, and ice and geologic hazards to industrial development. (ASTIS)

HAMMILL, M.H.

See: 142.

HANSEN, D.J.

303

**The potential effects of oil spills and other chemical pollutants on marine mammals occurring in Alaskan waters** / Hansen, D.J.

Anchorage, Alaska : U.S. Minerals Management Service, Alaska Outer Continental Shelf Region, 1985.

ii, 22 p. : 28 cm.

(OCS report MMS 85- 0031)

References.

ASTIS document number 174904.

ACU

This report describes and assesses the potential effects of oil spills and other contaminants on marine mammals that occur in Alaskan waters, assuming that a spill or contamination occurs. ... current information is used here to more clearly define the potential direct and indirect effects of oil spills and other contaminants on marine mammals than was possible in previous environmental impact statements ... which reviewed earlier information on oil-spill effects on marine mammals. ... The following discussions, which focus primarily on the potential direct and indirect effects of oil spills on marine mammals, address both short-term effects that occur at the time of contact with oil and long-term effects that occur long after contact with oil. Cetacean and noncetacean marine mammals - such as sea otters, pinnipeds, and polar bears - are treated separately in discussions of direct effects. Marine mammals are treated collectively in discussions of oil-spill avoidance, indirect and long-term oil-spill effects, and effects of other contaminants. The summary includes a perspective on oil-spill effects relative to the effects of other contaminants. ... (Au)

See also: 182.

HANSON, S.

See: 273.

HARDWOOD, L.A.

See: 244.

HARLAND, R.C.

See: 123, 124, 126, 145.

HARPER, J.R.

304

Coastal sensitivity analysis of the northern Chukchi Sea coast of Alaska / Harper, J.R. Isaacs, J. Robilliard, G.A. Owens, E.H.

(Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. - [Ottawa : EPS, 1984], p. 278-294)

References.

ASTIS document number 162272.

As part of the pre-lease sale evaluation of marine resources in Chukchi Sea, an oil spill sensitivity analysis was conducted of the coastal area located between Point Hope and Point Barrow, Alaska (approximately 650 km of open coastline and 864 km of lagoon coastline). The objective of the study was to (1) provide resource managers with a description of resources in the region and with an evaluation of which resources are sensitive, where they are located, and when they are sensitive and (2) provide contingency planners with guidelines for establishing countermeasure priorities. Three level indices (primary, secondary, and tertiary levels) were used to characterize (a) potential oil residence in the shore zone (ORI - Oil Residence Index), (b) potential impacts to human activities (HUI - Human Use Index). The use of three separate indices allows sensitivity of each of the resource categories to be explicitly identified while at the same time providing sufficient detail for contingency planning purposes (e.g., there are 27 potential combinations of indices). (Au)

See also: 333, 526, 527, 528, 531.

HARRALD, J.R.

305

Oil spills in the Alaskan coastal zone - the statistical picture / Harrald, J.R. Boyd, B.D. Bates, C.C.

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 1-7)

References.

ASTIS document number 175048.

ACU

This paper presents figures on the quantities and types of petroleum entering U.S. and Alaskan ocean waters. Sources of pollution and volumes of spills are also given. (Au)

HARRIS, G.W.

See: 332.

HARWOOD, L.A.

See: 256.

HASSAIN, K.

See: 710.

HAWKES, J.W.

306

The effects of petroleum on aquatic organisms : a multidisciplinary approach / Hawkes, J.W.

(Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 87-110)

(NTIS PB-277 060, p. 87-110)

References.

ASTIS document number 177350.

NSDB

The responses of marine organisms to environmental contaminants are reflected in a number of changes which can be detected at molecular, cellular, organismal, and population levels. The purpose of the studies reported here is to determine the effects of petroleum on subarctic and arctic marine animals; aspects of the chemistry, morphology, physiology, pathology, and behavior are used to evaluate alterations from exposure of the animals to petroleum. ... These studies include both definition and evaluation of: (1) effects of water-soluble fractions of crude oil and a model hydrocarbon mixture on salmon homing behavior; (2) effects of long-term ingestion of crude oil-coated food on reproduction of rainbow trout; (3) alterations in cellular structure of fish after petroleum exposure; (4) changes in feeding behavior of shrimp during exposure to water-soluble petroleum fractions; (5) uptake and depuration of toxic trace metals by salmon and flatfish; (6) effects of selected hydrocarbons on olfactory acuity of coho salmon; (7) uptake and depuration of petroleum hydrocarbons by salmon, flatfish, and shrimp; (8) enzymes (AHH) that metabolize (detoxify, activate) aromatic hydrocarbons in a variety of aquatic species; (9) pathological effects of exposure of flatfish to crude oil-contaminated sediment; (10) effects of exposure to oil in diet or in water on disease resistance of salmon. Several of the above studies have been completed and others are in progress. ... (ASTIS)

See also: 312, 437, 457.

HAYES, M.O.

307

Coastal morphology and sedimentation, Lower Cook Inlet, Alaska, with emphasis on potential oil spill impacts / Hayes, M.O. Brown, P.J. Michel, J. Columbia, S.C. : University of South Carolina, Dept. Geology, Coastal Research Division, 1976.

107 p.

(Technical report - Coastal Research Division, Department of Geology, University of South Carolina, no. 12-CRD)

Document not seen by ASTIS.  
ASTIS document number 181137.

308

Oil spill vulnerability, coastal morphology, and sedimentation of Kotzebue Sound / Hayes, M.O. Ruby, C.H.  
(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VII : Transport, p. 115-170, ill., maps)  
(NTIS PB80-186877, p. 115-170, ill., maps)  
References.  
ASTIS document number 175692.  
ACU

During the summer of 1976, 89 profile and sample sites were analyzed in Kotzebue Sound from Cape Prince of Wales to Point Hope. ... From this data, we have classified the shoreline with regard to its general geomorphology. Using the geomorphic classification, we have applied our Oil Spill Vulnerability Index (OSVI) which ranks the shoreline environments with regard to the expected impact of a potential oil spill. The OSVI is based primarily on the longevity of spilled oil within each coastal subenvironment. ... (Au)

309

Vulnerability of coastal environments of lower Cook Inlet, Alaska to oil spill impact / Hayes, M.O. Michel, J. Brown, P.J.  
(POAC 77 : proceedings / Edited by D.B. Muggeridge. - St. John's, Nfld. : Ocean Engineering Information Centre, Memorial University of Newfoundland, 1977, v. 2, p. 832-843)  
ASTIS document number 181145.  
ACU

The coastal waters of lower Cook Inlet, like many arctic areas, will undergo exploratory petroleum drilling in the near future. In preparation for the increased potential for oil spills, a field study of the coastal morphology and sediments, with emphasis on the behavior of spilled oil, was conducted in June 1976. A total of 1216 km of shoreline was classified into erosional (45 percent), neutral (38 percent), and depositional (17 percent) types, which were further divided into 16 subclasses on the basis of small scale morphological features. This classification was used in conjunction with a vulnerability index of potential oil spill damage, developed through study of two major oil spills, to predict the longevity of oil in the different coastal environments of the Inlet. ... We propose that the use of this type of vulnerability indexing, in conjunction with a biological susceptibility index and oil spill trajectory models, would provide a rational basis for decision making concerning the location of on- and off-shore oil facilities and the design of oil spill contingency plans. (Au)

See also: 297, 479, 611.

HEINEMANN, D.

See: 261, 736, 737.

HELLEBUST, J.

See: 206.

HEMMING, N.

See: 333.

HERLINVEAUX, R.H.

See: 275, 481, 482.

HESS, R.

310

Kodiak Islands oil pollution / Hess, R. Trobaugh, L.  
(Annual report - Smithsonian Institution. Center for Short Lived Phenomena, 1970, p. 150-153, ill.)  
References.  
ASTIS document number 170283.

OON

This brief report outlines the damage caused by the 1970 Kodiak Island, Alaska oil spill in terms of animal mortality estimates and expected effect on the hunting and fishing industries. (ASTIS)

HICKIE, J.P.

See: 399.

HILDEBRAND, P.

See: 30.

HILL, H.R.

See: 78, 79.

HILLMAN, R.E.

See: 496.

HIRTZER, P.

See: 103, 106.

HNATIUK, J.

311

An environmental research program for drilling in the Canadian Beaufort Sea / Hnatiuk, J.  
(Proceedings - Conference on Arctic Systems, St. John's, Newfoundland, August 18-22, 1975 / Edited by P.J. Amaria, A.A. Bruneau, and P.A. Lapp. New York : Plenum Press, 1977. Nato conference series : II. Arctic systems : v. 2, p. 237-256, figures, tables)  
Paper presented at the 26th Annual Technical Meeting of the Petroleum Society of CIM in Banff, June 11-13, 1975.  
References.  
ASTIS document number 63916.  
ACU, SSU, NFSMO

A multi-million dollar environmental research program consisting of thirty-three wildlife, biological, oceanographic, meteorological, sea ice and oil clean-up studies related to the southern Beaufort Sea is described. The studies are designed to provide ecological baselines, a better understanding of the physical environment, knowledge related to the consequences of a possible oil spill and means of oil clean-up in ice-infested waters. ... Government agencies co-ordinate the program with considerable management and scientific input from oil industry personnel. ... (Au)

## HODDO, T.

See: 223, 630.

## HODGINS, H.O.

312

**Marine fish and invertebrate diseases, host disease resistance, and pathological effects of petroleum / Hodgins, H.O.**

McCain, B.B. Hawkes, J.W.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 95-173, ill.)

References.

ASTIS document number 169382.

ACU

... [This chapter covers] the effects of petroleum and related substances, and environmental modifications resulting from petroleum exploration, on the health of [anadromous and marine arctic and subarctic animals.] ... The discussions ... begin with a review of the principal known diseases of arctic and subarctic fish and invertebrate species. ... Next [is] a review of knowledge concerning disease resistance mechanisms of vertebrates and invertebrates and environmental factors affecting disease and disease resistance .... Existing information about pathological changes in marine and certain other representative species exposed to petroleum will then be presented. ... (Au)

See also: 260, 434, 435, 436, 437, 438, 439, 440, 441, 457.

## HOM, W.

See: 540, 542, 543.

## HOOD, D.W.

313

**Environmental studies of Port Valdez / Hood, D.W. [Editor].**  
Shiels, W.E. [Editor]. Kelly, E.J. [Editor].

Fairbanks, Alaska : University of Alaska, Institute of Marine Science, 1973.

495 p. : ill., maps ; 23 cm.

(Occasional publication - Institute of Marine Science, no. 3)

Includes author index.

References.

ASTIS document number 178454.

ACU

... [This] project was designed to obtain critical environmental data on Port Valdez Narrows and the approaches to this system in Prince William Sound. ... Emphasis was on acquisition of baseline data against which future monitoring could be based and assessment of the oceanographic features of this system essential in predicting the impact of future additions of contaminants,

particularly as related to a crude oil tanker loading and ballast treatment facility. ... Geological studies with particular reference to sediment distribution, suspended sediments and correlation of sediment distribution with water circulation and types of benthic organisms present are described .... A general description of the circulation of the estuary, dilution rates at the outfall site, and rates of flushing into Prince William Sound were determined. ... Chemical studies were made of pH, alkalinity, total carbon dioxide, oxygen and nutrients. ... Primary productivity measurements were made at selected stations on each cruise to determine the net photosynthesis occurring at the various depths related to the penetration of incident light. ... The major benthic infaunal associations are identified and assessed .... Hydrocarbon analysis of water, sediments and organisms of Port Valdez and measurements of the biodegradation information on the levels of hydrocarbons added to this system were studied to give background information on the levels of hydrocarbons present in the system and the ability of indigenous organisms present to decompose added quantities. The toxicity of Prudhoe Bay crude oil to the phytoplankton indigenous to Port Valdez was examined to determine the level of contamination which would be inhibitory to photosynthesis. ... (Au)

314

**Marine terminus of the trans-Alaska pipeline / Hood, D.W.**

(Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 95-117, ill., maps)

References.

ASTIS document number 175099.

ACU

Expected to begin operations in mid-1977, the trans-Alaska pipeline is scheduled to carry oil at a rate of up to 2 million barrels per day from the arctic shore to a tanker terminal on the southern coast. Treatment will be required for as much as 1 million barrels of ballast water discharged by incoming tankers. The terminal facility, loading dock, and the effluent disperser for the ballast treatment plant are located in Port Valdez. In 1971-1972, a 15-month concentrated study was made to obtain background information on the baseline condition of the Port, including its physical circulation and dispersion, flushing rates, processes of primary productivity, the biology of the benthos, effects of crude oil on productivity, in-situ biodegradation rates of hydrocarbons, and sedimentary geology. ... The purpose of this chapter is to summarize some of the findings and conclusions of the preliminary baseline studies as they relate to assessment of this type of arctic environment. (Au)

See also: 653.

## HOPKINS, D.

See: 615.

## HOROWITZ, A.

315

**Continuous open flow-through system as a model for oil degradation in the Arctic Ocean / Horowitz, A.**

Atlas, R.M.

(Applied and environmental microbiology, v. 33, no. 3, Mar. 1977, p. 647-653, ill.)

References.

ASTIS document number 178071.

ACU, NSDB

A continuous flow-through system incubated in situ was used to

model oil biodegradation in Arctic coastal waters. High numbers of oil-degrading microorganisms were found in the Arctic coastal waters examined in this study. The microbial community underlying oil slicks increased and showed a population shift to a greater percentage of hydrocarbon-utilizing microorganisms. Microbial populations and oil biodegradation were increased by the addition of nitrogen and phosphorus. Both abiotic and biodegradation losses were lower than expected, perhaps due to the unusually harsh, ice-dominated Arctic summer, during which these tests were conducted. Chromatographic and spectrometric analyses showed that residual oils contained similar percentages of individual components and classes of hydrocarbons, regardless of the amount of degradation, indicating that most components of the oil were being degraded at similar rates. (Au)

316

**Crude oil degradation in the arctic : changes in bacterial populations and oil composition during one-year exposure in a model system / Horowitz, A. Atlas, R.M.**

(Proceedings of the Thirty-fourth General Meeting of the Society for Industrial Microbiology held at East Lansing, Michigan, August 21-26, 1977 / Edited by L.A. Underkofler. Developments in industrial microbiology, v. 19, 1978, p. 517-522, ill.)

References.

ASTIS document number 172693.

ACU

During a 2-wk period in early summer following establishment of experimental spills of Prudhoe crude oil in a model flow-through system, an approx. 18% weight loss, attributable to abiotic weathering, was found. Following this period, biodegradation of oil occurred very slowly with 75% of untreated oil slicks remaining at the end of the summer (70 days) and no biodegradation occurring during the winter. Oil biodegradation probably was limited severely not only by temp and available nutrients but also by available surface area of oil. Stimulation of oil biodegradation by nutrient addition occurred, 60% remaining after 70 days, but was still limited by some other factors. Biodegradation lessened weights of residual oil but did not alter the relative percentages of component hydrocarbon classes. Ratios of oil degraders to total heterotrophic bacteria were five times higher under oil slicks than controls. Rates of removal of C hydrocarbons were higher in water previously exposed to oil than in controls. (Au)

317

**Fate of petroleum hydrocarbons in nearshore arctic aquatic ecosystems / Horowitz, A.**

Louisville, Ky. : University of Louisville, Dept. of Biology, [1979].

xiii, 192 p. : ill. : 22 cm.

Thesis (Ph.D.) - University of Louisville, Louisville, Kentucky, 1978.

References.

ASTIS document number 177164.

NSDB

A continuous flow-through system incubated in situ was used to model oil biodegradation in Arctic coastal waters. High numbers of oil degrading microorganisms were found in the Arctic coastal waters examined in this study. The microbial community underlying oil slicks increased and showed a population shift to a greater percentage of hydrocarbon utilizing microorganisms. Microbial populations and oil biodegradation were increased by addition of nitrogen and phosphorus. ... Microbial seeding was shown to enhance hydrocarbon biodegradation. Seeding was field tested on surface water spillages of Prudhoe Bay crude oil. ... The response of microorganisms to an accidental spillage of 55,000 gallons of leaded gasoline into an arctic freshwater lake was studied. Shifts in microbial populations were detected following the spillage, reflecting the migration pattern of the gasoline and the enrichment for hydrocarbon utilizers and selection for leaded gasoline tolerant

microorganisms. Ratios of gasoline tolerant/utilizing to "total" heterotrophs were found to be a sensitive indicator of the degree of hydrocarbon contamination. Respiration rates were elevated in the highly contaminated area but did not reflect differences between moderately and lightly contaminated areas. ... (Au)

318

**Interactions of crude oil and Arctic microbial populations in open chemostats / Horowitz, A. Atlas, R.M.**

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1976, p. 194)

Abstract only.

ASTIS document number 176834.

The interactions of petroleum and Arctic microbial populations from the marine environment were studied in open-flow model chemostats. During the study, water temperature varied from 2 to 11 C and salinity varied from 3 to 22 per mille. Psychrotrophic microorganisms declined and mesophilic populations remained constant in unoled control chemostats. As compared to controls, microbial populations underlying oil slicks were higher and showed sinusoidal fluctuations. Additions of either water-soluble or oleophilic nitrogen and phosphorus nutrients to the oil resulted in larger increases and fluctuations of greater magnitude of microbial populations than occurred with unsupplemented oil. Population differences of one order of magnitude were observed between control and nutrient-enriched oil containing chemostats within 10 days. No initial population differences were observed between oleophilic and water-soluble nutrient-enriched chemostats. Addition of nutrients resulted in increased weight losses of recoverable oil after two months of exposure, up to 32% in nutrient-enriched chemostats compared to 15% for unsupplemented oil. (Au)

319

**Numerical taxonomic studies on bacteria selected for ability to utilize hydrocarbons from arctic aquatic ecosystems exposed to crude or refined oil / Horowitz, A. Krichevsky, M.I. Atlas, R.M.**

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1978, p. 208)

Abstract only.

ASTIS document number 176869.

Numerical taxonomic studies were performed on 243 psychrotrophic isolates from an Arctic freshwater lake contaminated with leaded gasoline and from Arctic coastal seawater exposed to Prudhoe Bay crude oil. Strains were examined for 127 phenotypic features. Clustering was done using Jaccard coefficients and unweighted average linkage. Clusters were defined at about 70% similarity. Twenty four clusters were obtained which included 90% of the isolates. One cluster contained 50% of the strains. All isolates from the lake occurred in this single cluster along with 27% of the seawater isolates. Closely related organisms were apparently enriched for in very different ecosystems by very different hydrocarbon mixtures. A higher proportion of the isolates could flow on a mixture of hydrocarbons than on single hydrocarbon substrates. Hexadecane, pristane, ethylcyclohexane, and methyl-naphthalene were utilized by more than 50% of the isolates. Forty-six % of the strains were resistant to 0.2% lead. (Au)

320

**Oil biodegradation in arctic coastal waters / Horowitz, A. Atlas, R.M. United States. Office of Naval Research [Sponsor].**

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 357-365, ill., map)

References.

ASTIS document number 175951.

ACU

The greatest ecologic effects of Arctic oil spills will probably be concentrated in coastal waters. Oil spilled inland may be washed down rivers into coastal waters. Oil spilled offshore may be trapped by sea ice in coastal areas and eventually be washed onto the shore. The present study was designed to assess the ability of microorganisms to biodegrade oil in coastal waters where oil may contaminate the shores of the Arctic Ocean. The study involved determinations of numbers of microorganisms in waters along the coast near Pt. Barrow, Alaska, including sites in Elson Lagoon, the Beaufort Sea and Chukchi Sea. Microorganisms capable of degrading petroleum hydrocarbons were included. Oil biodegradation by microorganisms indigenous to coastal waters was also measured in model in-situ experiments. (Au)

See also: 66, 130.

HOSSAIN, K.

See: 412, 416, 422, 675, 712.

HOST, A.

See: 327.

HOUGHTON, J.P.

See: 195.

HOULT, D.P.

321

Oil in the Arctic / Hoult, D.P. Wolfe, L.S. O'Dea, S. Patureau, J.P. United States Coast Guard. Office of Research and Development [Sponsor]. Cambridge, Mass. : Massachusetts Institute of Technology, 1975.

v. 217 p. : ill. ; 28 cm.

(Report - United States Coast Guard, CG-D-96-75)

(NTIS AD-A-010 269)

Appendices.

References.

ASTIS document number 169340.

ACU

This report describes the results of several researches on the behavior of oil spilled in the arctic. Included are studies on evaporation, spreading and maximum extent of oil spilled on ice, and the behavior of oil spilled under ice. Physically sound theories are developed which correlate well with laboratory and field data. (Au)

322

Oil pollution in the Arctic / Hoult, D.P.

American Institute of Chemical Engineers, 64th Annual Meeting, November 28-December 2, 1971, San Francisco Hilton Hotel. - [S.l.] : [s.n.], 1971, p. 40

Abstract of Paper 15b presented at the 64th annual meeting of the American Institute of Chemical Engineers, 1971, at a symposium on Pollution of the Sea by Oil : Problems and Technology.

ASTIS document number 181030.

OON

Oil spilled in an Arctic climate presents cleanup problems which differ from those associated with a temperate zone oil spill. In order to solve these special problems, it is important to know how oil spreads under and over ice, and how it ages in the Arctic environment. Theories to explain these phenomena are developed and results are compared with at-sea Arctic observations obtained by the U.S. Coast Guard. (Au)

See also: 739.

HSIAO, S.I.C.

323

Biological productivity of the southern Beaufort Sea : phytoplankton and seaweed studies / Hsiao, S.I.C.

Victoria, B.C. : Beaufort Sea Project, Dept. of the Environment, 1976.

ii, 99p. : charts, map, tables : 28cm.

(Technical report - Beaufort Sea Project, no. 12c)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 12c)

Bibliography: p.31-35.

ASTIS document number 11622.

ACU, NFSMO

Standing stock and in situ primary productivity of the southern Beaufort Sea phytoplankton were determined. ... Possible reasons for a greater standing stock and primary productivity at inshore stations are discussed. ... Diatoms were more sensitive than flagellates when they were exposed to crude oils. ... Primary production of seaweed was severely inhibited by all types of crude oil at relatively low concentrations. (Au)

324

Effects of crude oils and the oil dispersant Corexit on primary production of arctic marine phytoplankton and seaweed / Hsiao, S.I.C. Kittle, D.W. Foy, M.G.

(Environmental pollution, v. 15, no. 3, Mar. 1978, p. 209-221, ill., map)

References.

ASTIS document number 172715.

ACU, NSDB

Effects of crude oil and Corexit on primary production of arctic marine phytoplankton were studied in situ. The production rate varied with types and concentrations of crude oil, method of preparation of oil-seawater mixtures, environmental conditions and species composition of each sample tested. In samples with the same species composition, inhibition of production generally increased with increasing oil concentration. The crude oil-Corexit mixtures were more toxic than crude oil or Corexit alone. In situ primary production of the seaweeds, *Laminaria saccharina* (L.) Lamouroux and *Phyllophora truncata* (P.) Newroth et Taylor was significantly inhibited by all types and concentrations of oil tested. (Au)

325

Effects of crude oils on the growth of arctic marine phytoplankton / Hsiao, S.I.C.

(Environmental pollution, v. 17, no. 2, Oct. 1978, p. 93-107, ill.)

References.

ASTIS document number 172707.

ACU, NSDB

Growth responses of arctic marine phytoplankton to crude oils were determined at various temperatures and exposures in a defined medium at constant light energy. The growth of diatoms



(*Chaetoceros septentrionalis* Oestrup, *Navicula bahusiensis* (Grunow in van Heurck) Grunow and *Nitzschia delicatissima* Cleve) was inhibited by Atkinson Point, Norman Wells, Pembina and Venezuela crude oils after ten days' exposure at a concentration of 10 ppm at 0 degrees C, 5 degrees C and 10 degrees C. Growth of the green flagellate *Chlamydomonas pulsatilla* Wohlenweber was stimulated by Norman Wells and Pembina crude oils at 0 degrees C. Growth of both diatoms and the green flagellate was markedly inhibited by oil concentrations higher than 100 ppm but diatoms were more severely impaired than the green flagellate. Greater inhibition generally occurred with longer exposure at temperatures between 5 degrees C and 10 degrees C than at 0 degrees C. *Chlamydomonas* was not killed by any of the crude oils at the concentrations, temperatures and lengths of exposure tested. Lethal effects among diatoms varied with species, types of oil, temperatures and exposure time. Relative species sensitivity of the phytoplankton to the oils was determined based on percentage survival, exponential growth rate and generation time. *Chlamydomonas* was the most tolerant species and had a greater ability to resume growth, while diatoms were sensitive and had little or no ability to resume growth. Possible ecological consequences of such species sensitivity and differential growth are discussed. (Au)

**HUBBARD, J.D.**

See: 182.

**HUBER, H.R.**

See: 14.

**HUFFORD, G.L.**

326

**Storm-related oil spill movement on the Beaufort Sea shelf /** Hufford, G.L. Lissauer, I.M. Thompson, D.B. (Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 455-460, ill., maps)

References.

ASTIS document number 177180.

NSDB, ACU

A storm model is developed and applied to the north Alaskan coast. The model is used to generate wind fields from various storms which have occurred during the past 20 years. The wind fields generated are used to study the wind drift trajectories of oil spills from five different sites along the north Alaskan coast. The probability of an oil slick impacting the shoreline from the five different sites is discussed for different storms. Environmental risk analysis is discussed for drilling sites at different distances from the shoreline. (Au)

327

**WEBSEC 71-72 : an ecological survey in the Beaufort Sea, August-September, 1971-1972 /** Hufford, G.L. Fortier, S.H. Wolfe, D.E. Doster, J.F. Noble, D.L. Barnes, P.W. Weiss, H.V. Chew, K. Guttman, M. Host, A. Naidu, A.S. Mowatt, T.C.

Washington, D.C. : U.S. Coast Guard Oceanographic Unit, 1974.

xiv, 268 p. : ill., maps ; 28 cm.

(Oceanographic report - United States. Coast Guard, no. CG 373- 64)

(NTIS AD-A-012 351)

Alternate title: An ecological survey in the Beaufort Sea, August-September, 1971-1972.

Appendices.

References.

Contents: Physical oceanography of the western Beaufort Sea / Hufford, G.L., Fortier, S.H., Wolfe, D.E., Doster, J.F. and Noble, D.L. - Preliminary results of marine geologic studies off the northern coast of Alaska / Barnes, P.W. - Mercury in the environs of the north slope of Alaska / Weiss, H.V., Chew, K., Guttman, M. and Host, A.

ASTIS document number 177105.

NSDB

This report contains a collection of scientific papers from two successive marine ecological baseline cruises to the Western Beaufort Sea (August-September, 1971 and 1972). Preliminary results of the physical, chemical, biological, and geological data are presented and interpreted. The results indicate that the data were collected in a marine ecosystem that is still in a relatively unpolluted state. The data should provide a base for assessing the affects of pollution from future development, especially from petroleum. (Au)

**HUME, H.**

See: 687.

**HUMPHREY, B.**

328

**Baffin Island Oil Spill Project : chemistry component : report on the 1982 oil spill experiments, volume 1 : summary of field work and shoreline hydrocarbon analysis /** Humphrey, B. Canada. Environmental Protection Service [Sponsor]. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1983.

v, 64 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 82- 1) Appendix.

Cover title: Chemistry 1 : field sampling and measurements : 1982 study results.

References.

ASTIS document number 170054.

ACU

The sampling for the Baffin Island Oil Spill Chemistry component is described. The analytical method for total hydrocarbons and the results of those analyses are presented. Samples taken in 1982 are listed with the results of corresponding analyses from 1980 and 1981. (Au)

See also: 283, 284, 459, 628.

**HUNT, G.L.**

See: 261.

**HURST, R.J.**

329

**Effects of chronic/episodic oil spills resulting from normal petroleum hydrocarbon development activities within and adjacent to the marine environment on polar bears /** Hurst, R.J. [Participant]. Schweinsburg, R.E. [Participant]. Stirling, I. [Participant].

(Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. - Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34, p. 144-153)

## References.

ASTIS document number 177938.

## ACU

Oil spills occur as a result of normal hydrocarbon development activities in the Beaufort Sea. At present, these spills are largely restricted to fuel (primarily diesel) used in various shorebased and offshore operations, but will likely include crude oil spills at offshore production facilities in the future. ... There is some potential for bears to be affected by chronic spills in the Beaufort Sea, either through direct fouling following contact with surface slicks or indirectly through consumption of oil-contaminated prey. [This workshop discussion paper concludes that bear mortality from chronic/episodic oil spills would be limited]. (Au)

330

**Metabolic and temperature responses of polar bears to crude oil /** Hurst, R.J. Oritsland, N.A. Watts, P.D. (Land and water issues related to energy development : proceedings of the Fourth Annual Meeting of the International Society of Petroleum Industry Biologists, Denver, Colorado, September 22-25, 1981 / Edited by P.J. Rand. - Ann Arbor, Mich. : Ann Arbor Science, 1982, p. 263-280, ill.)

## References.

ASTIS document number 175358.

## ACU

The metabolic and temperature responses of three sub-adult polar bears (*Ursus maritimus*) were monitored before and after exposure to a 1 cm slick of Midale crude oil. Body and skin temperatures were measured by surgically implanted radio transmitters and metabolism by open circuit respirometry. Resting metabolic rate increased by 27% to 86% and averaged over 50% higher following oil fouling. Activity metabolism also increased in the one animal tested after oil contact, to 24% above the pre-oil level. Body temperature increased slightly in 2 of the animals and dropped in the third polar bear within 24 hours of oil contact. Skin temperatures of all animals remained abnormally high for approximately one week following oiling. The metabolic changes induced by oil, and the potential energetic consequences, are discussed in relation to a possible metabolic compensation for a reduction in fur insulation: a change in the minimum level of energy turnover of body tissues; and a skin reaction to the physical oil coating. (Au)

331

**Polar bear thermoregulation : effect of oil on the insulative properties of fur /** Hurst, R.J. Oritsland, N.A. (Journal of thermal biology, v. 7, no. 4, Dec. 1982, p. 201-208, figures, tables)

## References.

ASTIS document number 119490.

## ACU

Oil caused a substantial decrease in the insulative value of polar bear (*Ursus maritimus*) pelts measured in vitro. Following oil

contamination the calm air heat transfer coefficient increased a factor of 2 to 5; the wind coefficient averaged 290% greater; the solar utilization increased by 55%. Conductance through covered furs remained high at winter temperatures ... but decreased with time at summer temperatures .... The most viscous of the three oils tested had a more consistently negative effect on insulation. (Au)

See also: 523.

**HUTCHESON, M.S.**

332

**Sublethal effects of a water-soluble fraction and chemically dispersed form of crude oil on energy partitioning in two arctic bivalves /** Hutcheson, M.S. Harris, G.W. Ottawa : Environment Canada, 1982.

30 p.

Document not seen by ASTIS.

ASTIS document number 180572.

## NSDB

**IMPERIAL OIL LIMITED**

See: 478, 505.

**INSTITUTE OF OCEAN SCIENCES, PATRICIA BAY. OCEAN CHEMISTRY DIVISION**

See: 709.

**INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (CANADA)**

See: 709.

**ISAACS, J.**

333

**Kodiak Island coastal sensitivity study : balancing human use with oil residence and biological sensitivity /** Isaacs, J. Hemming, N. Harper, J.R. Grabacki, S. Lees, D.

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 362-374, maps)

## References.

ASTIS document number 165255.

## ACU

The Kodiak Island Borough, as part of its Coastal Management Program, recently funded a study of coastal sensitivity to petroleum product spills. The intent of the project was to evaluate the oil residence, and biological and human use sensitivity of the shoreline and nearshore waters. This information would then be used by decision-makers to determine appropriate response measures during an oil spill event. ... (ASTIS)

See also: 304.

ISAKSON, J.S.

See: 455.

IZMAILOV, V.V.

334

The computation of a pollutant budget for the Arctic Ocean / Izmailov, V.V. Smagin, V.M.  
(Polar geography and geology, v. 5, no. 4, Oct.-Dec. 1981, p. 228-234)

Translation from: Izvestiia Vsesoyuznogo Geograficheskogo Obshchestva, v.111, no.6, 1979, p.486-491.

References.

ASTIS document number 89338.

ACU, NSDB

An equation is proposed for calculating the pollutant budget of the Arctic Ocean, and its application is illustrated on the basis of data for oil pollution. ... (Au)

335

Effect of petroleum products on the snow-ice cover of the Arctic / Izmailov, V.V.

(Polar geography and geology, v. 5, no. 4, Oct.-Dec. 1981, p. 235-241, ill.)

Translation from: Izvestiia Vsesoyuznogo Geograficheskogo Obshchestva, v.12, no.2, 1980, p.147-152, ill.

References.

ASTIS document number 89346.

ACU, NSDB

The impact of oil spills on Arctic water and ice was investigated in 1978 on three plots on the drifting station North Pole 22 when it was 115 to 250 nautical miles north of Canada and Alaska. Oil products spilled on the surface of snow and ice were found to raise the surface temperature in spring to 5.3 degrees C. The melting of the snow and ice cover was found to be more rapid in polluted plots than in clean plots, with the acceleration greatest in a plot polluted with crude oil and smallest with gasoline. These effects apply only to the particular conditions in the area of investigation. Similar tests elsewhere in the Arctic may yield a more generalized model. ... (Au)

JAHNS, H.O.

See: 74.

JAMES F. MACLAREN LTD.

336

Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. Canada. Fisheries and Environment Canada [Sponsor].

Edmonton : James F. MacLaren Ltd., [1978].

iv. (various pagings) : ill., tables, graphs ; 28cm.

Seminar manager: James F. MacLaren Ltd.

Prepared for Supply and Services Canada and Fisheries and Environment Canada.

ASTIS document number 1082.

NFSMO, ACU, NSDB

Presents papers on oil spills in the Canadian Arctic. Topics include shorelines and protection studies, spill behaviour and effects, clean-up equipment, detection and tracking of spills, etc. (ASTIS)

JANDALI, T.

See: 82.

JARVELA, L.E.

337

The Navarin Basin environment and possible consequences of planned offshore oil and gas development / Jarvela, L.E. [Editor].

Juneau, Alaska : National Oceanic and Atmospheric Administration, 1984.

xvi, 157 p. : figures, tables; 28 cm.

References.

ASTIS document number 151351.

ACU

... Because of the Navarin Basin's remoteness, the regional environmental data base was comparatively scanty when it was placed on the OCS leasing schedule. OCSEAP subsequently initiated several research efforts to address perceived key information gaps. These included a limited number of field investigations and a summarization of available environmental information. The compilation was conducted by Science Applications, Inc. (SAI) under contract to NOAA; it was submitted to OCSEAP in December 1981. In late October 1982 OCSEAP convened a 3-day Navarin Basin Synthesis Meeting in Anchorage, Alaska. One major objective of the meeting was to update the document prepared by SAI. As a consequence of the field studies that were underway during and after the preparation of the document, a significant amount of new data had become available in 1982. Another objective was to assess selected issues related to possible oil and gas development in the basin; these concerned marine mammals, marine birds, environmental hazards, and fishery resources. ... This report is in large part the end product of the synthesis meeting. However, it also includes a significant amount of pertinent information that postdates the meeting or is appropriate to make the report more cohesive and comprehensive. ... We have attempted to emphasize those attributes of the Navarin Basin and its biota that are perceived to be most at issue within the context of the proposed oil and gas development activities. This is most evident in the newly created final chapter. Obviously, a number of other environmental questions and issues remain to be further evaluated and resolved. (Au)

JEFFREY, D.A.

See: 548.

JENSSEN, B.M.

338

Thermoregulation in a naturally oil-contaminated Black-billed Murre *Uria aalge* / Jenssen, B.M. Ekker, M. Bech, C.

(Bulletin of environmental contamination and toxicology, v. 35, no. 1, July 1985, p. 9-14, ill.)

References.

ASTIS document number 169560.

ACU, NSDB

The effect of oiled plumages on seabirds is considered to be reduced thermal insulation, with a resultant increase in metabolic rate. This conclusion is based on results from ducks with experimentally oil-contaminated plumages. ... In the present paper, data on body temperature, metabolic rate, and insulation in a Black-billed Murre (*Uria aalge*) contaminated during an oil-spill at sea [and captured near Runde (62° 24' N, 5° 37' E) on the central west coast of Norway] are presented. (Au)

JESSEN, S.

See: 498.

JEWITT, S.C.

See: 248.

JOHANSEN, O.

339

The Halten Bank experiment : observations and model studies on drift and fate of oil in marine environment / Johansen, O.

(Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. - [Ottawa : EPS, 1984], p. 18-36, ill., maps)

References.

ASTIS document number 171646.

A large interdisciplinary experimental oil spill was carried out by the Norwegian Marine Pollution Research and Monitoring Programme - FOH, at the Halten Bank offshore Norway in June 1982. The experiment was aimed at testing and verification of models on fate and effects of oil in marine environment. The paper includes a brief presentation of the experiment (planning, organisation), and a discussion of the observations with special emphasis on the physical processes, such as drift and spread of oil at the sea surface, oil weathering, and distribution of oil in the water column. The adequacy of established oil spill models are discussed, and a new concept for modelling of surface spreading and vertical dispersion of oil is tested on the basis of the observations. (Au)

See also: 69.

JOHN A. LESLIE AND ASSOCIATES

340

Coastal environments of Canada : the impact and cleanup of oil spills / John A. Leslie and Associates. Owens, E.H. Canada. Environmental Emergency Branch. Research and Development Division [Sponsor].

Ottawa : Environmental Impact Control Directorate, 1977. 413 p. : ill., maps ; 28 cm.

Economic and technical review report, EPS 3-EC-77-13) Appendix.

References.

ASTIS document number 181870.

OON

The impact of a major oil spill on Canada's shorelines would vary considerably, depending primarily on the shoreline types and on the character of the coastal environment of the affected area .... The primary objectives of this report were as follows: (1) to define the major coastal environments of Canada, including the [Arctic, Atlantic, Pacific and] Great Lakes, (2) to explain the significant geological characteristics and processes in each environment, (3) to discuss the expected nature and behaviour of oil residues in the different environments, (4) to discuss the expected distribution of oil residues in the littoral environment, (5) to discuss the expected persistence of oil residues in different littoral environments, (6) to assess available clean-up techniques in terms of their applicability and effectiveness, (7) to present guidelines for the implementation of the most suitable clean-up techniques in each coastal environment, and (8) to present a bibliography of relevant

geological and clean-up information sources. ... (Au)

JOHNSON, A.M.

See: 654.

JOHNSON, B.C.

See: 114.

JOHNSON, L.

341

Assessment of the effects of oil on arctic marine fish and marine mammals / Johnson, L. Bennett, E.B. Levy, E.M. Mansfield, A.W.

Winnipeg, Man. : Dept. of Fisheries and Oceans, 1983.

viii, 15 p. : map, table ; 28 cm.

(Canadian technical report of fisheries and aquatic sciences, no. 1200)

ISBN 0706-6457.

References.

ASTIS document number 133442.

ACU

Arctic marine ecosystems are briefly reviewed to provide a background for the assessment of the effect of oil on Arctic marine fish and marine mammals; the probability of an oil spill in Arctic waters and its possible effects is developed through the provision of answers to a series of questions drawn up by the Commissioners the Report. ... (Au)

JOHNSON, R.P.

See: 33.

JOHNSON, S.

See: 81, 82.

JOHNSTON, M.H.

See: 248, 513, 514.

JONES, S.

342

Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978 / Jones, S. [Editor]. Mackay, D. [Editor]. Arctic Petroleum

Operators Association [Sponsor]. Canadian Petroleum Association [Sponsor].

Toronto : Institute for Environmental Studies of the University of Toronto, [1978].

iii, 161 p. : figure ; 28 cm.

(Publication - University of Toronto. Institute for Environmental Studies, EE 8)

References.

ASTIS document number 18155.

ACU, NFSMO

Reviews current petroleum techniques and technologies now in use in the Arctic offshore, including underwater well completion, artificial islands, drilling vessel types and Beaufort Sea drilling. Environmental concerns studied include resources utilization, oil spills, and environmental regulatory processing. A list of registrants is provided. (ASTIS)

## JORDAN, R.E.

343

Fate and weathering of petroleum spills in the marine environment : a literature review and synopsis / Jordan, R.E. Payne, J.R.

Ann Arbor, Michigan : Ann Arbor Science. [1980].

x, 174p. : ill., tables ; 24cm.

ISBN 0-250-40381-1.

References.

Partial contents: Oil released in Arctic environments; Oil and ice/snow interactions, p.108-114. - Mass balance of oil released in ice covered areas, p.132-136.

ASTIS document number 84158.

ACU, NSDB

The fate of an oil spill in the marine environment is determined by the apparently complex and interrelated processes of evaporation, dissolution, photochemical and microbial degradation, emulsification, sedimentation, and sinking. The physical and chemical alterations to the spill occurring with time, as well as the rates of these changes, will be influenced by a variety of abiotic environmental parameters, as well as by the physical-chemical properties inherent to the oil itself. ... A number of excellent reviews have been published concerning the fate and effects of petroleum in the marine environment .... In this report some of the works cited in these previous reviews are touched upon; however, we have tried to concentrate, for the most part, on the more recent publications dealing with oil weathering, which have appeared in the literature since 1977. (Au)

See also: 540, 541, 542, 543.

## JOSEFSEN, K.

See: 223, 511, 630.

## JOYCE, G.

See: 260.

## JUCK, F.A.

See: 523.

## JUSZKO, B.A.

344

Sinking of oil : water density considerations / Juszko, B.A. Green, D.R.

(Spill technology newsletter, v. 8, no. 2, Mar.-Apr. 1983, p. 22-27, figures)

References.

ASTIS document number 132497.

ACU, NSDB

Large surface water density changes are associated with freshwater

input. At high latitudes, ice melt provides the necessary freshwater; at mid-latitudes, river runoff is more important. However, these areas of pronounced freshwater influence are spatially very limited. For most of Canada's coastal regions, temperature plays the major role in determining density changes. [Increase in density of various oils with aging is given]. (Au)

345

Sinking of oil : water density considerations / Juszko, B.A. Green, D.R. Fingas, M.F.

(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983]. p. 9-13. ill., maps)

References.

ASTIS document number 170968.

All oils initially have a specific gravity of 0.7 to 1.0 g/mL. At this density, oil would not sink in seawater. However, weathering by evaporation and dissolution of light components, emulsion formation, absorption of oil into particulates, and bacterial growth can greatly increase the density. ... Once the density of spilled oil increases to that of seawater, the oil will become entrained in the water column and its behaviour will be governed by physical oceanographic processes entirely different from those affecting a surface slick. This paper summarizes a study done for the Environmental Protection Service that discusses the processes affecting seawater density from the perspective of where spilled oil would be most likely to sink. The study includes contour maps of surface water density for all of Canada's coastlines, as well as typical vertical density profiles at stations in each area. In this paper, a written summary of the water density distribution for each of the major coastal areas is presented, together with some example data presentations. (Au)

## KANE, J.

See: 456.

## KANEKO, T.

See: 52.

## KAPLAN, I.R.

346

Characterization of organic matter in sediments from Cook Inlet and Norton Sound / Kaplan, I.R. Venkatesan, M.I. Ruth, E. Meredith, D. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 296-352, ill., maps)

Appendix.

References.

ASTIS document number 168297.

ACU

Sediments were collected from the lease areas of Cook Inlet and Norton Sound and analyzed for total carbon, organic carbon, aliphatic and aromatic hydrocarbon contents. The objectives of the investigation are: (1) to establish concentration levels and spatial variability of hydrocarbon components prior to actual production of oil in the area, (2) to characterize the distribution and nature of these hydrocarbons, (3) to assess the possible source of the hydrocarbons in surface sediments, whether biogenic or anthropogenic, and (4) to understand the probable pathways

hydrocarbon transport in each of the areas in case of an oil spill. ...  
(Au)

See also: 54, 723.

KARINEN, J.F.

347

Effects of Prudhoe Bay crude oil on molting tanner crabs,  
*Chionoecetes bairdi* / Karinen, J.F. Rice, S.D.

(Marine fisheries review, v. 36, no. 7, 1974, p. 31-37, ill.)

References.

ASTIS document number 178640.

OON

Premolt and postmolt juvenile male Tanner crabs, *Chionoecetes bairdi*, from Alaska waters were exposed to Prudhoe Bay crude oil in static bioassays in the laboratory. Crabs in both stages were similarly susceptible to crude oil; the estimated 48-hour TLM (median tolerance limits) values were 0.56 ml oil/liter. Molting success decreased with increasing exposure of crabs to oil, and newly molted crabs autotomized limbs during exposure to oil. Relating the results of our study to the known behavior of crabs and the documented behavior of oil spills in the ocean suggests that oil spilled in Alaska waters would harm the Tanner crab resources. The impact on all crab resources of chronic low-level oil pollution from the ballast water discharged into Prince William Sound is unknown. This study further illustrates our present state of ignorance concerning the biological effects of oil in the marine environment. (Au)

See also: 110, 473, 579, 580, 581, 584, 585, 586, 587, 588, 591, 594, 673, 674.

KARRICK, N.L.

348

Alterations in petroleum resulting from physico-chemical and microbiological factors / Karrick, N.L.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume I: Nature and fate of petroleum / Edited by D.C. Malins. - New York: Academic Press, 1977, p. 225-307)

References.

ASTIS document number 169366.

ACU

In this chapter we will discuss the specific nature of the changes that take place in petroleum in the marine environment as a result of physical, chemical, and microbiological forces and then, from this information, we will attempt to estimate the general pattern or trends that might be expected after addition of petroleum into the marine environment with particular reference to the arctic and subarctic areas. (Au)

See also: 439, 441.

KATZ, C.N.

349

Low molecular weight hydrocarbon concentrations (C1 - C4),  
Alaskan continental shelf, 1975-1979 / Katz, C.N.

Cline, J.D.

Seattle, Wash.: Pacific Marine Environmental Laboratory, 1980.

4 microfiches: map; 11 x 15 cm.

(NOAA data report, ERL PMEL- 2)

(NTIS PB82-154121)

Appendices.

References.

ASTIS document number 180742.

OON

Dissolved low molecular weight (LMW) aliphatic hydrocarbons, C1-C4, were measured on the Alaskan Continental shelf as a part of the Outer Continental Shelf Environment Assessment Program (OCSEAP). This data report summarizes light hydrocarbon concentrations made during 13 cruises from 1975 to 1979. The cruise numbers, geographic locations, inclusive dates, and number of samples analyzed for each cruise are shown chronologically in table 1. Spatial and temporal hydrocarbon distributions were obtained in seven geographical areas of the Alaskan shelf. These areas include the northeast Gulf of Alaska, Cook Inlet, Kodiak Shelf, Shelikof Strait, southeast Bering Sea, Norton Sound, and Chukchi Sea. Vertical profiles at each station usually included samples taken at the surface and within 5 m of the bottom. The number of samples taken at intermediate depths depended on the depth of the water column. Diel variability in hydrocarbon concentrations was determined at one or more 24 to 48 hour time series stations during most visits. Time series stations are listed. (Au)

350

Processes affecting the distribution of low-molecular-weight aliphatic hydrocarbons in Cook Inlet, Alaska / Katz, C.N. Cline, J.D.

Seattle, Wash.: Pacific Marine Environmental Laboratory, 1981.

1 microfiche: ill., maps; 11 x 15 cm.

(NOAA technical memorandum, ERL PMEL- 26)

(NTIS PB82-250663)

References.

ASTIS document number 180769.

OON

Measurements of low-molecular-weight (LMW) aliphatic hydrocarbons, C1 and C4, were made in Cook Inlet, Alaska, on five cruises between 1977 and 1979. The distributions of these compounds were variable in both space and time. Concentration levels and composition of these gases in the lower Inlet appeared to be typical of those found in other coastal marine environments. The upper Inlet, however, had significantly elevated concentrations of methane and the C2+ paraffins. On the basis of the contrasting hydrographic conditions of the two regions and the differing compositional characteristics of the hydrocarbon assemblages, the source of hydrocarbons was qualitatively determined to be predominantly biogenic in the lower Inlet and thermogenic in the upper Inlet. Hydrocarbon analyses made in concert with biological measurements in the lower Inlet suggested that the major source of methane was from the sediments, whereas the C2+ hydrocarbons were produced in the water column. The conclusions of these field studies were supported by in vitro experiments. A methane budget calculated on the basis of a two-box model of the Inlet showed air-sea exchange and tidal mixing to be the major sinks of hydrocarbons in the Inlet. The budget quantitatively supported the evidence of a thermogenic source of hydrocarbons in the upper Inlet. This source may be the result of submarine seepage or leakage from existing wells. (Au)

See also: 170, 171.

KAUFFMAN, P.

See: 453.

## KEEVIL, B.E.

351

### Behavior of oil spilled under floating ice / Keevil, B.E.

Ramseier, R.O.

(Proceedings of the Conference on Prevention and Control of Oil Pollution, San Francisco, California, 1975, p. 497-501, ill)

#### References.

ASTIS document number 177300.

NSDB

Cold room experiments designed to simulate a hot oil spill under ice demonstrated the basic behavior of crude oil at the ice-water interface. Observations in the cold room were compared with data from accidental oil spills in ice-covered waters. (Au)

## KELLY, E.J.

See: 313.

## KENYON, K.W.

352

### The effect of oil pollution on marine mammals / Kenyon, K.W.

Seattle, Wash. : Bureau of Sport Fisheries & Wildlife, [1971].

9 p. ; 28 cm.

#### References.

ASTIS document number 177296.

NSDB(O.S.BIB.)

This article lists anecdotal observations on the effects of petroleum contamination on several marine mammal species, ranging from Amchitka Island, Alaska to the California coast and the Canadian east coast. Effects on sea otters, northern fur seals, harbor seals, northern elephant seals, cetaceans and seabirds are presented. (ASTIS)

## KIESSER, S.L.

See: 23, 26, 73.

## KILIAAN, H.P.L.

See: 515.

## KINNEY, P.J.

353

### Baseline hydrocarbon concentrations / Kinney, P.J.

(Environmental studies of Port Valdez / Edited by D.W. Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska, Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 397-410, ill., map)

#### References.

ASTIS document number 178462.

ACU

An assessment of biodegradation rates in Port Valdez is presented in response to the suggestion that the inlet may receive an increased hydrocarbon load from the proposed pipeline. Techniques developed and used in this study were based on results obtained earlier in

Cook Inlet (Kinney et al. 1969), at which time hydrocarbon biodegradation was not widely recognized as an important marine oil removal mechanism .... Information obtained during the Cook Inlet study led to the development of two new techniques for estimating potential biodegradation rates. Slicks on water samples quickly dispersed when agitated with seawater containing populations of hydrocarbon-oxidizing organisms, but this was not the case when sterile water was used. An estimate of the indigenous hydrocarbon-oxidizing population was made by observing how large a volume of seawater was necessary to contain sufficient organisms to initiate the biodegradation process. Since biodegradation appeared to occur in the water column, this process was studied by introducing radioactive oil and measuring the rate of resulting metabolic product formation. A general estimate was thus made of the hydrocarbon-oxidizing microflora population in Port Valdez and the rate at which it can be expected to metabolize oil. ... (Au)

354

### Kinetics of dissipation and biodegradation of crude oil in

Alaska's Cook Inlet / Kinney, P.J. Button, D.K.

Schell, D.M.

(Proceedings of Joint Conference on Prevention and Control of Oil Spills, 1969, New York, N.Y. - Washington, D.C. : American Petroleum Institute, 1969, p. 333-340, ill., maps)

#### References.

ASTIS document number 177393.

NSDB

The results of a study to quantitatively define the magnitude of oil pollution problems in Alaska's Cook Inlet are reported. Physical dissipation and biodegradation rates were determined and combined with estimates of hydrocarbon input rates to assess the fate of oil in Cook Inlet. The question of accumulation of crude oil components within the Inlet is considered from the above results and by direct analysis. Results indicate that hydrocarbon accumulation is less than our present limits of detection. Cook Inlet flushing is 90 per cent complete in 10 months. Experimental results show that unsupplemented Cook Inlet water effectively degrades Cook Inlet crude, that this biodegradation is essentially complete in the order of a few months, and that the biodegradation capacity of Cook Inlet is large. Thus biodegradation is more important than physical flushing in removing hydrocarbon pollutants from Cook Inlet. The methods and results are discussed in terms of their applicability to other areas. (Au)

See also: 598.

## KINTER, W.B.

See: 544.

## KIRSTEIN, B.E.

See: 540, 541, 542, 543.

## KISIL, A.

See: 416, 422.

## KITTLE, D.W.

See: 324.

KLEIN, D.R.

See: 111.

KNOWLES, R.

355

Nitrogen fixation in arctic marine sediments : effects of oil and hydrocarbon fractions / Knowles, R. Wishart, C. (Environmental pollution, v. 13, no. 2, June 1977, p. 133-149, ill., map)

References.

ASTIS document number 172740.

ACU, NSDB

Nitrogen fixation (acetylene reduction) was measured in grab and core samples of sediments from the Beaufort Sea and Eskimo Lakes, Northwest Territories, Canada. Very low rates (about 25 mg N/sq m. year) were detected in untreated sediments. Activity was markedly stimulated by the addition of glucose, sucrose, lactose, mannitol and malate but much less so by acetate; negligible activity was supported by N-acetylglucosamine. There was no consistent effect of the presence or absence of oxygen. Nitrogen fixation potentials in glucose-supplemented sediment samples showed large variation between stations, between samples from the same station and between depths within single cores down to 18 cm. Weathered Norman Wells crude oil, hexane, decane, dodecane and hexadecane had no effect, stimulatory or inhibitory, on nitrogen fixation or carbon dioxide evolution. 1, 2, 4-trimethylbenzene caused complete inhibition of nitrogen fixation but only partial inhibition of CO<sub>2</sub> evolution. There was no evidence of utilisation of any of the hydrocarbons tested during periods of over 30 days under the experimental conditions employed. (Au)

KOBLINSKY, C.

See: 137.

KOORYMAN, G.L.

356

Effects of oiling on temperature regulation in sea otters / Kooryman, G.L. Costa, D.P. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 1-26, ill., maps)

References.

ASTIS document number 169781.

ACU

The objective of this study was to measure effects of crude oil contamination on sea otters through studies on the changes in the animals's metabolic rate and subcutaneous temperatures before and after contact with oil. A second objective was to attempt to rehabilitate the otters after crude oil contamination. ... The study has shown that small amounts of crude oil contamination have large effects on the metabolic rate of sea otters. ... (Au)

357

Physiological impact of oil on pinnipeds / Kooryman, G.L.

Gentry, R.L. McAlister, W.B.

(Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976. Vol. III, p. 3-26, ill.)

References.

Volume published 1977.

ASTIS document number 173509.

ACU

The objective of this study was to measure the effects of contamination on the northern fur seal through studies on the thermal conductance of pelts, dive performance, and alterations in the metabolic rate before and after contact with oil. A second objective was to compare thermal conductance in pelts of fur-bearing marine mammals with that of nonfur-bearing species to determine whether surface fouling might be a major route of impact for all species. ... [Field studies were done on St. George Island, Pribilof Group, Alaska.] The study has shown that small amounts of crude oil have large effects on thermal conductance of fur-bearing pelts, and no effect on nonfur-bearing pelts. In living animals light oiling of approximately 30% of the pelt surface area resulted in a 1.5-fold increase in metabolic rate while immersed in water of various temperatures. Furthermore, this effect lasted at least 2 weeks. Although normal diving was measured, we did not obtain post-oiling data to show the effect of oil contact on dive performance. ... Implications: Any contact with oil at any time of year would have a profound influence on the health of individual northern fur seals through increases in pelt conductance with concomitant increases in metabolic rate. ... (Au)

358

Thermal conductance of immersed pinniped and sea otter pelts before and after oiling with Prudhoe Bay Crude / Kooryman, G.L. Davis, R.W. Castellini, M.A.

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 151-157, ill.)

References.

ASTIS document number 174998.

ACU

Thermal conductance, (C) of the sea otter and several species of pinniped pelts was determined during immersion, after oiling, and after cleaning. A (C) of 7 Watts/sq meter/c degrees for the sea otter pup was the lowest measured in all controls. The highest was 58 W/sq m/c degrees for the California sea lion. Most affected by oiling was the sea otter pup in which (C) doubled. Least affected was the sea lion in which no change in (C) occurred. Washing slightly reduced (C) of the adult otter and fur seal. The results indicate that even a light oiling would have marked detrimental effects on the thermoregulatory abilities of otters and fur seals at sea. The thermal effects of oiling on other adult pinnipeds while at sea would be slight. (Au)

See also: 180.

KORN, S.

359

Effects of temperature on the median tolerance limit of pink salmon and shrimp exposed to toluene, naphthalene and Cook Inlet crude oil / Korn, S. Moles, D.A. Rice, S.D.

(Bulletin of environmental contamination and toxicology, v. 21, no. 4/5, Mar. 1979, p. 521-525)

References.

ASTIS document number 172952.

ACU, NSDB

Marine animals may be more susceptible to oil spills in Alaska and other cold waters than they would be in warmer waters because of direct and indirect effects of low temperatures on the physical behavior of oil and the sensitivity of animals. Oil-water solutions



probably remain at toxic concentrations for longer periods of time at lower temperatures because of reduced volatility and biodegradation of oil in seawater. ... We measured the effects of temperature on the TLM's [median tolerance limits] of pink salmon (*Oncorhynchus gorbuscha*) fry and shrimp (*Eualus* spp. and *Pandalus goniurus*) exposed to toluene, naphthalene, and the water-soluble fraction (WSF) of Cook Inlet crude oil. ... [The 96 hour TLM of pink salmon fry exposed to toluene was significantly lower at 4 degrees than at 12 degrees C. The trend toward lower TLM's at lower temperatures was observed for the Cook Inlet WSF, but the differences were not statistically significant. The 96 hour TLM's for shrimp exposed to toluene and naphthalene were significantly higher at 4 degrees C than at 12 degrees. Temperature did not affect the TLM of shrimp exposed to the Cook Inlet crude oil WSF.] (Au)

See also: 157, 489, 580, 585, 586, 587, 588, 593.

## KORONELLI, T.V.

360

**Lipid composition of a carbohydrate-oxidizing mycobacterium isolated from arctic waters / Koronelli, T.V. Stoeva, S. Ushakova, N.A. Rozynov, B.V.**

(Microbiology, v. 46, no. 6, Nov.-Dec. 1977, p. 864-867)

References.

Translation from Mikrobiologiya, v. 46, no. 6, Nov.-Dec. 1977, p.1070-1073.

ASTIS document number 175420.

ACU

The free lipids of the Arctic mycobacterium *Mycobacterium mucosum* AP-25, formed on a medium with hexadecane at various temperatures, were investigated. The main fractions, regardless of the temperature of culturing, are phospholipids, triglycerides, and mycolic acids. Cephalin was detected in the phospholipids. The fatty acids of the free lipids are represented by a mixture of C10:0, C12:0, C14:0, and C16:1, and C16:1, with a predominance of hexadecenoic acid. In cells grown at 18 degrees C, the content of unsaturated fatty acids and acids with a shorter carbon chain is somewhat higher than in cells cultured at 28 degrees C. Among the mycolic acids, the compounds C34:0, C36:0, C34:1, and C36:1, predominate; the composition of minor components is cited. The question of the relationship between the structure of the cell lipids of *Mycobact. mucosum* AT-25 and the existence under low temperature conditions is discussed. (Au)

See also: 298.

## KOVACS, A.

361

**Oil pooling under sea ice / Kovacs, A. Morey, R.M. Cundy, D.F. United States. Outer Continental Shelf**

Environmental Assessment Program [Sponsor].

United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 333-339, map)

References.

ASTIS document number 169471.

ACU

The objectives of ... [this study] are to determine the cause of and variation of the significant relief which exists under fast ice, to estimate the quantity of oil which could pool up in the under-ice depressions should a sea bed oil release occur, and to use impulse

radar to investigate sea ice thickness and electromagnetic phenomena. ... (Au)

362

**Oil pooling under sea ice / Kovacs, A. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 310-323, ill., map)

(NTIS PB80-186885, p. 310-323, ill., map)

References.

ASTIS document number 169528.

ACU

The objective of the CRREL study is to: (a) Determine the cause of the significant relief which exists under the fast ice. (b) Measure the variations in the relief under fast ice using electromagnetic echo sounding. (c) Determine if the under-ice relief is a series of individual pockets or consists of long rills. (d) Estimate the quantity of oil which could pool up in the under-ice depressions should oil be released under the ice cover. (e) Use impulse radar to study the electromagnetic properties and anisotropy of sea ice. ... (Au)

363

**Pooling of oil under sea ice / Kovacs, A. Morey, R.M. Cundy, D.F. Decoff, G.**

(POAC 81 : the Sixth International Conference on Port and Ocean Engineering under Arctic Conditions, Quebec, Canada, July 27-31, 1981, proceedings. - Quebec City : Universite Laval, 1981, v. 2, p. 912-922, ill., maps)

References.

ASTIS document number 167860.

ACU

Ice thickness profiles were constructed for six fast ice locations in the vicinity of Prudhoe Bay, Alaska, using a radar echo sounding system. The sounding data revealed in detail the undulating relief of the bottom of the sea ice in which oil could pool up if released under the ice. ... Estimates of the volume of oil that could pool up in the ice bottom relief range from 20,000 to 30,000 cubic m/sq km. ... The effect of slush ice relief and structure on potential under-ice oil pooling is for the most part unknown. ... (Au)

364

**Sea ice thickness profiling and under-ice oil entrapment / Kovacs, A.**

(Ninth Annual Offshore Technology Conference 1977, proceedings. - Dallas, Tex. : Offshore Technology Conference, 1977, v. 3, p. 547-554, ill.)

References.

ASTIS document number 172618.

ACU

Results obtained with a unique dual-antenna impulse radar system used to profile first- and multi-year sea ice near Prudhoe Bay, Alaska, are discussed. A description of the radar system is given along with representative field data. ... Ice thickness profiles are required for studies related to the determination of ice load distributions and force analyses, and the subsurface roughness as it pertains to under-ice sound propagation and to the quantity of oil that would be trapped in the undulating bottom relief of first-year and multi-year ice should an oil blowout occur in an ice-covered sea. From the radar impulse travel times obtained with the use of dual antennas, calculations of thickness, electromagnetic impulse velocity and effective dielectric constant of the ice were made. ... Continuous ice thickness profiles obtained with the radar were analyzed to provide representative cross sections of first-year and multi-year sea ice. These cross sections reveal the undulating bottom surface relief of both ice types. Calculations are presented that indicate a significant amount of oil could be trapped within

this bottom relief should the oil be released under the ice from a sea-floor oil-production system. (Au)

## KREILING, J.

365

Oil and ice / Kreiling, J.

(Technology review, v. 75, no. 6, May 1973, p. 45-46)

ASTIS document number 180998.

ACU

... Two mechanical engineers from M.I.T., L. Stephen Wolfe and David P. Hoult, have been injecting oil into a tank of brine iced on the top with varying and controlled temperatures to get indications of [how oil interacts with sea ice]. The test tank measured 12 in. in diameter and 42 in. in depth. This they believe was large enough to make a reasonable facsimile of sea ice. When the layer of ice had grown to 12-16 cm., they injected below it enough of either a North Slope crude or a No. 2 diesel to coat its lower surface with 1-2.6 cm. of oil. In their experiments they found little mixing of oil and ice. ... If the researchers lifted the slab of ice from the tank before the layer of ice under the oil had formed, usually some of the oil clung to it in an uneven layer. ... How much oil clings to the layer of ice seems to depend on the type of oil, the coldness of the air and the brine, and the thickness of the ice (which influences the temperature changes in the oil). How quickly the oil spread under the ice when it was injected depended on the same factors. Drs. Wolfe and Hoult generalize from their data that if a supertanker carrying 100,000 metric tons spilled its load in the Arctic, the 113,000 cu. m. of oil would cover an area between 9 sq. km. and 45 sq. km. - probably about 17 sq. km. ... (Au)

## KRICHEVSKY, E.J.

See: 52.

## KRICHEVSKY, M.I.

See: 319.

## KRUGER, J.F.

See: 455.

## KUWADA, M.N.

See: 16.

## KVENVOLDEN, K.A.

366

Hydrocarbon gas in sediment from the shelf, slope, and basin of the Bering Sea / Kvenvolden, K.A. Redden, G.D. *Geochimica et Cosmochimica Acta*, v. 44, no. 8, Aug. 1980, p.1145-1150, figures, tables)

References.

ASTIS document number 80527.

ACU, NSDB

Hydrocarbon gases (methane, ethane, ethene, propane, propene, isobutane and n-butane) are present in low concentrations in the top 10 meters of sediment from the shelf, slope and basin of the Bering Sea. Methane is most abundant and its concentration increases with depth in the sediment. Average concentrations ... are between about 4000 and 5000 nl per l of interstitial water. Ethane,

ethene, propane and propene are present in almost all samples, but the concentrations ... are about two orders of magnitude lower than ... methane. The average ratios of ethane to ethene are usually greater than one in shelf sediment, about one in slope sediment, and usually less than one in basin sediments. These hydrocarbon gases are probably derived from low-temperature chemical and biochemical processes operating at or near the sea-floor. At one location on the shelf, hydrocarbon gases suggest the possibility of petroleum at depth. (Au)

## LADOUCEUR, L.C.

See: 744.

## LAGERKVIST, S.

See: 258.

## LALIBERTE, J.

See: 123, 145.

## LAMBACH, J.L.

See: 540, 541, 542, 543.

## LAMBERT, G.

367

Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks / Lambert, G. Peakall, D.B.

Philogene, B.J.R. Engelhardt, F.R. (Bulletin of environmental contamination and toxicology, v. 29, 1982, p. 520-524)

References.

ASTIS document number 171786.

ACU, NSDB

Although some studies have been carried out on the effects of crude oil on the basic metabolic rate (BMR) of ducks ... none have assessed the combination of oil plus dispersant. Since the use of dispersants is a potentially major tool in the handling of oil spills, it seems advisable to study this problem so as to be able to make a rational decision whether or not to use dispersants when there is a threat to seabirds. ... Wild strain adult mallards (*Anas platyrhynchos*) were [used] .... Treatment for each bird included ... a one-time exposure to either Prudhoe Bay crude oil (PBCO). Corexit 9527 or PBCO + Corexit 9527. (Au)

368

Thermoregulatory metabolism in mallard ducks exposed to crude oil and dispersant / Lambert, G. Peakall, D.B. (Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 181-194, tables)

References.

ASTIS document number 80756.

ACU, NFSMO

... Since external oiling of the plumage of birds leads to a reduction of the insulating capacity of the plumage, it was decided to examine the effect of oil and oil dispersant on the basic metabolic rate of mallards. ... The complete treatment of each bird included two exposures to seawater alone, a few days apart, to establish the basic metabolic rate (BMR) of each individual bird, then a one-

time exposure to either Prudhoe Bay Crude Oil (PBCO), Corexit 9527 or PBCO + Corexit 9527. After this exposure to one of the pollutants, the bird was exposed two more times to seawater alone, 4 to 8 days and 8 to 14 days after, to follow the effect of the pollutant over a two-week period. (Au)

# LANFEAR, K.J.

See: 615.

# LANGTRY, T.

See: 77.

# LARSEN, D.

See: 89, 90.

# LASKEY, P.R.

See: 132.

# LAVERDIERE, C.

See: 744.

# LAW, R.

See: 168.

# LAW, R.A.T.

See: 597.

# LAWRENCE, D.

369

A simple oilspill trajectory model for the Scotian Shelf, using single and multi-point wind fields / Lawrence, D. Galbraith, P.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 17-32, ill., maps)

Appendix.

References.

ASTIS document number 169609.

OON

In projecting trajectories for oil slick movement at sea a number of factors come into play, including residual surface current, Coriolis force, tidal currents and winds. The last of these, surface winds, presents a particular problem in that winds for a large area are not constant in either direction or speed, but vary, sometimes greatly, from point to point. We have examined this problem with respect to spill movement during the Kurdistan accident, and have looked at several sources of wind data and contrasted their performance. We have also explored the importance of the surface residual currents

in constructing a wind-current derived model. (Au)

See also: 693.

# LEDREW, B.R.

370

Oil spill scenario for the Labrador Sea / LeDrew, B.R.

Gustajtis, K.A. Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. Canada. Environmental Emergency Branch. Research and Development Division [Sponsor]. Canada. Arctic Marine Oilspill Program [Sponsor]. [Ottawa : Environmental Protection Service. Dept. of the Environment], 1979.

iv, 675 p. : ill., figures, maps, tables : 28 cm.

(Economic and technical review report, EPS 3-EC-74- 4)

(C-CORE publication, no. 78- 2)

(C-CORE publication. Technical report)

A special study commissioned under AMOP.

References.

References.

ASTIS document number 37885.

ACU, NFSMO

This study develops a scenario following a large oil spill from a blowout of an exploratory well in the Labrador Sea. Scenario development leads to the delineation of gaps in pertinent baseline information and serves to identify the applicability and inadequacies of available countermeasure techniques. ... Twelve study topics are presented as input to the scenario narrative. ... the physical environment (emphasis on ice); resource utilization practices (potential, immediate and direct impact); factors peculiar to the area and that influence blowout probability; the behaviour of oil as it rises from the seabed and as it interacts with ice; the environmental prediction and logistics capability of the Labrador area to support a major countermeasures effort; and finally, an appraisal of the Canadian state of response preparedness. ... Recommendations are made of approaches to achieve the objectives of the Arctic Marine Oilspill Program (AMOP) insofar as it applies to the Labrador Sea. (Au)

# LEE, Y.-Z.

371

Effects of ingestion of Hibernia and Prudhoe Bay crude oils on hepatic and renal mixed function oxidase in nestling herring gulls (*Larus argentatus*) / Lee, Y.-Z.

Leighton, F.A. Peakall, D.B. Norstrom, R.J.

O'Brien, P.J. Rahimtula, A.D.

(Environmental research, v. 36, no. 1, Feb. 1985, p. 248-255, ill.)

References.

ASTIS document number 170330.

ACU

Oral administration of Prudhoe Bay crude or Hibernia crude to nestling herring gulls increased the hepatic cytochrome P-450 content 4-fold. Concomitantly, there was an increase in various mixed-function oxidase and phase II enzyme activities. 7-Ethoxyresorufin O-deethylase was elevated 19-fold, benzo(a)pyrene 3-hydroxylase 6-fold, aniline hydroxylase 3-fold, and aminopyrine N-demethylase and uridine diphosphate glucuronyl transferase 2-fold. There was no change in reduced glutathione S-transferase activity. Renal mixed-function oxidase activities were also elevated. Herring gull livers contained very low levels of DT-diaphorase activity which was inducible 3- to 5-fold by oil administration. (Au)

**LEENDERTSE, J.J.**

See: 406.

**LEES, D.**

See: 333.

**LEGORE, R.S.**

372

**The effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, *Crassostrea gigas* / Legore, R.S.**

Seattle, Wash. : University of Washington, 1974.

xii, 186 p. : ill., maps ; 21 cm.

Appendices.

References.

Thesis (Ph.D.) - University of Washington, Seattle, Washington, 1974.

Also available in microfilm.

ASTIS document number 175633.

ACU, NSDB

This study consisted of two related, but distinct goals. The primary objective was to elucidate the toxicity of Alaskan Prudhoe Bay crude oil as an aid toward the assessment of the potential damage of an accidental spill in the marine environment. It was determined that Alaskan crude oil presents a significant threat to at least some marine organisms. The second objective of this study was to compare the biological effects of representative pure hydrocarbons that normally occur in petroleum, including aliphatic, alicyclic and aromatic compounds. It is hoped that the resulting information may form the basis for future development of a technique to predict the relative toxicities of hydrocarbon mixtures, based upon analyses of their components. (Au)

373

**A preliminary assessment of the effects of Alaskan North Slope crude oil on developing larvae of the Pacific oyster, *Crassostrea gigas* / Legore, R.S.**

(Proceedings of the National Shellfisheries Association, v. 64, 1973, p. 4)

Abstract only.

ASTIS document number 177210.

NSDB

The discovery of oil under Alaska's North Slope and proposals to transport the oil to the Puget Sound area for processing have precipitated public concern for the durability of the local marine biota. To help assess the potential danger of accidental oil spills, the toxicity of Prudhoe Bay crude oil to larvae of the Pacific oyster (*Crassostrea gigas*) is under investigation. Oyster larvae were selected as the test organisms for this study because their use is rapidly becoming a standard for the evaluation of environmental degradation. Fertilized oyster eggs were subjected to graded doses of whole crude oil and to doses of two different kinds of seawater extracts of the oil. The extracts are subsequently being analysed for their content of small hydrocarbon compounds consisting of fewer than nine carbon atoms. Differences in the larval developmental responses to the various toxicants were discussed and some potential biological repercussions of oil importation into Puget Sound were considered. (Au)

374

**Toxicity of Alaskan north slope crude oil and selected hydrocarbons / Legore, R.S. Brown, G.W.**

(Research in fisheries, 1973, p. 57)

References.

ASTIS document number 178616.

OON

The discovery of oil under Alaska's North Slope, and proposals to transport the oil to the Puget Sound area for processing have precipitated public concern for the durability of the local marine biota. To help assess the potential danger of accidental oil spills, the toxicity of Prudhoe Bay crude oil to larvae of the Pacific oyster (*Crassostrea gigas*) was investigated. Embryonic and larval stages of oysters were selected for the tests because of their great sensitivity to stress. ... Normal development of oyster embryos was apparently stimulated by very low doses of sea-water extracts of the Alaskan crude oil. However, higher doses of extract resulted in severe inhibition of normal development, and in significant levels of mortality. The "threshold dose," at which deleterious effects were first noted, contained a total dissolved concentration of 3.1-3.6 mg/liter (parts per million) of benzene, toluene, and the xylenes, combined. ... (Au)

**LEIGHTON, F.A.**

375

**Heinz-body hemolytic anemia from the ingestion of crude oil : a primary toxic effect in marine birds / Leighton, F.A.**

Peakall, D.B. Butler, R.G.

(Science, v.220, May 20, 1983, p. 871-873, ill.)

ASTIS document number 171182.

ACU, NSDB

Hemolytic anemia developed in young herring gulls and Atlantic puffins given daily oral doses of a Prudhoe Bay crude oil. Anemia developed 4 to 5 days after the initiation of oil ingestion and was accompanied by Heinz-body formation and a strong regenerative response. The data evince a toxic effect on circulating red blood cells involving an oxidative biochemical mechanism and the first clear evidence of a primary mechanism of toxicity from the ingestion of crude oil by birds. (Au)

376

**Oil and arctic marine birds : an assessment of risk /**

Leighton, F.A. Butler, R.G. Peakall, D.B.

(Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London : New York : Elsevier Applied Science Publishers, 1985, p. 183-216)

References.

ASTIS document number 168653.

This is a review of the effect of oil on arctic seabirds including embryo-toxicity, external oiling, ingestion of oil, and general toxicity, including an assessment of oil spill risk to arctic sea-bird populations. (ASTIS)

See also: 371.

**LEINONEN, P.J.**

377

**A mathematical model of evaporation and dissolution from oil spills on ice, land, water and under ice / Leinonen, P.J.**

Mackay, D.

(Water pollution research in Canada, v. 10, 1975, 132-141, ill.)

References.

ASTIS document number 177008.

Mathematical models are presented which quantify the processes of evaporation and dissolution of components of crude oil in three

situations: a spill on water, a spill on ice, and a spill under ice cover in which the oil lies between the water and ice phases. Constant spill area is assumed. The evaporation flux is calculated using a mass transfer coefficient based on windspeed and spill dimensions. The dissolution flux can be calculated from two models, a mass transfer coefficient approach and an eddy diffusivity approach involving the integration of a set of partial differential equations in depth and time. The selection of model parameters is discussed. For the three physical situations, using a synthetic crude oil, results are presented giving the relative rates of evaporation and dissolution and the aqueous phase concentration of selected hydrocarbons. The implications of the results for clean-up technology and aquatic toxicity are discussed, particularly with regard to spills under ice. (Au)

See also: 285.

LEMON, D.D.

See: 41.

LEVALLEY, R.R.

See: 14.

LEVY, E.M.

378.

**Background levels of petroleum residues in Baffin Bay and the eastern Canadian Arctic : role of natural seepage / Levy, E.M.**

(Petromar 80 : petroleum and the marine environment / EUROCEAN. - London : Graham & Trotman Ltd., 1981, p. 345-362, figures)

References.

ASTIS document number 132578.

ACU, NFSMO

Concentrations of petroleum residues in the waters and surficial bottom sediments of Baffin Bay and the Eastern Arctic were measured during Bedford Institute of Oceanography surveys in 1977 and 1978. While floating particulate residues were only rarely encountered, concentrations of extractable residues ranged from 3-1726 microgram/L in the surface microlayer, 0-87.5 microgram/L in the water column and 1-41 microgram/g in the sediments. The geographical distribution of the residues in Baffin Bay suggests that they are derived predominantly from atmospheric fall-out of combustion products, although there are significant inputs from natural seepage at Scott Inlet and elsewhere along the northeast coast of Baffin Island. (Au)

379

**Commentary : what impact will the oil industry have on seabirds in the Canadian Arctic? / Levy, E.M.**

(Arctic, v. 36, no. 1, Mar. 1983, p. 1-4)

References.

ASTIS document number 113662.

ACU, NFSMO

Traditional environmental impact statements have not adequately discussed the impact on seabirds and other arctic marine life of oil at levels that do not cause immediately discernible toxicological responses. "Of particular importance in this regard is the effect of oil at sublethal levels on individuals and populations that are already stressed at or near their levels of tolerance, i.e. under conditions where any additional stress, however small, could be the 'straw that breaks the camel's back'. Future EIS's would be of

considerably more value if they were to address the impact of oil from the point of view of stress, though it must be realized a fully satisfactory quantitative assessment is impossible because of the lack of a fundamental understanding of stress levels and how they interact." Other stressors would include chronic discharges of wastes and increased human disturbance along with ships and aircraft. Specific factors contributing to overall stress can be reduced (e.g. restricting harvest of a species). The author urges more research be carried out for a better understanding of the general ecology of various species of seabirds. (ASTIS)

380

**Concentration of petroleum residues in the waters and sediments of Baffin Bay and the eastern Canadian Arctic - 1977 / Levy, E.M.**

Dartmouth, Nova Scotia : Bedford Institute of Oceanography, 1979.

1 microfiche, tables : 11x15cm.

(Report series - Bedford Institute of Oceanography, BI-R-79-3)

Appendices.

References.

ASTIS document number 26301.

ACU, NFSMO

A general survey of Baffin Bay, Davis Strait, Lancaster Sound, Jones Sound, and Smith Sound during 1977 demonstrated that the overall background level of dissolved and/or dispersed petroleum residues in these waters was 0.46 micrograms/L. Concentrations considerably in excess of this were encountered off Scott Inlet and at the entrance to Lancaster Sound where there is natural seepage from the seabed and near Resolute where there are localized inputs from anthropogenic sources. Concentrations in the surface microlayer ranged from 3.5 to over 1700 micrograms/L depending on the location, and the bottom sediments contained 1 to 14 micrograms/gram of extractable residues. Floating particulate residues were virtually absent from this region. (Au)

381

**Further chemical evidence for natural seepage on the Baffin Island shelf / Levy, E.M.**

(Current research - Geological Survey of Canada, Part B. Paper - Geological Survey of Canada, 79-1B, p. 379-383)

Document not seen by ASTIS.

ASTIS document number 181153.

382

**Natural hydrocarbon seepage at Scott Inlet and Buchan Gulf, Baffin Island shelf : 1980 update / Levy, E.M.**

MacLean, B.

(Paper - Geological Survey of Canada, 81-1A, p. 401-403, figures)

References.

ASTIS document number 64882.

ACU

Chemical, geological and geophysical investigations carried out in 1977 and 1978 have provided strong evidence that slicks, which are frequently present off the northeast coast of Baffin Island in the vicinity of Scott Inlet and Buchan Gulf are the consequence of natural seepage of petroleum from the seabed .... As all the available chemical and geological data indicated that natural hydrocarbon seepage is occurring at both Scott Trough and Buchan Trough, detailed studies of these areas were carried out in September 1980 (CSS Hudson, Cruise 80-028). During this cruise oil droplets were observed erupting at the surface of the sea and forming iridescent patches which quickly spread into slicks. ... This phenomenon, is the most direct visual indication of seepage yet obtained in this area. In addition, the distribution of slicks is

discussed and a brief summary is given of the kinds of chemical, geological and geophysical investigations carried out. ... (Au)

383

**Natural seepage of petroleum at Buchan Gulf, Baffin Island /**  
Levy, E.M. Ehrhardt, M.

(Marine chemistry, v. 10, 1981, p. 355-364, ill., maps)

References.

*ASTIS document number 169145.*

Analyses by fluorescence spectrophotometry and computerized gas chromatography/mass spectrometry of the hydrocarbons present in surficial bottom sediments from Buchan Gulf, Baffin Island established that natural seepage of petroleum is occurring from the seabed. In addition, compounds of recent biosynthetic origin and from atmospheric fall-out of combustion products were identified. (Au)

384

**Oil pollution and seabirds : Atlantic Canada 1976-77, and some implications for northern environments /** Levy, E.M.

(Marine pollution bulletin, v. 11, no. 2, Feb. 1980, p. 51-56, ill., map)

References.

*ASTIS document number 170933.*

ACU, NSDB

Chemical analyses of the oils on dead or moribund seabirds from Atlantic Canada during the winter of 1976-77 indicated that some of the birds were contaminated with oil spilled by the Argo Merchant grounding, some by oil probably from the Grand Zenith sinking, and still others by oil from various small local spills of unknown origin. These victims demonstrated that an extremely minute oiling may lead to the death of a seabird when the effects of the oil are synergistically combined with the stresses imposed by severe environmental conditions. This may intensify the impact of oil in the Arctic and thereby have a profound effect on seabird populations. (Au)

385

**Petroleum residue concentrations in Scotian Shelf waters following the Kurdistan spill : preliminary results /** Levy, E.M.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 87-104, maps)

Appendices.

References.

*ASTIS document number 169676.*

OON

An intriguing aspect of the Kurdistan spill from an environmental point of view was the initial 'disappearance' of the spilled oil. ... While it is possible that the oil was somehow shielded from aerial detection by the pack ice or that it had drifted out of the area under surveillance, it is also reasonable to suppose that a portion of the spilled oil had been dispersed by wave action into the water column where it would be present in solution or as dispersed droplets. ... This report summarizes the preliminary results of cruises by CSS Hudson (March 24-26, 1979) and J.L. Hartt (May 3-13, 1979) to Cape Breton waters in order to determine the distribution of the oil on the sea surface and in the water column. ... (Au)

386

**Scott Inlet slick : an arctic oil seep? /** Levy, E.M.

(Spill technology newsletter, v. 2, no. 6, Nov.-Dec. 1977, 21-27, ill., map)

*ASTIS document number 172200.*

ACU, NSDB

On several occasions during the 1976 cruise of C.S.S. Hudson to the Arctic, slicks were observed at 71° 24' N, 70° 10' W in the vicinity of Hecla and Griper Bank off Scott Inlet, Baffin Island (Loncarevic and Falconer, 1977). Water samples were collected from the surface and at mid-depth using Niskin samplers and a primitive attempt was made to sample the floating slick with a swab of cheesecloth. Analysis of the water samples by fluorescence spectrophotometry ... revealed concentrations of fluorescing substances (primarily aromatic hydrocarbons) .... [Opinion is divided as to whether the slick was caused by a sunken wreck or a natural oil seep]. ... (Au)

387

**Visual and chemical evidence for a natural seep at Scott Inlet, Baffin Island, District of Franklin /** Levy, E.M.

(Current research - Geological Survey of Canada, Part B. Paper - Geological Survey of Canada, 78-1B, p. 21-26, ill., map)

References.

*ASTIS document number 179442.*

OON

A visual reconnaissance of the sea surface off Scott Inlet in 1977 demonstrated the presence of slicks in an area where they were observed in 1976, although their extent was very much greater than previously thought. An extensive hydrochemical investigation was carried out, and elevated concentrations of dissolved and/or dispersed petroleum residues both at the surface and in the water column provided strong evidence for natural seepage of petroleum from the seabed. (Au)

See also: 341.

LEWBEL, G.S.

388

**Transport and fate of spilled oil /** Lewbel, G.S.  
Gallaway, B.J.

(Proceedings of a synthesis meeting : the Barrow Arch environment and possible consequences of planned offshore oil and gas development, Girdwood, Alaska, 30 October-1 November, 1983 / Edited by J.C. Truett. - Anchorage, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984, p. 7-29, ill., maps)

References.

*ASTIS document number 178683.*

OON

The question of where oil spilled in the Barrow Arch might go and what might eventually happen to it is addressed in this chapter. Descriptions of the physical environment are presented as background. Predictions of oil transport are based upon known physical data, including wind and current directions and intensities, and upon modeling results. Three hypothetical oil spill scenarios are evaluated. Predictions of fate are based upon experimental field and laboratory oil spills, and upon extrapolation from other geographic areas. (Au)

LEWIS, A.

See: 132.

## LEWIS, E.L.

389

### Oil in sea ice / Lewis, E.L.

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 229-260, ill., map)

#### References.

ASTIS document number 175935.

ACU

... The timing of industrial developments in Arctic Canada required a study of oil in sea ice by the end of 1975. ... This report has been based upon the writings of Topham, Wadhams, and Walker of this Group, upon that of Dickins, Overall, and Brown of NORCOR Ltd. and upon that of Rosenegger of Imperial Oil in Calgary. All these works are available as Beaufort Sea Technical Reports .... [This report discusses the knowledge of sea ice/oil interactions as of 1975. It covers ice movement, oil entrainment, fate of blowout oil and gas, circumstances at the oil/ice interface, possible climatic effects, and description of a possible blowout under ice scenario]. (Au)

390

### Oil in sea ice / Lewis, E.L.

Sidney, B.C. : Institute of Ocean Sciences, Patricia Bay, 1976.

26 p.

(Pacific marine science report, 76- 12)

Document not seen by ASTIS.

ASTIS document number 181161.

391

### Some possible effects of arctic industrial developments on the marine environment / Lewis, E.L.

(POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 1, p. 369-392, ill., map, photo.)

#### References.

ASTIS document number 55603.

ACU

Marine environmental disturbances associated with the exploratory, production, and transportation phases of the exploitation of the arctic by primary industry are discussed. ... Probable physical changes to the environment to be expected from routine operations and those that may result from disasters are outlined, with some suggestions as to the possible biological consequences. The use of biological information within an engineering context is discussed. (Au)

## LGL ECOLOGICAL RESEARCH ASSOCIATES, INC.

392

Proceedings of a synthesis meeting : the Barrow Arch environment and possible consequences of planned offshore oil and gas development, Girdwood, Alaska, 30 October-1 November, 1983 / LGL Ecological Research Associates, Inc. Truett, J.C. [Editor]. United States. Outer Continental Shelf Environmental Assessment Program [Sponsor].

Anchorage, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984.

xxi, 229 p. : ill., maps : 28 cm.

#### References.

ASTIS document number 178675.

OON

A portion of the continental shelf of the eastern Chukchi Sea between Point Hope and Point Barrow, Alaska, has been proposed for oil and gas lease sale (OCS Sale 85). ... In an effort to assemble, review, and interpret environmental data prior to lease sales, the Outer Continental Shelf Environmental Assessment Program convened a Barrow Arch Synthesis Meeting on 31 October-2 November 1983 in Girdwood, Alaska in anticipation of Sale 85. The purpose of this meeting was to bring together scientists and administrators so that the expected scenarios of oil and gas development, the hazards to development, and the biota and habitats at risk from such development could be identified. This report summarizes the information assembled and discussed at this meeting, relying on additional outside information where necessary to provide a comprehensive synthesis of the Barrow Arch environment and possible consequences of petroleum development. It includes a brief description of the probable exploration and development activities, an evaluation of the transport and fate of pollutants that might be introduced by these activities, an analysis of the possible environmental hazards to the activities, descriptions of the status of biological and sociological conditions, and predictions of potential effects of oil and gas activities on the biota and on the local people. ... (Au)

## LGL LIMITED, ENVIRONMENTAL RESEARCH ASSOCIATES

393

Acute lethal toxicity of Corexit 9527/Prudhoe Bay crude oil mixtures to selected Arctic invertebrates / LGL Limited, Environmental Research Associates. Sekerak, A.D.

Foy, M.G.

(Spill technology newsletter, v. 3, no. 2, Mar.-Apr. 1978, p. 37-41, tables)

#### References.

ASTIS document number 71285.

ACU, NFSMO, NSDB

As part of the Arctic Marine Oilspill Program, Prudhoe Bay crude oil and Prudhoe Bay crude oil/Corexit 9527 dispersant mixtures were tested for acute lethal toxicity on four arctic marine invertebrates - Onisimus litoralis, Boeckosimus edwardsi, Anonyx nugax and Calanus hyperboreus. ... the work was performed in Resolute, N.W.T. in December 1977 and January 1978. (Au)

394

Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 on four arctic marine invertebrates / LGL Limited, Environmental Research Associates. Foy, M.G. Canada. Environmental Protection Service [Sponsor]. Canada. Arctic Marine Oilspill Program [Sponsor].

Toronto : LGL Ltd., Environmental Research Associates, 1978.

xv, 98p. : figures, tables : 28cm.

(Eastern Arctic Marine Environmental Studies)

#### References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES72.

ASTIS document number 88412.

ACU

With the increased activity of the petroleum industry in the Canadian Arctic has come an increase in the chances of crude oil contamination of the arctic marine environment. The ecology of this environment ... is poorly understood and the effects of oil contamination on such interrelationships are even less well understood. ... Nothing is known about effects of oil on marine

invertebrates from the High Arctic. The objective of the present study was to provide preliminary data on the acute lethal toxic effects of monitored concentrations of a crude oil (Prudhoe Bay crude) and oil/dispersant (Corexit 9527) mixtures on arctic marine invertebrates and to assess their relative sensitivities. The study was conducted as part of the Arctic Marine Oilspill Program. (Au)

395

**Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 to arctic marine fish and invertebrates / LGL Limited, Environmental Research Associates. Foy, M.G. Canada. Environmental Impact Control Directorate [Sponsor].**

[Ottawa : Environmental Protection Service, Dept. of the Environment], 1982.

xii, 62 p. : figures, tables ; 28 cm.

(Technology development report, EPS 4-EC-82- 3)

ISBN 0-662-12001-9.

References.

ASTIS document number 109908.

ACU

The toxicities of Prudhoe Bay crude oil, the dispersant Corexit 9527 and mixtures of these, to several arctic marine amphipods, one arctic marine copepod and one arctic marine fish were investigated. Toxicities were evaluated in semi-static 96 h bioassays in which exposure concentrations of hydrocarbons were measured by fluorescence spectroscopy. Mortality results were analyzed by probit analysis to determine the concentration which would be expected to cause 50 percent mortality in 96 hours (96 h LC50). In addition, the toxicity of a reference toxicant, sodium lauryl sulphate, was determined. ... Mortality in oil-Corexit-water mixtures was much higher than in oil-water mixtures of the same nominal oil concentration. Measured oil concentrations in the water column, however, were much higher in mixtures dispersed with Corexit than in mechanically dispersed mixtures when the same amounts of oil and water were mixed initially. Therefore, the higher mortality observed in the oil-Corexit-water mixtures, relative to the oil-water mixtures, is thought to reflect the higher concentrations of oil to which the organisms were exposed. ... (Au)

396

**Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 to arctic marine invertebrates and fish from Frobisher Bay, N.W.T. / LGL Limited, Environmental Research Associates. Foy, M.G. Canada. Environmental Protection Service [Sponsor].**

Hull, Quebec : EPS, 1979.

viii, 90 p. : ill., figures, tables ; 28 cm.

References.

ASTIS document number 111031.

ACU, NSDB(ENV.)

The toxicity of Prudhoe Bay crude oil and the dispersant, Corexit 9527, separately and in combination, to several arctic marine amphipods and one arctic marine fish was investigated. Toxicity was evaluated in semi-static 96 h bioassays in which exposure concentrations of hydrocarbons were measured by fluorescence spectroscopy. Mortality results were analyzed by probit analysis to determine the concentration which would be expected to cause 50 percent mortality in 96 h (96 h LC50). In addition, the toxicity of a reference toxicant, sodium lauryl sulphate, was determined. ... (Au)

397

**Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, Environmental Research Associates. ESL Environmental Sciences Limited. ESSA Ltd. Arctic Land Use Research Program (Canada) [Sponsor].**

Ottawa : Northern Environmental Protection Branch, 1985. xxxvi, 292 p. : ill., maps ; 28 cm.

(Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34)

ISBN 0-662-14242-X.

Appendices.

Cover title: Beaufort environmental monitoring project, 1983-1984 : final report.

References.

ASTIS document number 177903.

ACU

There is considerable concern that hydrocarbon development activities in the Beaufort Sea may result in adverse environmental impacts. Because of these concerns and the recognized uncertainties associated with environmental impact assessment, there is a clear need for an environmental research and monitoring program that is fully integrated with future exploration and development plans. In response to this need, Indian and Northern Affairs Canada (INAC) and Environmental Monitoring Project (BEMP). The long-term objective of BEMP is to provide INAC and Environment Canada with the technical basis for design, operation and evaluation of a comprehensive and defensible environmental research and monitoring program to accompany phased hydrocarbon development in the Beaufort Sea. This report is the product of a series of steps aimed at meeting the immediate objective of providing INAC and Environment Canada with a research and monitoring plan ... The initiation of new monitoring programs is recommended in relation to four of the 19 hypotheses evaluated during the second workshop. These monitoring programs are directed at hypotheses dealing with the potential impacts of industry facilities and activities on bowhead whales and the white whale harvest, the effects of chronic oil releases on bird populations, and the potential uptake of hydrocarbons and tainting of fish within Tuktoyaktuk harbour. Continuation and revision of existing white whale and polar bear monitoring programs is also encouraged, while other monitoring would be dependent on the results of recommended research programs. (Au)

398

**Dome Petroleum Ltd. environmental impact statement oil spill scenario 4 : tanker collision in Lancaster Sound / LGL Limited, Environmental Research Associates. Dome Petroleum Limited [Sponsor].**

[Calgary : Dome Petroleum Limited], 1981.

vi, 50 p. : figures, tables ; 28 cm.

(Beaufort E.I.S. support document, no. BEISSD15)

References.

ASTIS document number 92096.

ACU, NSDB(ENV.)

The scenario described in this report is one of a series of descriptions of potential effects of oil spilled under specified circumstances in various areas in the Beaufort Sea and Northwest Passage. In the particular scenario discussed in this report ... an oil-carrying tanker is assumed to be involved in a collision at 74 degrees N 84 degrees W in central Lancaster Sound. ... The following sections describe first the fate of the oil during 21 days from August 20 to September 10 and then the potential effects of this oil on flora and fauna of Lancaster Sound. The trajectory of the oil slick is based on wind and current data collected in 1978. ... (Au)

399

**Effects of offshore petroleum operations on cold water marine mammals, a literature review / LGL Limited, Environmental Research Associates. Richardson, W.J. Greene, C.R. Hickie, J.P. Davis, R. American Petroleum Institute [Sponsor].**

Washington, D.C. : American Petroleum Institute, 1983.

xxiii, 248 p. : figures, tables ; 28 cm.



(Report - American Petroleum Institute, no. 4370, Oct. 1983)

Appendix.

References.

ASTIS document number 134708.

ACU

This report presents a detailed review of the available literature concerning the acoustic, non-acoustic and cumulative effects of offshore petroleum operations on marine mammals. Species inhabiting Alaskan waters are emphasized, but the world literature on related species and topics is considered. The review of acoustic effects discusses background information on underwater acoustics, ambient noise, noise from petroleum industry operations, propagation of sound in water, sounds produced by marine mammals, hearing by marine mammals, zones of noise influence around industrial sites, and documented reactions of marine mammals to industrial noise. Types of industry activities considered include aircraft and vessel traffic, icebreaking, seismic exploration, dredging and island construction, offshore drilling, and production facilities. The review of non-acoustic effects discusses the effects of oil spills and other discharges, dredging, shock waves, icebreaking, collision hazards, general disturbance, and increased access. The report includes comments on the acoustic and non-acoustic impacts of related activities not associated with the petroleum industry, such as general ship traffic and hunting. The final section discusses the cumulative effects of multiple human activities. It also discusses the available evidence concerning tolerance of and habituation to various human activities. ... (Au)

400

**Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. IV. Results of 1980, 1981, 1982 and 1983 pre- and post-spill studies / LGL Limited, Environmental Research Associates. Cross, W.E. Thomson, D.H. Martin, C.M. Fabijan, M.F. Canada. Baffin Island Oil Spill Project [Sponsor].**

Edmonton, Alta. : BIOS Project Office, 1984.

xxv, 176 p. : ill., maps ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 83- 3)

Appendices.

Cover title: Macrobenthos : 1983 study results.

References.

ASTIS document number 169838.

ACU

The objectives of the macrobiological component of the BIOS project were to assess the effects of oil and dispersed oil on the macrophytic algae, the relatively immobile benthic infauna (e.g., bivalves, polychaetes), and the motile epibenthos (e.g., amphipods, urchins) in shallow arctic waters. Four bays at Cape Hatt, northern Baffin Island, were selected as experimental bays. During August 1981, 15 cubic m of Lagomedio crude oil was applied to the surface of one bay, and 15 cubic m of dispersed oil (10 Lagomedio : 1 Corexit 9527) was released underwater in another bay. ... (Au)

401

**Environmental issues and impacts associated with exploratory drilling in Lancaster Sound / LGL Limited, Environmental Research Associates. Davis, R.A. McLaren, P.L. Buchanan, R.A. Consolidex Magnorth Oakwood Joint Venture [Sponsor]. Pallister Resource Management Ltd. [Sponsor].**

Calgary, Alta. : CMO Lancaster Sound Joint Venture, 1983.

iii, 171 p. : figures, tables ; 29 cm.

(Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document, no. RMPD09)

References.

Also available as 3 microfiches.

ASTIS document number 121363.

ACU, NFSMO

This document presents an analysis of environmental impacts that may be associated with exploratory drilling in eastern Lancaster Sound. ... Some of the information presented in this report has been taken from the Environmental Impact Statement covering the original application for exploratory drilling in Lancaster Sound (Norlands Petroleum Limited 1978). This information has been updated and incorporates data collected during the Eastern Arctic Marine Environmental Studies (EAMES) program in eastern Lancaster Sound and western Baffin Bay in 1978 and 1979. The present report is not intended to be a complete revised Environmental Impact Statement. Rather, it is an update that incorporates new information to respond to deficiencies identified at the hearings of the Lancaster Sound Environmental Assessment Review Panel. ... This report contains an overview of the existing environment in Lancaster Sound. ... Chapter 3 provides a description of the possible biological effects associated with exploratory drilling in Lancaster Sound. After an examination of the possible effects of routine drilling activities, there is a detailed discussion of the possible effects from an uncontrolled oil blowout on the biota of Lancaster Sound and an evaluation of the impact of those effects on the animal populations in the region. Effects of a blowout on resource harvesting and a description of mitigative measures and residual impacts are also presented. The final chapter presents a brief summary of the types of environmental effects that might be associated with oil production systems in Lancaster Sound. ... simulations of the flow of oil as a result of a blowout indicate that the oil will be present on the waters of both eastern Lancaster Sound and western Baffin Bay. In this report we have considered these waters and their adjacent coastlines as a single study area. ... (Au)

402

**In situ studies of effects of oil and chemically treated oil on primary productivity of ice algae and on under-ice meiofaunal and macrofaunal communities / LGL Limited, Environmental Research Associates. Cross, W.E. Martin, C.M. Canada. Baffin Island Oil Spill Project [Sponsor].**

Edmonton, Alberta : BIOS Project, 1983.

1 microfiche : ill. ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 82- 7, Part I)

References.

Fiche heading title: Baffin Island Oil Spill Program : special studies : 1982 study results.

ASTIS document number 159565.

ACU

Effects of in situ application of oil and chemically treated oil on the under-ice algae, meiofauna and amphipods were studied at Cape Hatt, northern Baffin Island. Immediate effects of oil on ice algae and meiofauna were studied by adding oil, solidified oil and oil treated with three different dispersants (Corexit 9527, BP 1100WD, BP CTD) into large enclosures on the under-ice surface. The abundance and productivity of ice algae and the abundance of meiofauna were studied. In addition, distribution and life history data were collected for amphipods occupying under-ice, intertidal and shallow sublittoral habitats. The latter component of the study utilized the large-scale experimental spills carried out at the BIOS (Baffin Island Oil Spill) site in August 1981; we obtained pre-spill (May and August 1981) and post-spill (September 1981 and August and September 1982) data. (Au)

403

In situ studies of effects of oil and dispersed oil on primary productivity of ice algae and on under-ice amphipod communities / LGL Limited, Environmental Research Associates. Cross, W.E. Canada. Baffin Island Oil Spill Project [Sponsor]. Canada. Supply and Services Canada [Sponsor].

(Working report - Baffin Island Oil Spill Project, 81- 10, p. 1-61 [i.e. 85-146], ill., map)

References.

Cover title: Special studies : 1981 study results.

ASTIS document number 169927.

ACU

Effects of in situ applications of oil and dispersed oil on the abundance and productivity of under-ice algae and on behaviour, mortality and distribution of under-ice amphipods were studied at Cape Hatt, northern Baffin Island. ... In addition, distribution and life history data were collected for amphipods occupying under-ice, intertidal and shallow sublittoral habitats. The latter component of the study utilizes the large-scale experimental spills carried out at the BIOS (Baffin Island Oil Spill) site in August 1981; we obtained pre-spill (May and August 1981) and post-spill (September 1981) data. ... (Au)

404

Review of the effects of oil on marine flora and fauna with special reference to arctic regions / LGL Limited, Environmental Research Associates. Thomson, D.H. McLaren, M.A. Petro-Canada [Sponsor].

[S.l.] : PetroCanada, 1982.

1 v.

Document not seen by ASTIS.

ASTIS document number 180866.

405

A review of the wildlife and marine resources of the Cape Parry region in relation to a fuel staging area for sea vessels near Cape Parry, N.W.T. / LGL Limited, Environmental Research Associates. Fraker, M.A. Griffiths, W.B. Ward, J.G. Dome Petroleum Limited [Sponsor].

Vancouver, B.C. : LGL Limited, 1979.

2 microfiches : figures, tables ; 11 x 15 cm.

Beaufort E.I.S. reference work, no. RWE01)

References.

ASTIS document number 107077.

ACU, NSDB(ENV.)

Canadian Marine Drilling Ltd. presently has a one year land use permit to construct a fuel staging area for sea vessels at Summer's Harbour on Booth Island. ... Recent investigations ... indicate that Wise Bay ... may also be a suitable location for the fuel staging area. ... The construction of the fuel staging facility, as described ... would require an extension to the present permit. Before a further land-use permit for a fuel tank farm at either Summer's Harbour or Wise Bay can be issued, an Initial Environmental Evaluation (IEE) must be submitted to the Department of Indian Affairs and Northern Development. This report is intended to form part of the IEE and deals with the wildlife and marine resources of the Cape Parry region. The specific objectives of this report are: 1. to summarize the available information on the abundance and distribution of wildlife and marine resources in the area; 2. to summarize the available information on human utilization of these wildlife and marine resources; 3. to identify the potential impacts of the development on the wildlife and marine resources and their use; 4. to identify mitigative procedures that will eliminate or reduce the potential impacts; and 5. to describe planned research for 1979 that will fill gaps in the information about wildlife and marine resources in the area. (Au)

See also: 239.

LINDROTH, P.

See: 258.

LINDSAY, S.A.

See: 593.

LISSAUER, I.M.

See: 326, 622, 696, 697.

LIU, S.-K.

406

A 3-D oil spill model with and without ice cover / Liu, S.-K. Leendertse, J.J.

Santa Monica : Rand Corporation, 1981.

ix, 23p. : figures ; 28cm.

(Rand paper series - Rand Corporation, P- 6620, 1981)

Presented at the International Symposium on Mechanics of Oil Slicks, Paris, France, September 8, 1981.

References.

ASTIS document number 74306.

ACU

The paper presents the methodologies developed for performing stochastic simulations of oil spill trajectories using a three-dimensional numerical model, a stochastic weather model, and models associated with the behaviors of the spreading oil, all for the purpose of assessing risks and environmental impacts. ... For the study areas in the eastern Bering Sea, the paper gives 60 computed surface oil trajectories under a 30-day stochastic weather scenario from 30 hypothetical spill locations representing platforms, pipelines, and transportation routes. (Au)

LOCKHART, W.L.

See: 266.

LONCAREVIC, B.D.

407

An oil slick occurrence off Baffin Island / Loncarevic, B.D. Falconer, R.K.

(Report of activities, part A. Paper - Canada. Geological Survey, 77- 1A, p. 523-524, map)

ASTIS document number 175374.

ACU

During the 1976 cruise of C.S.S. Hudson to the Arctic an oil slick was observed off Baffin Island. The occurrence is off Scott Inlet, near the northern edge of the Hecla and Griper Bank in the vicinity of 71 24 N, 70 15 W .... It is possible that this oil slick is caused by a seepage along edges of flat-lying sedimentary beds where these have been truncated and eroded by glaciers emerging from Scott Inlet. ... (Au)

**LOUCKS (R.H.) OCEANOLOGY LTD.**

See: 505.

**LOWTHIAN, J.W.**

408

**Oil spill cleanup in the Beaufort Sea : another viewpoint /**  
Lowthian, J.W.

(Spill technology newsletter, v. 2, no. 3, May-June 1977, p. 33-52, ill., maps)

**References.**

ASTIS document number 172219.

ACU, NSDB

This article outlines the potential difficulties of oil spill cleanup in the Beaufort Sea. The author asserts that some literature on this topic is overly optimistic. He details the various factors to consider in an oil-spill-in-ice cleanup (flying weather, aircraft availability, igniter equipment availability, slick or melt pool conditions) and gives each a probability factor. (ASTIS)

**LYSYJ, I.**

409

**Distribution of aromatic hydrocarbons in Port Valdez, Alaska /**  
Lysyj, I. Perkins, G. Farlow, J.S. Morris, R.W.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 47-53, maps)

**References.**

ASTIS document number 171689.

The distribution of aromatic hydrocarbons in Port Valdez, Alaska, was studied. Such compounds are present in the effluent from the ballast treatment plant located at the terminal of the TransAlaska Pipeline. The plant processes 10 to 20 million gallons per day (mgd) of ballast water from arriving tankers. The principal organic components found in the treated effluent are benzene, toluene, and xylenes/ethylbenzene. Such volatile aromatic hydrocarbons comprise up to 50 percent of the total organic load in the effluent, and are discharged at a rate of 60 to 80 gallons per day. State regulations limit aromatic hydrocarbon content in waters outside the mixing zone to 10 micrograms per liter concentration. ... It was found that the treated effluent does not mix uniformly with the receiving waters of Port Valdez during the summer period of density stratification, at which time the volume of the mixing zone is grossly underutilized and no significant amount of hydrocarbons diffuses into the upper reaches of the water column. ... (Au)

**MACDONALD, D.**

See: 740.

**MACDONALD, R.W.**

410

**Distribution of low-molecular-weight hydrocarbons in southern Beaufort Sea /** Macdonald, R.W.

(Environmental science and technology, v. 10, no. 13, Dec. 1976, p.1241-1246, ill., map)

**References.**

ASTIS document number 171204.

ACU, NSDB

Seawater concentrations of C1-C4 hydrocarbons were measured in the summers of 1974 and 1975 in the Southern Beaufort Sea continental shelf region. In general, there was good agreement between the levels of methane found in the surface waters of the Beaufort Sea and those found in similar environments by others. A few high methane concentrations were found, especially near the bottom, and were attributed to seepage from the sediments. C2-C4 saturated hydrocarbon concentrations were low, in contrast to other shelf areas where extensive shipping, ballast tank dumping, and drilling have occurred. Consequently, their concentrations could serve as useful indicators of deterioration of water quality in this area by future shipping or drilling activities. Unsaturated C2-C4 hydrocarbon concentrations tended to be somewhat lower than those reported for other oceanic regions, possibly a consequence of low biological productivity in the shelf area at that time of year. (Au)

See also: 187, 741.

**MACGREGOR, C.**

411

**Fate of crude oil spilled in a simulated arctic environment /**  
MacGregor, C. McLean, A.Y.

(Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 461-463, ill.)

**References.**

ASTIS document number 177458.

NSDB, ACU

A simulated Arctic crude oil spill was investigated by monitoring physical and chemical changes in a laboratory spill of Guanipa (Venezuelan) crude. The spill consisted of one gallon of crude on 100 gallons of synthetic seawater contained in a fiberglass tank fitted with a wave generator and a controlled radiation system, all located in an environmental chamber held at 2 degrees C. ... Evaporation removed the largest quantity of material from the spill, the rate varying directly with the exposure time to solar radiation. Solution or sinking removed only minimal quantities of oil although the influence of these factors increased with time. The most notable physical change was the rapid formation of stable emulsions. These emulsions formed discrete lumps commonly referred to as "tarballs". The formation of tarballs occurred within a few days after the spill and they remained stable over the four-month duration of the experiment. Their formation drastically reduced weathering effects by removing the bulk of the oil from contact with the air/seawater interface. It was concluded that a crude oil spill in the Arctic could contribute significantly to tarball pollution of northern oceans. ... It would appear that tarball formation depends upon the available wave mixing energy. The ultimate fate of oil spilled in Arctic regions could be in the form of persistent tarballs. (Au)

**MACKAY, D.**

412

**Analyses of Beaufort Sea and Prudhoe Bay crude oils /**

Mackay, D. Hossain, K. Shiu, W.Y. Dome Petroleum Limited [Sponsor].

[Calgary : Dome Petroleum Limited], 1980.

1 v. (various pagings) : ill., tables : 28 cm.

(Beaufort E.I.S. support document, no. BEISSD25)

**References.**

ASTIS document number 87572.

ACU, NSDB(ENV.)

When crude oil is spilled on water it is subject to physical, chemical and biological processes which control the oil's location, area, thickness, and the extent of transfer to the atmosphere by

evaporation and into the water column by dissolution and dispersion. ... In this paper we address the question of which properties should be measured, how they should be measured, and provide some illustrative data for selected crude oils. ... Three oils were studied; an oil from Prudhoe Bay used in the 1980 Beaufort Sea Experimental Spills at McKinley Bay; a sample of Kopanoar crude oil supplied by Canmar in late 1979 and a sample of Kopanoar crude oil supplied earlier and believed to be contaminated with an unknown amount of other oils, possibly diesel fuel. The latter oil, referred to here as the "Kopanoar mixture", was not subjected to the same degree of analysis because of its uncertain history. (Au)

413

Arctic oil spills / Mackay, D. Green, G.  
(Chem 13 news, v. 70, 1975, p. 3-5, ill.)

References.

ASTIS document number 178608.

OON

This article gives a brief overview of research into the physical fate and effects of oil in arctic terrestrial and marine environments. It includes discussions of the weathering process and the effect of oil on permafrost. Research on the topic at the University of Toronto is described. (ASTIS)

414

Fate and behaviour of oil spills / Mackay, D.

(Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 7-28)

References.

ASTIS document number 181293.

ACU

The physical, chemical and biological processes which occur when oil is spilled at sea, and the identification of processes which are inadequately understood are described in this chapter. An inventory and overview of the processes, stressing the relative importance of each process at each stage of the spill history, is presented in the first part of the chapter. Each process is examined in detail and gaps in knowledge are identified. Finally, recommendations for research are presented, which if carried out, would elucidate the process rates and mechanisms, and ultimately lead to an adequate understanding of the fate and behaviour of oil spills. Throughout this review emphasis is placed on spill behaviour under conditions encountered in Canadian waters. Although in many cases the voluminous literature on behaviour of spills in other, usually warmer waters can be extrapolated to Canadian conditions, there are areas of particular Canadian interest, especially interactions with ice in its many forms. ... (Au)

415

Interfacial behaviour of oil under ice / Mackay, D.

Medir, M. Thornton, D.E.

Canadian journal of chemical engineering, v. 54, Feb./Apr. 1976, p. 72-74, ill.)

References.

ASTIS document number 170518.

ACU

... It is certainly desirable to obtain as complete an understanding as possible of the behaviour of oil under ice and in particular the spreading rate of oil and the likely ultimate steady state thickness of an oil film under ice. From such data spill areas may be related to oil volumes and the environmental effects estimated and appropriate clean up and containment systems devised. We are concerned here with one aspect of this issue, namely the role of interfacial tension forces in assisting or retarding the spread of oil under ice. These forces are believed to be unusually significant in

this regime because of the relatively small density difference between oil and water which provides the buoyancy or hydrostatic driving force for spreading and the high contact angle between oil and ice in a water environment which retards spreading. ... 7. general conclusion is that oil behaviour in water under ice is significantly different from that on water or on ice in that surface forces tend to restrict spreading and prevent "wetting". (Au)

416

A laboratory study of the behaviour of oil and gas under ice / Mackay, D. Kisil, A. Buist, I.A. Hossain, K. Mascarenhas, R. Paterson, S.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 101-109, ill.)

References.

ASTIS document number 177407.

NSDB, OON

The behaviour of oil discharged under growing sea ice is now regarded as being well understood. ... Considerably less knowledge is available about the behaviour when both oil and gas are released under growing sea ice. Although it is obvious that hydrostatic forces will cause the gas to be located above the oil lens, the exact configuration of the oil with respect to the gas bubbles or layers is far from clear. To elucidate the subject, a series of laboratory experiments were undertaken, in which the physical processes which occur when oil is released under gas films present under an ice sheet are observed and measured. The ultimate configuration adopted by the oil is not only of scientific interest but it is of importance in assessing the average oil thickness which is likely to be experienced as a result of a blowout. To a large degree this thickness controls the effectiveness of cleanup measures and, in particular, the likelihood of oil being present in pools deep enough to permit ignition and sustain combustion. The approach taken in this work was to construct a relatively simple apparatus in which a slab of fresh water ice could be located vertically above a column of fresh water at 0 degrees C. Gas bubbles were then released under ice, allowed to stabilize, and oil droplets were then released and allowed to rise and impinge on both the gas bubble surface and on the surrounding ice. The coalescence and spreading phenomena and the configuration adopted by the oil with respect to the gas, was then observed and measured. Since the spreading behaviour of oil under a gas bubble is in many respects similar to the oil spreading behaviour on a water surface under air, a series of complementary tests were undertaken in which oil spreading behaviour was observed in dishes. ... (Au)

417

Oil in the Beaufort and Mediterranean seas / Mackay, D.

(Arctic, v. 30, no. 2, June 1977, p. 93-100)

References.

ASTIS document number 103560.

ACU

Spillage of oil into the Beaufort Sea in the course of exploration and exploitation of offshore resources may occur at an estimated rate of 20 milligrams per square metre per year, or about one-fifth the rate of spillage into the Mediterranean Sea. Overall rates of degradation and dispersion of spilled oil under the conditions prevailing in the Beaufort Sea are however likely to be significantly slower than under the conditions in the Mediterranean. The various input, degradation and dispersion rates may be interrelated in the form of a simple algebraic equation. From current estimates of these rates it is suggested that standing concentrations of oil in the Beaufort Sea could in time become comparable to those in the Mediterranean. (Au)

418

**Oil spill processes : evaporation, emulsification, dissolution and sinking / Mackay, D.**

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS]. 1985, p. 53-58, ill.)

References.

ASTIS document number 171840.

ACU

In this paper we review briefly some recent studies of aspects of oil spill processes [including evaporation, emulsification, dissolution and sinking]. The general aim is to contribute to a better understanding of the rates of these processes in the hope that they may contribute to better "management" of oil spills and discharges and to more effective countermeasures and better assessment of the severity of their adverse effects, especially in Arctic waters. (Au)

419

**Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Mackay, D. [Editor]. Paterson, S. [Editor]. Arctic Petroleum**

Operators Association [Sponsor]. Canada. Dept. of Indian Affairs and Northern Development [Sponsor]. Canada. Environmental Protection Service [Sponsor]. University of Toronto. Institute for Environmental Studies [sponsor].

Toronto : University of Toronto Institute for Environmental Studies, [1979].

iii, 169p. : ill., maps, photos. ; 28cm.

(Publication - University of Toronto. Institute for Environmental Studies, EE 14)

References.

Also cited as: Oil, gas and ice : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979.

ASTIS document number 52256.

ACU, NFSMO

This report records the proceedings of a workshop on the behaviour of oil and natural gas in marine environments in which ice is present. ... The objective of the workshop was to review and document the state-of-the-art in this subject area .... A series of papers is presented reviewing current research programs, ice and oceanographic conditions, and observations of various accidental oil spills in ice-infested waters. The meeting broke up into three workshops .... The findings of these workshops and subsequent discussion are presented. The meeting ended with consideration of the perceived present and future capability of responding to oil spills in Northern open waters, ice-infested waters, and in landfast ice. (Au)

420

**On experimental oil spills / Mackay, D.**

(Spill technology newsletter, v. 5, no. 5, Sept.-Oct. 1980, p. 131-136)

Reviewed by ASTIS document number 62073, On experimental oil spills - a response / N.B. Snow and H. Hume in Spill technology newsletter, v. 5, no. 5, Sept.-Oct. 1980, p. 137-146.

ASTIS document number 62065.

ACU, NFSMO, NSDB

... I have gathered some thoughts and articulated some prejudices on experimental oil spills in the hope that they may be of some use to those who design and fund such spills, and possibly provoke some discussion and even a little indignation. ... The recent adverse publicity about experiments with polar bears and oil suggests that it is important to prepare a complete justification for spills both scientifically, and for the public. ... I hope that three points will

emerge. ... first ... that experimental spills are an essential component of the overall oil pollution effort. ... Second ... that it is on the frontiers between biology, physical chemistry and oceanography that the real advances have to be made. ... Third ... that significant strides have been made recently in the organization of the research content of the BIOS project. ... (Au)

421

**The physical and chemical fate of spilled oil / Mackay, D.**

(Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 37-62)

References.

ASTIS document number 168610.

This is a general review of the behaviour of oil in arctic oceans, ice and shorelines with some discussion of oil spill countermeasures. (ASTIS)

422

**Research in oil, gas and ice at the University of Toronto / Mackay, D. Hossain, K. Kisil, A.**

(Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 27-31)

References.

ASTIS document number 175196.

ACU

This is a brief review of the work which has taken place in recent years at the University of Toronto on the physical behaviour of, and cleanup measures for, oil and gas in the presence of ice. ... Our first experience was with Norcor in their pioneering studies of oil behaviour under first year land fast ice at Balaena Bay near Cape Parry, N.W.T. This experience was invaluable in suggesting a number of relevant laboratory studies which could be pursued in the South in support of Northern efforts. Our analysis of oil samples from under the ice ... showed that oil does not "weather" while encapsulated in the ice. ... [Other study topics included oil-gas configuration under ice; fundamentals of oil spill ignition, burning, and smoke plumes; behaviour of oil in snow; oil behaviour and migration in sea ice; dispersant effectiveness; oil spill modelling; and water-in-oil emulsion properties.]. (Au)

See also: 200, 285, 286, 342, 377, 545, 667, 675, 710, 711, 712.

**MACKIE, P.R.**

See: 563.

**MACLEAN, B.**

See: 382.

**MACLEOD, W.D.**

See: 166.

**MACNEILL, M.R.**

423

**Motion of oil in leads / MacNeill, M.R. Goodman, R.H.**  
(Proceedings of the Eighth Annual Arctic Marine Oilspill  
Program Technical Seminar, June 18-20, 1985,  
Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 42-52,  
ill.)

## References.

*ASTIS document number 165077.*

ACU

In the event of an oil spill in Arctic waters during the spring  
breakup season, oil will be found in the leads between ice floes. To  
develop suitable mitigation tools for this situation, it is essential to  
know where the oil will move, that is, its fate. This paper will  
report on experimental data on the motion and ultimate fate of oil  
as lead structures close. [The experiment used a relatively heavy  
Arctic crude oil in an outdoor test basin.] ... (Au)

**MAGEAU, C.**

424

**Behavioural and physiological effects of hydrocarbon exposure  
on selected arctic invertebrates / Mageau, C.**  
Engelhardt, F.R. Canada. Baffin Island Oil Spill  
Project [Sponsor].

Ottawa : EPS, 1984.

1 microfiche : ill. ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 83- 7,  
[Part II])

## References.

Fiche heading title: Baffin Island Oil Spill Project :  
toxicology : 1983 study results.

*ASTIS document number 160121.*

ACU

A series of experiments was carried out in 1982 and 1983 with the  
purpose of defining the behavioural responses and the dynamics of  
hydrocarbon uptake and clearance in three species of benthic  
invertebrates, *Strongylocentrotus droebachiensis*, *Serripes*  
*groenlandicus* and *Mya truncata*, following exposure to Lago Medio  
crude oil. ... The experimental procedure involved exposure to  
dispersed crude oil in a flow-through seawater system on site at  
Cape Hatt, N.W.T. ... In addition in 1983, a low level, long term  
exposure experiment was carried out using a regulated oil seawater  
flow-through system. ... [The behavioural responses of *M. truncata*  
and *S. groenlandicus* did not change over the years of the study,  
whereas reduced behavioural response and hydrocarbon uptake in *S.*  
*droebachiensis*] indicate a more oil resistant population in 1983 than  
in 1982. (Au)

See also: 225, 226, 230.

**MAIERO, D.J.**

See: 272, 541.

**MALCOLM, J.D.**

425

**The interfacial tension and contact angle of crude oil under  
ice / Malcolm, J.D. Dutton, C.R.**

(POAC 79 : the Fifth International Conference on Port and  
Ocean Engineering under Arctic Conditions, at the  
Norwegian Institute of Technology, August 13-18, 1979,

proceedings. - [Trondheim, Norway : Norwegian Institute  
of Technology], 1979, v. 1, p. 771-778, photo.)

## References.

*ASTIS document number 55794.*

ACU, NFSMO

... An improved sessile drop analysis has been applied to laboratory  
measurements on two crude oils under ice in both fresh water and  
sea water. The interfacial tension of all crude oil/water systems  
tested were found to be in the relatively narrow range  $20 \pm 5$   
dynes/cm. The contact angles were found to be 180 deg. in every  
case. It is expected that a thin film of water exists between the oil  
drop and the ice, which would account for the apparent lack of  
wetting. (Au)

426

**Movement of oil and gas spills under sea ice / Malcolm, J.D.**  
Cammaert, A.B.

(POAC 81 : the Sixth International Conference on Port and  
Ocean Engineering under Arctic Conditions, Quebec,  
Canada, July 27-31, 1981, proceedings. - Quebec City :  
Universite Laval, 1981, v. 2, p. 923-936, ill.)

## References.

*ASTIS document number 167851.*

ACU

Laboratory studies related to the complex behavior of oil-well  
blowout products under Arctic ice are described. The studies  
include the disposition of crude oil and gas bubbles under smooth  
ice and the effects of currents on crude oil behaviour under  
undulating ice covers when the undulations contain gas. The  
potential for ice fracture by a well blowout is reviewed, along with  
a brief survey of literature on sea ice roughness. Hypotheses  
concerning the behavior of well blowout products under Arctic  
conditions are discussed. (Au)

427

**Studies of oil spill behaviour under ice / Malcolm, J.D.**

(Oil, ice and gas : proceedings of a workshop held in  
Toronto, Canada, October 10 and 11, 1979 / Edited by  
D. Mackay and S. Paterson. - Toronto : University of  
Toronto Institute for Environmental Studies, [1979], p.  
47-54, ill.)

## References.

*ASTIS document number 175218.*

ACU

Laboratory scale investigations related to oil spill behaviour have  
been underway at Memorial University for the past two years. ...  
The most important findings of the studies thus far are listed  
below: (1) An improved method for determining the interfacial  
tension ... between oil and water, and the contact angle ... at the  
oil-water-ice contact line has been developed .... (2) Data using the  
above method show that crude oil drops placed under submerged ice  
or glass sheets possess a contact angle of 180 degrees. This is  
interpreted to mean that the oil is separated from the solid surface  
by a thin water film, so that the oil does not wet or coat the solid.  
... (3) The existence of a water layer between the oil and solid  
surface is confirmed by observing oil motion under a glass plate  
which is tilted to the horizontal. The sliding oil drop leaves no  
tracks. (4) Oil droplets released from depth (up to 1.2 meters)  
which impact on a submerged tilted glass plate, also slide along the  
tilted glass after impact, leaving no tracks behind. This shows that  
the thin water film remains intact during the impact and is not  
penetrated or removed by the impact process. (5) It has been  
established that pools of oil under solid horizontal ice or glass  
sheets possess a maximum thickness at an intermediate volume.  
For the fresh crude oils tested, maximum thickness is 11 mm &  
8.5 mm in fresh water and sea water respectively. (Au)

428

**Transport and deposition of oil and gas spills under sea ice /**  
Malcolm, J.D. Cammaert, A.B. Acres/Santa Fe  
Pomeroy Arctic Services.

(Proceedings of the Arctic Marine Oilspill Program  
Technical Seminar, June 16-18, 1981, Edmonton,  
Alberta. - Ottawa : EPS, 1981, p. 45-73, figures, tables)

References.

ASTIS document number 80730.

ACU, NFSMO

The potential for Arctic oil spills is increasing dramatically with the level of petroleum exploration and development activity. Response to an oil spill in the Arctic is expected to be slowed by the remoteness, inaccessibility, severe climate, and a lack of fundamental knowledge of oil spill behaviour under Arctic conditions. ... Although a dramatic reordering of global climate and temperatures may be an improbable consequence of an Arctic well blowout, many other more localized consequences are highly probable. ... (Au)

**MALINKY, G.**

429

**Modeling the association of petroleum hydrocarbons and sub-  
arctic sediments /** Malinky, G. Shaw, D.G.

(Proceedings - 1979 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : 1979, Los Angeles,  
California. - Washington, D.C. : American Petroleum  
Institute, 1979, p. 621-623)

References.

ASTIS document number 177377.

NSDB

The extent of association between labeled hydrocarbons representing the major chemical classes of petroleum, and marine suspended sediments from south-central Alaska has been investigated in a series of laboratory experiments using hydrocarbon concentrations near or below saturated solution. For a saturated solution of either an aliphatic or aromatic hydrocarbon, the concentration of hydrocarbon in parts per million (ppm) associated with sediment is roughly 30 percent of the original aqueous concentration in ppm. Extrapolation of these results to permitted discharge concentrations and dilution rates encountered in south-central Alaska indicates that concentrations of hydrocarbons sorbed to sediments are in the parts per trillion (ppt) to parts per billion (ppb) range. It appears that this process cannot be a major transport pathway for the dispersal of oil under the conditions investigated. (Au)

See also: 641, 643.

**MALINS, D.C.**

430

**Assessment of available literature on effects of oil pollution on  
biota in arctic and subarctic waters /** Malins, D.C.

Stansby, M.E.

(Environmental assessment of the Alaskan continental shelf :  
Principal investigators reports for the year ending March  
1976. Vol. 8 : Effects of contaminants, p. 155-324)

(NTIS PB-261 407, p. 155-324)

References.

ASTIS document number 175889.

ACU

The objective of this project is to summarize knowledge already available regarding effects of petroleum and especially petroleum industrial activities in the outer continental shelf areas upon marine biota with special reference to the Arctic and subarctic

environment. This information is being developed both in the form of extensive bibliographic reference lists, tabulated under 20 subject headings, and by preparation of a series of critical reviews prepared by scientific specialists from the information gleaned from available reports compiled in the bibliography. In general, considerable is known already concerning effects on a world-wide basis of petroleum upon the marine biota. Much less research, however, has been carried out in an Arctic environment. ... (Au)

431

**Biotransformation of petroleum hydrocarbons in marine  
organisms indigenous to the Arctic and Subarctic /**  
Malins, D.C.

(Fate and effects of petroleum hydrocarbons in marine  
ecosystems and organisms : proceedings of a symposium,  
November 10-12, 1976, Olympic Hotel, Seattle,  
Washington / Edited by D.A. Wolfe, J.W. Anderson,  
D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. -  
Toronto : Pergamon Press, 1977, p. 47-59, ill.)

References.

ASTIS document number 175005.

ACU

A comprehensive review of accumulations and biotransformations of petroleum hydrocarbons in marine organisms was undertaken by Varanasi and Malins (1977). The literature indicates that work thus far relates primarily to the accumulation and discharge of petroleum hydrocarbons rather than to their bioconversion. In fact, our understanding of the bioconversion (metabolic fate) of hydrocarbons in petroleum-exposed marine organisms is in its infancy. Yet arguments can be made in the light of studies with mammals that certain metabolites of the polynuclear hydrocarbons may have a high innate toxicity exceeding that of the hydrocarbons themselves. ... In attempting to evaluate our understanding of petroleum hydrocarbon biotransformations in marine organisms, the alkane and alicyclic fractions will not be included; rather discussion will be devoted to the aromatic hydrocarbons because of their notable potential for forming potentially toxic products in vivo (Sims and Grover 1974, Arcos and Argus 1974). No effort will be made to review the relatively large volume of literature on the storage and discharge of aromatic hydrocarbons by exposed marine organisms. This matter was addressed in considerable detail previously (Varanasi and Malins 1977). An attempt will be made, however, to evaluate briefly our understanding of the biotransformation of aromatic hydrocarbons in arctic and subarctic species, and to assess deficiencies in existing knowledge, which, if not resolved, may hinder a timely understanding of the impact of petroleum operations on indigenous organisms and ecosystems. (Au)

432

**Effects of petroleum on arctic and subarctic marine  
environments and organisms /** Malins, D.C. [Editor].

New York : Academic Press, [c1977].

2v. : ill., tables, graphs ; 24cm.

ISBN 0-12-466901-8, 0-12-466902-6.

Index.

Contents. - v.1. Nature and fate of petroleum. - v.2.  
Biological effects.

References.

ASTIS document number 248.

ACU, NSDB

Papers discuss the various effects of petroleum on the arctic and subarctic environment. The discussions are for researchers, environmentalists, petroleum industry managers and executives, and public officials, concerned with the many aspects of petroleum pollution of marine ecosystems. Volume 1 deals with the nature and fate of petroleum in the marine environment while Volume 2 covers the biological effects of petroleum in the alteration of life processes and in community structures. (ASTIS)

433

**Identification of major processes in biotransformations of petroleum hydrocarbons and trace metals / Malins, D.C.**

Reichert, W.L. Roubal, W.T.

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 139-153)

(NTIS PB-261 407, p. 139-153)

**References.***ASTIS document number 175870.*

ACU

[These] studies are intended to elucidate biological effects induced in marine organisms by exposure to petroleum hydrocarbons and trace metals under conditions consistent with arctic and subarctic environments. ... The work involves the measurement and evaluation of a number of biological parameters: uptake, accumulation and depuration of petroleum oil fractions and radioactively-labeled aromatic compounds using salmonids, flatfish, larval shrimp and molluscs as experimental animals. The study is oriented toward an understanding of relations existing between (1) levels of dietary and water-borne hydrocarbons, exposure times, degrees of hydrocarbon accumulations, and (2) metabolic conversions, depurations, and morphological alterations evidenced by microscopic techniques. Comparable studies are conducted to relate experimental conditions to the biological fate and effects of trace metals on salmonids and flatfish. ... (Au)

434

**The nature and biological effects of weathered petroleum /**

Malins, D.C. Chan, S-L. Clark, R.C.  
 Varanasi, U. Hodgins, H.O. Brown, D.W.  
 Weber, D.D. Sanborn, H.R. Finley, J.S.  
 Robisch, P.A. Stein, J.E. United States. Minerals  
 Management Service [Sponsor].

(Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 231-285, ill.)

**Appendix.****References.***ASTIS document number 168939.*

ACU

[The objectives of the study were to:] Determine under laboratory conditions the toxicities of: (a) Alaskan crude oil "weathered" by exposure to ultraviolet (UV) light compared to non-UV-exposed Alaskan crude oil, (b) Alaskan crude oil weathered under simulated natural conditions compared to nonweathered Alaskan crude oil, and (c) No. 2 fuel oil refined from an Alaskan crude oil exposed to UV light, in order to compare crude oil with a material (i.e., fuel oil) known to be capable of extensive photooxidation. Determine: (a) changes in concentrations of total hydrocarbons as a result of exposure to UV light, and (b) the nature of oxidized compounds formed from Alaskan crude oils and No. 2 fuel oil and found in the underlying seawater. Determine the relative uptake by selected marine organisms of hydrocarbons and oxidized components from weathered and nonweathered petroleum materials. Determine the nature of oxidized components in the organisms used for toxicity assays. (Au)

435

**Petroleum and marine fishes : a review of uptake, disposition, and effects / Malins, D.C. Hodgins, H.O.**

(Environmental science and technology, v. 15, no. 11, Nov. 1981, p.1272-1280, ill.)

**References.***ASTIS document number 171131.*

ACU, NSDB

The aims of this article are to present, by means of selected examples, an overview of the current state of knowledge on the

uptake, disposition, and effects of petroleum compounds in marine fishes and to give our views on the nature and extent of some of the problems arising from this phenomenon and on the direction that should be taken for future research. Because our experience has been primarily with species found in the northeastern Pacific Ocean [including Alaskan waters], these are emphasized. ... (Au)

436

**Sublethal effects as reflected by morphological, chemical, physiological and behavioral indices / Malins, D.C. Hodgins, H.O. Weber, D.D. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 119-138)

**References.***ASTIS document number 169617.*

ACU

The objective of these studies is to identify and evaluate in selected marine organisms the effects of chronic exposure to petroleum hydrocarbons and trace metals. Particular emphasis is on changes in tissue structure and ultrastructure, chemosensory perturbations and related behavior, disruptions in larval development, and alterations in physicochemical properties of mucus. ... (Au)

437

**Sublethal effects of petroleum hydrocarbons and trace metals including biotransformations, as reflected by morphological, chemical, physiological, and behavioral indices / Malins, D.C. Hodgins, H.O. Varanasi, U. Chan, S-L. McCain, B.B. Weber, D.D. Brown, D.W. Collier, T.K. Folmar, L.C. Gronlund, W.D. Gruger, E.H. Hawkes, J.W. Reichert, W.L. Roubal, W.T. Sanborn, H.R. Schiewe, M.H. Stein, J.E. United States. Minerals Management Service [Sponsor].**

(Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 1-229, ill.)

**References.**

*ASTIS document number 168807.*

**References.***ASTIS document number 168807.*

ACU

The responses of marine organisms to environmental contaminants are reflected in a number of changes detectable at organismic, as well as at tissular, cellular, subcellular, and molecular levels. The general purpose of this study was to detect these petroleum-related changes in marine species and to evaluate their implications for the survival and health of the animals. [Specifically, this study emphasized indirect, long-term effects such as:] ... Destruction of the generally more sensitive juvenile forms of organisms. ... Incorporation of sublethal amounts of oil and oil products into organisms resulting in reduced resistance to infection and other stresses and, in failure to reproduce. ... Exposure to long-term poisons, e.g., carcinogens. ... Low level interruption of any of the numerous events necessary for the feeding, migration, and propagation of marine species and for the survival of those species which stand higher in the marine food web. ... (Au)

438

**Sublethal effects of petroleum hydrocarbons and trace metals including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices / Malins, D.C. Hodgins, H.O. McCain, B.B. Weber, D.D. Varanasi, U. Brown, D.W. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 119-138)

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 119-138)



Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 13-79, ill.)

References.

ASTIS document number 168262.

ACU

... [The specific objectives of this study were as follows:] (1) Determine the effects of crude petroleum (Prudhoe Bay and Cook Inlet) on the development of embryos and larvae of salmon, of a representative species of Alaskan flatfish, and of Osmeridae (capelin, smelt). (2) Continue studies on pathological effects resulting from long-term exposure of juvenile flatfish to sediments contaminated with petroleum. (3) (a) Determine if exposure to Cook Inlet crude oil (CICO)-contaminated sediment alters disease resistance in juvenile flatfish and in a representative Alaskan crustacean species and (b) conduct preliminary studies on the effect of petroleum/dispersant mixtures on disease resistance of juvenile salmon. (4) (a) Continue studies on the uptake of aromatic hydrocarbons and their oxidized products. (5) Determine the effects of CICO on the ability of salmon fry to avoid predation. (6) Determine the concentrations of specific hydrocarbons in water, sediment, and tissues of exposed organisms in order to relate the presence of these components to biological effects. ... (Au)

439

**Sublethal effects of petroleum hydrocarbons and trace metals including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices / Malins, D.C. Gruger, E.H. Hodgins, H.O. Karrick, N.L. Weber, D.D. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 12-146, ill., maps)

(NTIS PB80-130065, p. 12-146, ill., maps)

References.

ASTIS document number 176044.

ACU

The overall objective of this program was to assess potential effects of petroleum operations on marine organisms indigenous to Alaskan waters. There were several primary objectives of this research unit ... during the contract period. These were to define and evaluate: (1) the alterations in structure of eggs, larvae, livers, and tissues of fish after petroleum exposure; (2) the importance of skin and epidermal mucus in metabolism and disposition of petroleum hydrocarbons in salmonids and flatfish; (3) the uptake, metabolism, and elimination of petroleum aromatic hydrocarbons by salmonids, demersal fish, and shrimp; (4) the effects of toxic trace metals on the metabolism of aromatic hydrocarbons by salmonids and flatfish; (5) the enzymes (aryl hydrocarbon monooxygenases) that metabolize and detoxify or activate aromatic hydrocarbons in a variety of aquatic species; (6) the physiological and embryological effects of aromatic hydrocarbons on early life forms of invertebrates; (7) the pathological effects of exposure of flatfish to crude petroleum-contaminated sediment; (8) the effects of exposures to petroleum on disease resistance of salmonids; and (9) the behavioral responses of vertebrate and invertebrate species exposed to petroleum hydrocarbons. (Au)

440

**Sublethal effects of petroleum hydrocarbons and trace metals, including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices / Malins, D.C. Chan, S-L. Hodgins, H.O. Varanasi, U. McCain, B.B. Weber, D.D. Brown, D.W. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf :

Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 79-171, ill.)

References.

ASTIS document number 169188.

ACU

[The objectives of this program are as follows:] (1) Complete analyses of previously collected data and provide information concerning effects of petroleum on embryo and larval development of chum salmon (*Oncorhynchus keta*), flatfish (*Pleuronectidae*), and surf smelt (*Hypomesus pretiosus*), and the ability of the organisms to survive in a petroleum-contaminated environment. (2) Complete analysis of the effects of exposure to petroleum-impacted sediments on disease resistance of flatfish. (3) Assess the effects of petroleum on predator-prey relationships in salmon. (4a) Continue studies on the uptake of specific aromatic hydrocarbons (3-, 4-, and 5-ring) in an Alaskan species of flatfish exposed to these compounds in the sediment or by way of their diet. (4b) Evaluate the potential of specific petroleum hydrocarbons and their oxidized products for interacting with critical cellular constituents of a key Alaskan species of flatfish. (5) Determine the relative toxicities of weathered petroleum components in relation to fresh petroleum hydrocarbons. (Au)

441

**Sublethal effects of petroleum hydrocarbons and trace metals, including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices / Malins, D.C. Hodgins, H.O. Karrick, N.L. Weber, D.D. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 60-171, ill.)

Appendix.

References.

ASTIS document number 169811.

ACU

... Several principal objectives were addressed by this research unit .... These were: (1) To evaluate the effect of petroleum on sensory systems and behavior of marine species by (a) determining if petroleum in sediment causes flatfish to avoid the contaminated area or interferes with normal feeding and activity patterns, and (b) evaluating the effect of crude oil exposure on defensive behavior of a sea urchin. (2) To investigate the metabolism and disposition of petroleum hydrocarbons in demersal fish. (3) To develop and refine ultrastructural criteria for assessing cellular damage in marine organisms resulting from exposure to petroleum. (4) (a) To detect and characterize pathological changes resulting from the exposure of flatfish to sediments contaminated with crude oil, and (b) to detect effects of petroleum exposure on flatfish disease resistance. (5) To determine if petroleum-exposed eggs and larvae of salmon and flatfish develop abnormally, and to evaluate the effect of any detected abnormalities on survival. (Au)

See also: 722.

MALLON, M.H.

See: 134, 135.

MALTBY, A.R.

See: 191.

## MANEN, C.-A.

442

Transport and fate of spilled oil / Manen, C.-A. Pelto, M.J.

(Proceedings of a synthesis meeting : the north Aleutian Shelf environment and possible consequences of planned offshore oil and gas development, Anchorage, Alaska, 9-11 March, 1982 / Edited by L.K. Thorsteinson. - Juneau, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984, p. 11-34, ill., maps)

## References.

ASTIS document number 178705.

OON

This section describes the factors affecting, and the probable path of, an oil spill in the north Aleutian Shelf area. Oil spilled offshore would come ashore more rapidly in summer than in the winter season. Oil fate is given in terms of percentages evaporated, dispersed, etc. Several detailed scenarios are described for locations within the lease area. (ASTIS)

443

The use of computer modelling to predict the effects of an oil spill / Manen, C.-A.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 447-450, ill.)

## References.

ASTIS document number 164372.

In order to assess the potential ecological impact of a spill, one must know both the probable movement of the oil and any changes in the composition of the oil. To provide this information, OCSEAP has sponsored the development of an oil spill trajectory model and an oil weathering model. Together, these two models are a predictive tool of great capability and potential. The oil spill trajectory model has been developed by J. Leendertse and S.K. Liu of the Rand Corporation. The model is formulated according to the mass, momentum, constituents, and energy balances, coupled to the effects of topography, bottom roughness, wind, ice and the earth's rotation. In solving the resulting equations, the initial and boundary conditions are prescribed according to field measurements. Data from more than 300 sampling stations are used in the southeastern Bering Sea trajectory model. (Au)

## MANKIEWICZ, P.J.

See: 541.

## MANN, K.H.

444

A biologist looks at oil in the sea / Mann, K.H.

(Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978 / Edited by S. James [and] D. Mackay. Toronto : Institute for Environmental Studies of the University of Toronto, [1978]. Publication - University of Toronto. Institute for Environmental Studies, EE 8, p. 67-73)

ASTIS document number 19801.

ACU, NFSMO

Describes the effect of oil spills on marine life, with reference to Canadian arctic waters. (ASTIS)

## MANSFIELD, A.W.

See: 341.

## MAPES, G.

See: 641, 643.

## MARKO, J.R.

445

Deep-water blowout trajectory models for the Lancaster Sound region / Marko, J.R.

(Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 37-65, ill., maps)

## References.

ASTIS document number 177814.

NSDB, OON

The rapid expansion of Arctic environmental studies continues to produce large amounts of new data. These data should be incorporated into our models of major pollution events such as deepwater oilwell blowouts. The present work was conceived specifically to develop an updated model for the distribution of oil and other pollutants arising from such a blowout in eastern Parry Channel. Hypothetical releases of oil were considered at ... four locations [in the Lancaster Sound area. Conclusions drawn from application of the model are presented.] ... (Au)

See also: 37, 38, 39, 40, 41, 42, 82.

## MARSH, G.D.

446

Cold regions spill response / Marsh, G.D. Schultz, L.A. DeBord, F.W.

(Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 355-358, maps)

## References.

ASTIS document number 177440.

NSDB

As part of its Arctic Pollution Response Research and Development Program, the U.S. Coast Guard in 1977 awarded a systems analysis contract to ARCTEC Incorporated to identify the pollution response system requirements for dealing with spills in ice-infested waters. A cold regions oil pollution response system was defined through an engineering and cost effectiveness analysis of six oil spill scenarios, selected to encompass the broad range of oil spill and environmental conditions likely to be encountered offshore Alaska. Also identified were modifications to the system required to extend the response capability to the seasonally ice-infested waters of the lower 48 states, including the Great Lakes, the northern rivers, and the northern coastal regions. Projections were made of the behavior of the spilled oil in ice-infested waters, and oil spill response scenarios were developed for three levels of spill response. Three distinctly different types of spill response operations were identified: (1) for thick, stable, level shorefast ice situation; (2) for a dynamic hummocky, heavily concentrated broken ice situation; (3) for case of light broken ice and open water. The presence of ice was found to aid response efforts in some cases and to hinder or preclude response efforts in others. This paper discusses the three types of spill response required for cold regions and reviews the six

Alaskan and three lower 48 scenarios used to define the system requirements. (Au)

MARTIN, C.M.

See: 400, 402.

MARTIN, L.C.

See: 242.

MARTIN, S.

447

Anticipated oil-ice interactions in the Bering Sea / Martin, S. (The eastern Bering Sea Shelf : oceanography and resources, volume one / Edited by D.W. Hood and J.A. Calder. - [Washington : Office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration ; Seattle : University of Washington Press [distributor], 1981], p. 223-243, ill.)

References.

ASTIS document number 172995.

ACU

In the lee-shore regions of the Bering Sea, ice formation is dominated by the presence of wind waves and swell. Laboratory experiments and field observations show that the kinds of ice which form in these regions are grease and pancake ice. The laboratory experiments also show that much of the oil spilled within these kinds of ice accumulates on the surface. [This] ... chapter also summarizes the entrainment mechanisms for oil released under first-year ice, and discusses from field observations possible oil entrainment mechanisms which may occur at the ice edge. (Au)

448

A field study of brine drainage and oil entrainment in first-year sea ice / Martin, S.

(Journal of glaciology, v. 22, no. 88, 1979, p. 473-502, ill., photos.)

(Contribution - University of Washington. Dept. of Atmospheric Sciences, no. 522)

(Contribution - University of Washington. Dept. of Oceanography, no. 1114)

References.

ASTIS document number 44857.

ACU, NFSMO, NSDB

From field observations this paper describes the growth and development of first-year sea ice and its interaction with petroleum. In particular, when sea ice initially forms, there is an upward salt transport so that the ice surface has a highly saline layer, regardless of whether the initial ice is frazil, columnar, or slush ice. When the ice warms in the spring, because of the eutectic condition, the surface salt liquifies and drains through the ice, leading to the formation of top-to-bottom brine channels and void spaces in the upper part of the ice. If oil is released beneath winter ice, then the oil becomes entrained in thin lenses within the ice. In the spring, this oil flows up to the surface through the newly-opened brine channels and distributes itself within the brine-channel feeder systems, on the ice surface, and in horizontal layers in the upper part of the ice. The paper shows that these layers probably form from the interaction of the brine drainage with the percolation of melt water from surface snow down into the ice and the rise of the oil from below. Finally in the summer, the oil on the surface leads to melt-pond formation. The solar energy absorbed by the oil on the surface of these melt ponds eventually causes the melt pond to melt through the ice, and the oil is again released into the ocean. (Au)

449

The interaction of oil with sea ice in the Arctic Ocean / Martin, S. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VI : Transport, p. 1-8, ill.)

References.

Partial contents: Direct measurement of the attenuation of ocean waves by pack ice / V.A. Squire and S.C. Moore, reprinted from Nature, v.283, no.5745, Jan. 24, 1980, p. 365-368.

ASTIS document number 168114.

ACU

... To understand how spilled oil might interact with the various kinds of ice in the Beaufort, Bering and Chukchi Seas, we have done field traverses in these regions, with particular emphasis on ice types which have previously not been studied. These include grease and pancake ice in Norton and Kotzebue Sound, and most recently a field investigation of the ice bands which form at the pack ice edge in the Bering Sea. In the laboratory, we have carried out experiments on how spilled oil interacts with grease ice, pancake ice, and simulated multi-year ice. ... (Au)

450

The interaction of oil with sea ice in the Arctic Ocean / Martin, S. United States. Minerals Management Service [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. V : Transport, p. 1-28, ill., map)

Appendices.

References.

Partial contents: Appendix I - Temperature and salinity observations in the Bering Sea marginal ice zone / R.D. Muench; Appendix II - Ice edge transect on 7 March 1981 / R.D. Muench.

ASTIS document number 169030.

ACU

This paper describes observations of ice movement near the marginal ice zone in the Bering Sea, using radar buoys. Temperature and salinity observations were also carried out. (Au)

451

The interaction of oil with sea ice in the Arctic Ocean / Martin, S. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VII : Transport, p. 171-180) (NTIS PB80-186877, p. 171-180)

References.

ASTIS document number 169536.

ACU

... To understand how spilled oil might interact with the various kinds of ice in the Beaufort, Bering and Chukchi Seas, we have done field traverses in these regions, with particular emphasis on ice types which have previously not been studied. These include grease and pancake ice in Norton and Kotzebue Sound, and most recently a field investigation of the ice plumes which form at the pack ice edge in the Bering Sea. In the laboratory, we have carried out experiments on how spilled oil interacts with grease ice, pancake ice, and simulated multi-year ice. ... (Au)

452

**The interaction of oil with sea ice in the Arctic Ocean /**

Martin, S.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. XI : Hazards, p. 8-10)

(NTIS PB80-130107, p. 8-10)

References.

ASTIS document number 181196.

ACU

This brief report summarizes the activities and publications of research unit #87 for 1977-1978. From field work in Prudhoe Bay and related lab work, a theory is evolved that oil will collect in grease ice at its point of transition from a liquid to a solid. Such oil is expected to gather in bands parallel to the Langmuir-like plumes of grease ice formed by wind and waves. (ASTIS)

453

**A laboratory study of the dispersion of crude oil within sea ice grown in a wave field /**

Martin, S. Kauffman, P. Welander, P.E.

United States. Bureau of Land Management [Sponsor].

United States. National Oceanic and Atmospheric Administration [Sponsor].

United States. Office of Naval Research [Sponsor].

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 261-287, ill.)

References.

ASTIS document number 175943.

ACU

In a laboratory experiment, we studied the formation and growth of sea ice in a wave field, and the interaction with the sea ice of oil released under it. The kinds of ice which grew in the wave field were grease and pancake ice. Our experiments show that the grease ice, which generally grew to a thickness of 100 mm, had a porosity of about 60% and a surface temperature which was only of the order of 0.1 degrees below the sea water temperature. The presence of grease ice did not inhibit oil released beneath it, rather the oil rose through the ice and spread out on the surface. The pancake ice formed when the grease ice thickness reached about 100 mm; our experiments showed that the length scale of the pancakes was about one-fifth of the driving wavelength. The rims around the pancakes were built up from grease ice which the oscillating wave field pumped onto the ice surface where it would freeze. Petroleum spilled under the pancakes rose to the surface in the cracks around the pancakes, where the oscillating motion pumped the oil both laterally through the cracks and onto the ice surface. Once on the ice surface, the pancake rims contained the oil so that it did not re-enter the water. (Au)

454

**Oil spills in the Arctic Ocean : extent of spreading, and possibility of large-scale thermal effects [reply] /**

Martin, S. Campbell, W.J.

(Science, v.186, Nov. 29, 1974, p. 845-846)

Untitled reply to ASTIS document number 172553, Oil spills in the Arctic Ocean : extent of spreading, and possibility of large-scale thermal effects / R.C. Ayers, H.O. Jahns, and J.L. Glaeser, in Science, v.186, Nov. 29, 1974, p. 843-845.

References.

ASTIS document number 172561.

ACU, NSDB

The authors here respond to criticisms by Ayers, Jahns and Glaeser regarding spill thickness, albedo changes and oil diffusion

mechanisms in a possible Arctic Ocean oil spill. (ASTIS)

See also: 139.

**MASCARENHAS, R.**

See: 416, 710.

**MASSOTH, G.J.**

See: 252.

**MATHEMATICAL SCIENCES NORTHWEST, INCORPORATED**

455

**Comparison of ecological impacts of postulated oil spills at selected Alaskan locations /**

Mathematical Sciences Northwest, Incorporated. Isakson, J.S. Storie, J.M.

Vagners, J. Erickson, G.A. Kruger, J.F. Corlett, R.F. United States. Coast Guard.

Office of Research and Development [Sponsor].

Washington, D.C. : U.S. Coast Guard, Office of Research and Development, 1975.

7 microfiches : ill., maps ; 11 x 15 cm.

(Report - United States. Coast Guard, CG-D-155- 75)

(NTIS AD-A-017 600)

Contents: v. 1, Introduction, summary, methodology evaluation and appendices. - v. 2, Results.

References.

ASTIS document number 176966.

A ranking of potential environmental impact for spills of crude oil, diesel-2, bunker C, and gasoline in amounts ranging from 100 to 50,000 barrels was made for specific sites at Yakutat Bay, Valdez Harbour, Valdez Narrows, Drift River Channel, Port Graham, Kamishak Bay, Unimak Pass, Port Moller, Kvichak Bay, St. Matthew Island, Offshore Prudhoe, Onshore Prudhoe, Nome, Cape Blossom Channel, Colville River, Yukon River, and Denali Fault. Spills were assumed to disperse from inertial, viscous, surface tension, wind and current forces. Most probable wind and current conditions were utilized. Sites were characterized in terms of eight species habitats. Most probable cases were evaluated. A rating system was devised to characterize the impact based upon estimated species abundance, importance of species, and the impact of oil on such species over the short and long term. Impacts were estimated with the use of three-dimensional matrices. The highest impact ratings were obtained for spills at Port Graham, Valdez Narrows, Unimak Pass, and the Yukon River Crossing, assuming no spill cleanup. The same five locations dominated the impact ratings where containment/cleanup were assumed to take place. Data gaps were noted and future studies are recommended. (Au)

**MAURER, R.**

456

**Zooplankton in the vicinity of the USNS Potomac oil spill**

(Baffin Bay, August 5, 1977) / Maurer, R. Kane, J.

Woods Hole, Mass. : National Marine Fisheries Service, Northeast Fisheries Center, [1978].

[17] p. : ill. ; 28 cm.

(Narragansett Laboratory reference, no. 78- 07)

References.

ASTIS document number 177369.

# NSDB

On the morning of 5 August 1977, the USNS Potomac was bound for Thule Air Force Base, Greenland, with a cargo of Arctic-blend diesel fuel. At 0430 local time it was determined that the No. 2 Bunker tank had been holed by an iceberg or "growler" spilling an estimated 100,000 gal of Bunker C oil. The Potomac's position at the time of siting was 74 53 N, 61 13 W, in local waters known as Melville Bay off western Greenland. Members of the NOAA/CEDDA, Spilled Oil Research Team (SOR Team), Dr. James S. Mattson, Dr. Peter Grose, and Miss Elaine Chan, arrived in the area and on August 19, 20 and 21 collected a series of biological samples in the vicinity of the spill .... These samples were forwarded to the Plankton Ecology Laboratory, NMFS, Narragansett, R.I., for analysis of species composition, abundance and contamination of plankton. This report describes the zooplankton present in the spill area and statistically examines the relationship between the presence of oil and plankton biomass, total zooplankton numbers and species composition. (Au)

## MCALISTER, W.B.

See: 268, 357.

## MCCAIN, B.B.

457

**Bioavailability of crude oil from experimentally oiled sediments to English sole (*Parophrys vetulus*), and pathological consequences / McCain, B.B. Hodgins, H.O. Gronlund, W.D. Hawkes, J.W. Brown, D.W. Myers, M.S. Vandermeulen, J.H.**  
(Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 657-664, ill.)

### References.

ASTIS document number 172928.

### ACU

English sole (*Parophrys vetulus*) were exposed to experimentally oiled (Alaskan North Slope crude oil) sediments over a 4-mo period to assess the bioavailability and tissue hydrocarbon distribution kinetics in flatfish. Data were also obtained on hydrocarbon related physiological changes and tissue pathology. Crude oil was mixed with aromatic hydrocarbon-free sediments to a concentration of 700 micro g/g dry weight at the beginning of the experiment. ... Flatfish maintained in such oiled sediments readily took up alkane and aromatic petroleum hydrocarbons from these sediments, and accumulated these in skin, muscle, and liver; 1- and 2-methylnaphthalene and 1, 2, 3, 4-tetramethylbenzene were accumulated to greater extent than other aromatics. Tissue hydrocarbons decreased with time, and after 27-d continuous exposure to oiled sediments only the liver contained detectable levels of hydrocarbons. After 2 mo <2% of the initial aromatic hydrocarbon load could be detected, and only in the liver in flatfish that were continuously maintained on oiled sediments. Depuration of tissue aromatics differed for various aromatics, 1, 2, 3, 4-tetramethylbenzene and 2-methylnaphthalene being most persistent. Depuration is thought to be due to induction of the aryl hydrocarbon hydroxylase system during initial exposure to oiled sediments. Concomitant with the high tissue hydrocarbon period were found enhanced weight loss and severe hepatocellular lipid vacuolization (HLV). Although the observations on growth changes and liver pathology are preliminary, the data indicate the need for further detailed study of fish growth abnormalities and pathology in the presence of petroleum hydrocarbons. (Au)

458

**The effects of Alaskan crude oil on flatfish and the prevalence of fish pathology in Alaskan marine waters / McCain, B.B.**

(Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado : NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 54-71)

(NTIS PB-288 935, p. 54-71)

Document not seen by ASTIS.

ASTIS document number 181200.

See also: 312, 437, 438, 440.

## MCCART, P.J.

See: 27.

## MCCOMISKEY, J.

See: 81.

## MCCURDY, D.

See: 675.

## MCDONALD, J.

See: 82.

## MC GEE, T.

See: 710.

## MCGILL UNIVERSITY. MARINE SCIENCES CENTRE

459

**Dome Petroleum experimental oil spill at McKinley Bay, N.W.T. : examination of ice biota / McGill University. Marine Sciences Centre. Acreman, J. Arctic Laboratories Limited. Borstad, G. Humphrey, B.**  
Dome Petroleum Limited [Sponsor].

[S.l. : s.n., 1980?].

1 microfiche : figures, tables ; 11 X 15 cm.

(Beaufort E.I.S. reference work, no. RWC09)

ASTIS document number 107948.

ACU, NSDB(ENV.)

... Apollonia (1965) stressed the importance of ice algae as a potential food source for grazing invertebrates such as amphipods ... which are in turn important food sources for polar cod. ... In view of this grazing activity at the bottom of the ice, the early ice algal production could be very significant. Clasby et al. (1976) calculated the annual carbon input by ice algae off Pt. Barrow was about 5 gC/square m which would amount to a very significant fraction of the total primary production for Arctic waters, estimated by various authors .... The fact that oil floats will mean that it will accumulate in pools under the ice. ... There are several possible effects of oil accumulated at the under-ice surface. A physical coating would lead to isolation of the algae from their nutrient and light source and also from the grazers .... More important is probably the effect that the more volatile components of the oil will have on the organisms present. ... In the Arctic, Alexander et al. (1972) found that primary production was significantly depressed and seasonal

succession of algal species was reduced in an oil-polluted small pond in Alaska. ... Hsiao (1976). ... predicted a large spill would result in a change of species composition of the phytoplankton community from diatoms to flagellates because of this differential sensitivity. ... With this background, we wanted to take advantage of the opportunity to collect some preliminary information on this subject in the Beaufort Sea in an area subjected to two experimental oil spills. (Au)

MCINTOSH, D.J.

See: 637, 641, 643, 650.

MCLAREN, M.A.

See: 404.

MCLAREN, P.

460

**The coastal morphology and sedimentology of Cape Hatt : implications for the Baffin Island Oil Spill Project (BIOS)**  
/ McLaren, P. Barrie, W.B. Sempels, J.-M.

(Paper - Geological Survey of Canada, 81- 1B, p. 153-162, figures, tables)

References.

ASTIS document number 67350.

ACU

Cape Hatt, a small peninsula that protrudes into Eclipse Sound at the north end of Baffin Island is the site for an experimental oil spill to take place in the summer of 1981. Three small bays are required : one as a control; a second to study the effects of oil spilled on the surface and allowed to impinge the shoreline; and a third to use an oil-dispersant mix for comparison with the oil-only experiment. The chosen site contains at least 13 bays potentially suitable for the experiments. ... Geomorphic and sedimentologic criteria indicate that the processes of winds, waves and ice action are greatest in bay 10 and least in bay 11. On the assumptions that cross-contamination must be minimal and longevity of the oil in the environment is desirable to ensure reasonable and measurable detrimental effects, we suggest that bay 10 should be used for control, bay 11 for the oil-dispersant mix and bay 9 for the oil-only experiments. (Au)

461

**The coastal morphology and sedimentology of Cape Hatt : implications for the Baffin Island Oil Spill Project (BIOS)**  
/ McLaren, P. Barrie, W.B. Sempels, J.-M.

Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1981.

200 p. : figures, tables ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 7)

Cover title: Geomorphology: Baffin Island Oil Spill Project, 1980 study results.

"Correct citation for this publication: ... Geomorphology - 1980 Study Results ...".

References.

ASTIS document number 135771.

NFSMO

Cape Hatt, a small peninsula that protrudes into Eclipse Sound at the north end of Baffin Island is the site for an experimental oil spill to take place in the summer of 1981. ... Analyses of data from baseline studies in 1980 has resulted in selection of 3 suitable bays (bays 9, 10 and 11). Geomorphic and sedimentologic criteria indicate that the processes of winds, waves and ice action are greatest in bay 10 and least in bay 11. On the assumptions that

cross-contamination must be minimal and longevity of the oil in the environment is desirable to ensure reasonable and measurable detrimental effects, we suggest that bay 10 should be used for control, bay 11 for the oil-dispersant mix and bay 9 for the oil-only experiments. (Au)

462

**The coastal morphology and sedimentology of eastern Lancaster Sound and northeast Baffin Island : a study of shoreline sensitivity to a potential oil spill** / McLaren, P. Barrie, W.B.

Ottawa : Geological Survey of Canada, 1985.

32 p. : ill., maps ; 30 cm. + 6 folded maps.

(Paper - Geological Survey of Canada, 83- 24)

Appendices.

References.

ASTIS document number 164470.

ACU

The coasts of eastern Lancaster Sound and northeast Baffin Island may be vulnerable to the effects of an oil spill should offshore drilling take place. ... To provide the physical environmental information necessary for future contingency planning, the coast was mapped with respect to (i) slope, (ii) glacier, rock or unconsolidated coast, (iii) type and sedimentology of the beach and (iv) nature of the intertidal zone. Each of these geomorphic/sedimentologic criteria provides an indication of the coastal "physical sensitivity". This term is a relative measure of the seriousness of oil pollution in a particular environment with respect to probable dispersal of oil, residence time and cleanup difficulties. Physical sensitivity increases when (i) slope decreases, (ii) the coast is unconsolidated, (iii) a beach is present, (iv) the beach material is coarse rather than fine, (v) intertidal flats are present, and (vi) the width of the intertidal flat increases. ... In general, as the PSO [physical sensitivity category] increases, the following also increase: (i) the persistence time of hydrocarbons in the environment and hence the need for cleanup, (ii) cleanup difficulties and (iii) the potential damage to the environment by cleanup operations. The physical sensitivity maps will enable rapid determination of the environments that warrant protection whereas, if oil does pollute the coast, the descriptive maps will provide the basis for cleanup procedures. ... (Au)

463

**The coastal morphology and sedimentology of Labrador : a study of shoreline sensitivity to a potential oil spill** / McLaren, P.

[Ottawa : Geological Survey of Canada], 1980.

41p. : ill., photos., maps (2 fold. in pocket) ; 28cm.

(Paper - Geological Survey of Canada, 79- 28)

ISBN 0-660-10583-7.

Appendices.

References.

ASTIS document number 49255.

ACU, NFSMO

... During the six month, ice-free period from June to November, 42 per cent of all winds blow in directions capable of driving oil to some or all of the coastline. Strong, unpredictable nearshore tidal currents may sweep oil far into the bays and fiords resulting in extensive contamination of this highly convoluted shoreline. ... To provide the physical environmental information for the Labrador coast that will be necessary for future contingency planning, the coast was mapped from Saglik Bay to Mary's Harbour with respect to (i) slope, (ii) rock or unconsolidated coast, (iii) type and sedimentology of the beach and (iv) nature of the intertidal zone. Each of these geomorphic/sedimentologic criteria provides an indication of the coastal "physical sensitivity". This term is a relative measure of the seriousness of oil pollution in a particular environment with respect to probable dispersal of oil, residence time and cleanup difficulties. ... It is suggested that an oil spill contingency plan be implemented in the following order: (i) offshore

coastal protection, (ii) onshore protection and (iii) shoreline cleanup. The physical sensitivity maps will enable rapid determination of the environments that warrant protection whereas, if oil does pollute the coast, the descriptive maps will provide the basis for cleanup procedures. (Au)

464

**The coastal sediments of Labrador and their use to predict the movement of an oil spill in the coastal zone / McLaren, P.**

(Proceedings - Workshop on Research in the Labrador Coastal and Offshore Region, Goose Bay, Labrador, September 4-6, 1980 / Newfoundland Institute for Cold Ocean Science. [St. John's] : Memorial University of Newfoundland, 1980, p. 244)

Abstract only.

ASTIS document number 73571.

ACU, NFSMO

... An examination of sediment trends, as illustrated by examples from the Labrador coast, offers a rapid and simple method to predict the path of oil which should be an aid to contingency planners. In situations where a shoreline has already been polluted, a sediment trend analysis could locate priority cleanup areas (i.e. shoreline that is accreting and burial is probable) of areas that could be self-cleaning due to net erosion of sediments to the offshore. (Au)

465

**Trends in sediment distributions : a method to predict oil spill movement in the coastal zone / McLaren, P.**

(Spill technology newsletter, v. 5, no. 3, May-June 1980, p. 76-87, figures, tables)

References.

ASTIS document number 51764.

ACU, NFSMO, NSDB

... This paper attempts to show the relationships among grain-size characteristics between a possible source and a possible deposit and therefore, by inference, a transport path for sediment movement. This transport path can then be used to predict the probable direction that oil will take and/or the fate of oil in the coastal environment. ... [Transport data was gathered in the Eclipse Sound-Baffin Island coast area]. (Au)

**MCLAREN, P.L.**

See: 401.

**MCLEAN, A.Y.**

466

**The behavior of oil spilled in a cold water environment / McLean, A.Y.**

(1972 Offshore Technology Conference, May 1-3 - Houston, Texas : preprints. - [Dallas, Tex.] : Offshore Technology Conference, 1972, v. 1, p.1- 129-1- 140, ill.)

(OTC paper, 1522)

References.

ASTIS document number 175650.

ACU

On 4th February 1970, the tanker Arrow struck Cerberus Rock in the entrance to Chedabucto Bay, Nova Scotia in bad weather. The Arrow, under charter to Imperial Oil Ltd., was carrying 16,000 tons of Bunker C oil for a pulp mill at Point Tupper, N.S. The loss of most of the cargo resulted in an oil pollution incident of such magnitude that the Minister of Transport established a Task Force

with wide authority to draw on all resources of men and materials necessary to minimise the consequences of the spill. ... One feature of the spill was that it took place in cold water [it interacted with the sea ice in the area,] and was a presage of what might be experienced in a spill in Arctic waters. This paper deals mainly with the way in which oil behaves when it interacts with the environment and the effect of these interactions on the effectiveness of clean up techniques. ... (Au)

467

**Oil-in-cold-water research at Nova Scotia Technical College / McLean, A.Y.**

(Oil and the Canadian environment : Proceedings of the Conference, 16 May, 1973, sponsored by the Institute of Environmental Sciences and Engineering, University of Toronto / Edited by D. Mackay and W. Harrison. - Toronto : Institute of Environmental Sciences and Engineering, 1973, p. 104-106)

References.

ASTIS document number 180432.

ACU

The consequent oil pollution incident following the wreck of the tanker Arrow in Chedabucto Bay, Nova Scotia in March 1970 illustrated the low levels of defence, both organisational and technical, against such a disaster. Various clean up techniques such as pumping, burning and absorption were tried and found to be ineffective due to unanticipated changes in the properties of the oil. The lesson drawn by the various members of the Chemical Engineering Department at Nova Scotia Technical College who were involved in the clean up operations was that there was a great lack of information of how oil interacts with a cold water environment. A research programme was therefore initiated at the College to investigate the way in which the composition of oil and the physical properties change after a spill in a low temperature environment and how these changes affect the design and operation of clean up equipment. Projects have been started to investigate evaporation, solution, emulsification and natural weathering. Another major project has been to develop the use of gas liquid chromatography to study changes in composition especially with reference to the detection of the source of oil pollutants. ... (Au)

See also: 411.

**MCMAHON, R.S.**

See: 161.

**MCMINN, T.J.**

468

**Behavioural characteristics and cleanup techniques of North Slope crude oil in an arctic environment / McMinn, T.J. Golden, P.**

(Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13-15, 1973, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1973, p. 263-276, ill., map)

Appendices.

References.

ASTIS document number 175064.

ACU

This paper deals with the physical fate and behavior of crude oil when spilled on winter arctic ice and snow surfaces. The concepts and theories developed are a result of a series of experiments performed by Coast Guard personnel in the Alaskan arctic during January-February 1972. The paper will develop spreading and aging

of oil on ice and snow, the unique interaction phenomena of snow and crude oil, and effectiveness of various cleanup techniques attempted on crude spilled on snow and ice. The paper will also briefly outline the Coast Guard's continuing research plans regarding arctic oil spills. Investigations prove that oil spreading over ice and snow is largely unaffected by oil properties such as density, viscosity, and surface tension. Oil spreading rate is also believed not to be a function of ambient air temperatures. Terminal spreading limit, independent of oil properties, is a function of effective surface roughness and volume of oil spilled. Oil was found to age on arctic ice. The winter aging rate was found to be significant although reduced from summer aging rates. Migration of oil into the ice or snow surface is minimal. However, snow falling on the surface of a freshly spilled oil pool migrates into the oil forming a mixture that contains up to 80% snow (by volume). An array of sorbents, surfactants, and dispersants were tested with largely negative results. (Au)

469

**Crude oil behavior on Arctic winter ice / McMinn, T.J.**  
Washington, D.C. : U.S. Coast Guard, 1972.

1 microfiche : ill. ; 11 x 15 cm.

(Report - United States Coast Guard, 734108)

(NTIS AD-754 261)

Appendices.

References.

ASTIS document number 178730.

ACU

Oil spill behavior in an Arctic winter environment is investigated. Several small controlled oil spills were conducted during January 1972 on the Bering Sea in Northwestern Alaska. To duplicate a real world spill as closely as possible, a Prudhoe Bay crude oil was used as the test oil. Investigated were oil spread rate on snow and ice, oil absorption into snow and ice surfaces, aging of oil on snow and ice surfaces, and effectiveness at various cleanup procedures. (Au)

470

**Oil spill behavior in a winter arctic environment / McMinn, T.J.**

(1973 Offshore Technology Conference, April 30-May 2 - Houston, Texas : preprints. - Dallas, Tex. : Offshore Technology Conference, 1973, v. 1, p.I- 233-I- 248, ill.)

(OTC paper, 1747)

References.

ASTIS document number 175625.

OON

... A comprehensive Coast Guard research program was initiated to determine the fate and behavior of crude oil discharges in an arctic environment. Arctic field tests were conducted off of Barrow, Alaska, in June, 1970, and at Port Clarence, Alaska, in Jan., 1972, in an attempt to quantitize oil spreading on and under ice, oil aging on ice, unique interaction characteristics between snow and oil, and the effectiveness of existing oil recovery techniques and treating agents. ... (Au)

**MCNABB, G.D.**

See: 540, 541, 542, 543.

**MCNAMARA, T.M.**

See: 287.

**MCQUERRY, D.L.**

See: 23.

**MCROY, C.P.**

471

**Sublethal effects on seagrass photosynthesis / McRoy, C.P.**

(Environmental assessment of the Alaskan continental shelf :

Quarterly reports of principal investigators October-December 1976. Vol. III, p. 169-173)

Volume published 1977.

ASTIS document number 173533.

ACU

... [The objectives of this project were:] ... An evaluation of uptake rates by eelgrass of the selected contaminants on the basis of: (1) photoperiod; (2) light intensity; (3) salinity; (4) temperature [and] ... An evaluation of the effect of the contaminants on the kinetics of photosynthetic carbon uptake in the limiting kinetic situations. ... During July and August, 1976 field and laboratory experiments were performed in Izembek Lagoon, Cold Bay, Alaska. Laboratory experiments were controlled exposure of uprooted seagrass to hydrocarbons and subsequent measurement of their productivity as estimated by <sup>14</sup>C uptake. In situ exposure to hydrocarbons was done on the grassbeds and results were followed for two weeks. ... (Au)

**MECKLENBURG, T.A.**

472

**Effects of Cook Inlet crude oil, benzene, and naphthalene on heart rates of the Alaskan king crab (*Paralithodes camtschatica*) / Mecklenburg, T.A. Rice, S.D.**

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 184)

Abstract only.

ASTIS document number 176036.

ACU

Continuously monitoring heart rates simultaneously with declining concentrations of oil in the exposure water was shown to be a sensitive indicator of sublethal responses in the king crab, *Paralithodes camtschatica*. In exposures to water soluble fractions of Cook Inlet crude oil, benzene, and naphthalene, the heart rate response was consistently one of depression, followed by return to normal as the crude oil or aromatic concentrations in the seawater declined. In one of the experiments with crude oil, respiration was also monitored; it closely paralleled the changes in heart rate. In another, using periodically replenished crude oil water soluble fractions, the heart rate remained depressed until the oil concentration was allowed to drop, substantiating a strong relationship between oil degradation and heart rate recovery. This experiment also showed some tendency for the heart rate to decrease further during each depression/recovery cycle. Benzene produced more severe and longer lasting heart rate depressions than did naphthalene or crude oil; the response to benzene also occurred much sooner after initial exposure. The long lasting sublethal effect of benzene was evident even though the benzene was more rapidly degraded in the water than either crude oil or naphthalene. (Au)

473

**Molting and survival of king crab (*Paralithodes camtschatica*) and coon-stripe shrimp (*Pandalus hypsinotus*) larvae exposed to Cook Inlet crude oil water-soluble fraction / Mecklenburg, T.A. Rice, S.D. Karinen, J.F.**



(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 221-228, ill.)

References.

ASTIS document number 175030.

ACU

Larvae of coonstripe shrimp and king crab were exposed to solutions of the water-soluble fraction (WSF) of Cook Inlet crude oil in a series of bioassays on intermolt stages I and II and the molt period from stage I to stage II. Molting larvae were more sensitive than intermolt larvae to the WSF, and molting coonstripe shrimp larvae were more sensitive than molting king crab larvae. When molting larvae were exposed to high concentrations of the WSF (1.15-1.87 ppm total hydrocarbons) for as little as 6 hr, molting success was reduced by 10-30% and some deaths occurred. When larvae were exposed to these high concentrations for 24 hr or longer, molting declined 90-100% and the larvae usually died. The lowest concentrations tested (0.15-0.55 ppm total hydrocarbons) did not inhibit molting at any length of exposure, but many larvae died after molting. Median lethal concentrations (LC50's) based on 144 hr of observation for molting coonstripe shrimp and 120 hr for molting king crab were much lower than the 96-hr LC50's, showing that the standard 96-hr LC50 is not always sufficient for determining acute oil toxicity. Although our LC50's for intermolt larvae are higher than levels of petroleum hydrocarbons reported for chronic and spill situations, some of our LC50's for molting larvae exposed 24 hr and longer are similar to or below these environmental levels. Comparisons of sensitivity to oil between different crustacean species or life stages should be based on animals tested in the same stage of the molt cycle, such as intermolt. (Au)

See also: 110, 581.

MEDIR, M.

See: 415.

MELLING, H.

See: 82.

MEMORIAL UNIVERSITY OF NEWFOUNDLAND.  
CENTRE FOR COLD OCEAN RESOURCES  
ENGINEERING

474

Investigation of the use of microwave systems in detecting and monitoring oil slicks over ice and ice-infested waters - Phase I report / Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. Parashar, S.K. Dawe, B.R. Worsfold, R.D. Canada. Arctic Marine Oilspill Program.

St. John's, Newfoundland : C-CORE, 1978.

lv. (various pagings : figures ; 28cm.

(C-CORE publication, no. 78- 18)

(Contract report - Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering)

Supported by the Canada Centre for Remote Sensing as part of the Arctic Marine Oil Spill Program.

Phase II and III under title "Microwave systems for detecting oil slicks in ice-infested waters."

Appendix 6: "Annotated bibliography of available literature on the micro-wave emission and scattering from ice, oil, and water ...."

ASTIS document number 22268.

ACU, NFSMO

... A comprehensive investigation into the microwave emission and scattering properties of sea ice, oil on water, and the ocean surface was made and the results of analyses are presented. ... The results show that only a qualitative assessment of a limited nature can be made on the performance of active and passive microwave systems in detecting oil slicks in the ice environment from the limited information available on microwave emission and scattering from sea ice, oil on water, and the ocean. ... (Au)

475

Investigation of the use of microwave systems in detecting and monitoring oil slicks over ice and ice-infested waters - Phase II and III report / Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. Parashar, S.K. Roche, C. Worsfold, R.D. Canada. Arctic Marine Oilspill Program.

St. John's, Newfoundland : C-CORE, 1979.

viii, 62p. : ill., charts, tables ; 28cm.

(C-CORE publication, no. 79- 4)

(Contract report - Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering)

Supported by the Canada Centre for Remote Sensing as part of the Arctic Marine Oil Spill Program.

References.

ASTIS document number 22250.

ACU, NFSMO

Two ice regimes, one corresponding to waves in ice, and the other depicting an iceberg, were selected for further study under the C-CORE AMOP Phase III contract. The results obtained from the manual and digital analysis of 4-channel SAR imagery of these regions are presented and discussed in terms of their relevance to the potential of detecting oil pollution in the ice environment through SAR. The digital analysis consisted of generating histograms, statistics, clutter to noise-ratios and gray-tone reproduction. ... (Au)

476

An oilspill in pack ice / Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering. Canada. Arctic Marine Oilspill Program.

St. John's : C-Core, [1980].

xvii, 231p. : ill., figures, maps, photos., tables ; 28cm.

(C-CORE publication, no. 80- 2)

(Contract report - Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering)

The study was largely funded by the Arctic Marine Oilspill Program, Environmental Protection Service.

Section 8.4 of this report, entitled "The visual identification of Bunker-C oil in dynamic pack ice", was presented at the Kurdistan Workshop at the Bedford Institute of Oceanography, Dartmouth, N.S., in June 1979, and has been designated C-CORE publication 80-1.

ASTIS document number 57886.

ACU, NFSMO

About 1100 tonnes of oil from the KURDISTAN was entrained in pack ice off the Cape Breton Coast. The oil ... was distributed in streaks and patches as a fine particulate dispersion in the ice. Oil concentrations were as high as 200 ppm in heavily contaminated areas. Only a small fraction of the oil-contaminated ice was deposited along shorelines. Most of the shoreline contamination in

the area studied occurred after the ice pack had dispersed or melted. A variety of oilspill detection and tracking techniques were evaluated. ORION spill tracking bouys were very successful. Remote sensing techniques relying on high altitude passive imaging systems were not reliable .... Slick trajectory modelling techniques were not able to cope with ice conditions, nor were they highly successful in predicting open water trajectories due to a lack of adequate current data. There is no existent cleanup technology which could successfully cope with oil-ice mixtures of the type observed. It is expected that similar conditions would result from a crude oil spill in pack ice. ... (Au)

See also: 370.

## MEREDITH, D.

See: 346.

## METGE, M.

477

Oil in moving pack ice - laboratory study / Metge, M.  
Telford, A.S.

POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 3, p. 255-264, ill., photos.)

References.

ASTIS document number 56120.

ACC, NFSMO

This paper describes a series of three laboratory tests, largely qualitative in nature, during which two different crude oils were released under moving ice. The moving pack ice was simulated by small ice floes, about 30 cm in diameter, confined in a 3 m diameter steel ring, in a basin, in a cold room, and agitated by the slow back and forth motion of the confining ring. ... observations, relative to the spreading of the oil, the effect of wind and waves and countermeasures are ... described. (Au)

478

Oil in pack ice coldroom tests / Metge, M. Imperial Oil Limited.

[Calgary : Distributed by APOA], 1978.

microfiche : map, photos. ; 11x16cm.

APOA project no. 149 : Oilspill and iceberg studies conducted for preparation of an environmental impact statement for Davis Strait. Report, no. 2)

Eastern Arctic Marine Environmental Studies)

Original publisher: Imperial Oil Limited Production Dept.

References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES68.

ASTIS document number 40827.

ACC, NFSMO

The objective of this study was to investigate the behaviour and fate of crude oil spilled in moving pack ice. ... Two different crudes (Atkinson and Prudhoe Bay) were spilled under scaled down ice floes confined in a 3m diameter basin and agitated by the back and forth motion of the confining ring. ... (Au)

See also: 677.

## METIKOSH, S.

See: 77.

## MICHEL, J.

479

Application of an oil spill vulnerability index to the shoreline of lower Cook Inlet, Alaska / Michel, J. Hayes, M.O. Brown, P.J.

(Environmental geology, v. 2, no. 2, 1978, p. 107-117, ill., map)

References.

ASTIS document number 177610.

NSDB

Offshore tracts in Alaska's lower Cook Inlet are scheduled to be opened for exploratory petroleum drilling in the near future. Because of the potential for oil spills resulting from this activity, a field study of the coastal zone was conducted in June 1976. A total of 1216 km of shoreline was classified into 3 types: erosional (45 percent), neutral (38 percent), and depositional (17 percent). These were further subdivided into 16 subclasses on the basis of small scale morphological features. This classification was used in conjunction with a vulnerability index of potential oil spill damage, developed through study of three major oil spills, to predict the longevity of oil in the different coastal environments of the Inlet. ... We propose that the use of this type of vulnerability indexing, in conjunction with a biological susceptibility index and oil spill trajectory models, would provide a rational basis for decision making concerning the location of on- and off-shore oil localities and the design of oil spill contingency plans. (Au)

See also: 307, 309.

## MILLER, D.S.

480

Which components of crude oil are toxic to young seabirds? / Miller, D.S. Hallett, D.J. Peakall, D.B.

(Environmental toxicology and chemistry, v. 1, no. 1, 1982, p. 39-44, ill.)

References.

ASTIS document number 174807.

Studies from this laboratory have focused on sublethal physiological effects of small amounts of ingested crude oil in young herring gulls (*Larus argentatus*). Clearly, the most striking effect of certain oils in gulls is the marked reduction in rates in weight gain found after administration of a single 0.2-1 ml oral dose. For example, dosing with one South Louisiana crude (obtained from the American Petroleum Institute in 1976; SLC-76) reduced weight gain by 40-80%; another SLC, obtained in 1978, had no effect. Gas chromatographic-mass spectrographic analyses of the oils indicated that SLC-1978 lacked certain aromatics. Weathering of SLC-76 over sea water for 36 h did not reduce its ability to inhibit weight gain in gulls. Both findings implicated higher weight aromatics as the active compounds. SLC-76 was split on an alumina column into aliphatic and aromatic fractions; only the aromatic fraction reduced gull rates of weight gain. Using a Prudhoe Bay crude (as toxic to gulls as SLC-76), the aromatic fraction was split into two subfractions on Sephadex LH-20. Analyses showed that one subfraction contained those aromatics with three or less rings and the other contained those with four or more rings. Only the second fraction (high molecular weight aromatics) reduced gull weight gain. These findings clearly show that oil composition is a major determinant of oral toxicity to young seabirds, and that the higher molecular weight aromatics are most effective in reducing gull weight gain. (Au)

See also: 544, 547, 548, 695.

# MILNE, A.R.

481

Crude oil in cold water : the Beaufort Sea and the search for oil / Milne, A.R. Herlinveaux, R.H. Childerhose, R.J. [Editor]. Beaufort Sea Project (Canada). [Ottawa : Dept. of the Environment, 1979?]. 119p. : ill., figures, col. photos., maps, tables ; 23cm. *ASTIS document number 32220*. ACU, NFSMO, NSDB(ENV.)

... The purpose of this book is to trace the drift of oil flowing unchecked from an imaginary offshore blowout through the seasons of the year. No mathematical models of oilspill trajectories will be developed. Mathematical representations of sea, wind and ice interactions in the Beaufort Sea lie beyond our present abilities. Much of the text is devoted to the oceanography of the Beaufort Sea and features such as sediments, storm surges and sea ice. Diagrams near the end of the book show the possible spread of oil from a blowout for the spring, summer and winter. These predictions show where and when the oil is most likely to appear but do not forecast its actual drift; this cannot be done with any more accuracy than next summer's weather can be foretold. ... (Au)

482

A field study on the permeability of multiyear ice to sea water with implications on its permeability to oil / Milne, A.R. Herlinveaux, R.H. Wilton, G.R. [Ottawa : Fisheries and Environment Canada, Environmental Protection Service, c1977]. iv, 33p. : ill., figures, tables ; 28cm. (Technology development report, EPS 4-EC-77- 11) ISBN 0-662-01220-8. References. *ASTIS document number 27413*. ACU, NFSMO

Four multiyear ice floes of opportunity, in the vicinity of Resolute Bay, N.W.T., were investigated for their permeability with respect to sea water. Experiments took place between 24th August and 19th September, 1976 .... The main technique was to measure the flow-rate of water which filled blind holes drilled to various depths in the ice. All holes flooded but at varying rates, depending on the particular floe examined, and the hole depth. A simple, analytical model for hole-flooding, where applicable, enabled the porosity with respect to interconnected pores and capillaries to be determined. Although no oil was used, results indicate that most, if not all oil trapped in and under multiyear ice should surface before mid-September if it was spilled under the ice during the previous winter and spring. (Au)

483

Offshore drilling for oil in the Beaufort Sea : a preliminary environmental assessment / Milne, A.R. Smiley, B.D. Victoria, B.C. : Beaufort Sea Project, 1976. 1 microfiche : figures ; 11 X 16 cm. (Technical report - Beaufort Sea Project, no. 39) (APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 39) *ASTIS document number 92312*. ACU, NFSMO

... This report is an environmental assessment and by assuming hypothetical worst-case oil well blowout scenarios, examines the nature of the transport and fate of oil in the Beaufort Sea and draws conclusions regarding the impact of the oil on the environment, including climate, seabirds, marine mammals and other marine organisms. ... Assuming a "worst-case" sub-sea oil well

blowout, major conclusions are [presented]. (Au)

484

Offshore drilling in Lancaster Sound : possible environmental hazards / Milne, A.R. Smiley, B.D. Sidney, B.C. : Dept. of Fisheries and the Environment, Institute of Ocean Sciences, Patricia Bay, 1978. iv, 95p. : ill., tables, maps, charts ; 28cm. References. *ASTIS document number 1686*. ACU, SSU, NFSMO, NSDB(ENV.)

Lancaster Sound, a highly productive maritime region within Canada's High Arctic, is judged to be sensitive to oil pollution from a blowout. The Sound's rich waters host, seasonally, over 50% of Eastern Arctic marine birds, one-third of North America's White Whales and, possibly 85% of North America's narwhals. These are at threat from oil in offshore and coastal waters, in sea ice, at ice edges and on shores. ... The purpose of this report is to provide the reader with a review of the most relevant information, pertinent to these choices: on the drilling system which might be used, on the hazards to offshore drilling, on the physical and biological environment, on the fate and effects of oil from an assumed oilwell blowout, on the effectiveness of oilspill countermeasures, on the effects the oil might have on wildlife. ... (Au)

485

Oil, ice and climate change : the Beaufort Sea and the search for oil / Milne, A.R. Childerhose, R.J. [Editor]. Beaufort Sea Project (Canada). [Ottawa : Dept. of the Environment, Beaufort Sea Project, 1978?]. 103p. : ill. (part. col.), maps ; 23cm. References. *ASTIS document number 11720*. ACU, SSU, NFSMO, NSDB(ENV.)

... This book is one of a series of six examining the ramifications of possible oil spills during either the initial drilling or extraction and transport stages of the petroleum recovery process. As the title implies, this volume deals with the anticipated effects of an undersea oilwell blowout, or a major spill from a submerged pipeline or tanker ship, in ice-cluttered arctic waters. (Au)

486

The physical environment of the Beaufort Sea related to oil, ice and water interactions / Milne, A.R. (Proceedings - Arctic Environmental Workshop, 6th, Fairmont Hot Springs, B.C., April 17-20, 1977 / Edited by J.G. Gainer, W.J. Logan [and] D. Mackay. Ontario : Institute for Environmental Studies, [1977]. Publication - University of Toronto. Institute for Environmental Studies, EE 6, p. 43-53, maps) *ASTIS document number 30082*. ACU, NFSMO

A main reason for this workshop is to stimulate new ideas and concepts for oil spill countermeasures in the Beaufort Sea. ... I will cover, briefly, the main features of its physical marine environment in relationship to oil pollution which could result from a subsea oilwell blowout. ... (Au)

See also: 91.

**MISCH, C.J.**

See: 581.

**MOIR, A.J.**

See: 44.

**MOLES, A.**

487

**Sensitivity of parasitized coho salmon fry to crude oil, toluene, and naphthalene / Moles, A.**

(Transactions of the American Fisheries Society, v.109, no. 3, May 1980, p. 293-297, ill.)

References.

ASTIS document number 179434.

ACU

The effect of parasitism by glochidia of *Anodonta oregonensis* (a freshwater mussel) on the sensitivity of coho salmon fry, *Oncorhynchus kisutch*, to oil was determined by exposing fry with different levels of parasitism to several concentrations of either the water-soluble fraction of Prudhoe Bay crude oil or the aromatic hydrocarbons toluene and naphthalene. Fry infested with 20-35 glochidia were significantly ( $P < 0.05$ ) more sensitive to each of the toxicants than uninfested fish. Sensitivity increased linearly with increased parasite numbers. Interpretation and application of results of toxicity tests should take into account the kinds and intensities of parasitism found both in the test animals and in the wild populations of fish. (Au)

See also: 591.

**MOLES, D.A.**

488

**Effects of crude oil and naphthalene on growth, caloric content, and fat content of pink salmon juveniles in seawater / Moles, D.A. Rice, S.D.**

(Transactions of the American Fisheries Society, v.112, no. 2A, Mar. 1983, p. 205-211, ill.)

References.

ASTIS document number 179426.

ACU

Juvenile pink salmon *Oncorhynchus gorbuscha* were exposed for 40 days to stable, sublethal concentrations of naphthalene ( $< 0.80$  mg/liter) and the water-soluble fraction of Cook Inlet crude oil ( $< 0.87$  mg/liter total aromatic hydrocarbons). All fish were fed equal daily rations of Oregon Moist Pellet Formula II. Concentrations (percentage of the 96-hour LC50, median lethal concentration) of 10% naphthalene and 14% water-soluble fraction of crude oil did not affect wet weight or length of exposed fish. At higher concentrations, however, growth per day determined from wet weight decreased with increased toxicant concentrations. Change in length of the fish was not a sensitive measure of toxicity. Fish exposed for 40 days to concentrations of toxicants as low as 33% of the 96-hour LC50 weighed significantly less than control fish ( $P < 0.05$ ). Juveniles exposed to the water-soluble fraction of crude oil had slower growth rates than those exposed to the same concentration (percentage of the LC50) of naphthalene. Fish exposed to either naphthalene or the water-soluble fraction of crude oil had decreased caloric content; however, fat content of the fish was not affected. Chronic marine oil pollution at a concentration as low as 0.40 mg/liter total aromatic hydrocarbons could reduce growth of juvenile pink salmon. (Au)

489

**Sensitivity of Alaskan freshwater and anadromous fishes to Prudhoe Bay crude oil and benzene / Moles, D.A.**

Rice, S.D. Korn, S.

(Transactions of the American Fisheries Society, v.108, no. 4, July 1979, p. 408-414, ill.)

References.

ASTIS document number 172944.

ACU

The sensitivity of various species and life stages of Alaskan freshwater and anadromous fishes to benzene and the water-soluble fraction of Prudhoe Bay crude oil was determined with 96-hour toxicity tests. Freshwater juveniles of the six salmonid species tested had similar sensitivities. Median tolerance limits (TLM's) of these salmonids for crude oil ranged from 2.7 to 4.4 mg/liter; TLM's of benzene ranged from 11.7 to 14.7 micro l/liter. Threespine sticklebacks and, to a lesser extent, slimy sculpins, were more tolerant than salmonids and had larger TLM's; threespine sticklebacks had a crude-oil TLM of 10.4 mg/liter and a benzene TLM of 24.8 micro l/liter; slimy sculpins had a crude-oil TLM of 6.44 mg/liter and a benzene TLM of 15.4 micro l/liter. Eggs of pink salmon and coho salmon were quite tolerant to crude oil (TLM  $> 12$  mg/liter) and benzene (TLM = 339-542 micro l/liter). Emergent fry were the most sensitive freshwater stage (crude-oil TLM = 8.0 mg/liter; benzene TLM = 12.3-17.1 micro l/liter). Out-migrant salmonids tested in sea-water were twice as sensitive as out-migrant salmonids tested in fresh water, apparently because of the additional stress of entering seawater and the physiological changes associated with this transition. Freshwater TLM's were 2.3-8.0 mg/liter for crude oil and 10.8-17.1 micro l/liter for benzene. Corresponding seawater sensitivities were 1.1-3.6 mg/liter for crude oil and 5.5-8.5 micro l/liter for benzene. (Au)

See also: 359, 581, 583, 585.

**MONK, D.C.**

See: 181.

**MORELL, S.H.**

See: 14, 15.

**MORELLI, F.A.**

See: 57.

**MOREY, R.M.**

See: 361, 363.

**MORITA, R.Y.**

490

**Baseline study of microbial activity in the Beaufort Sea and Gulf of Alaska, and analysis of crude oil degradation by psychrophilic bacteria / Morita, R.Y. Griffiths, R.P.**

(Environmental assessment of the Alaskan continental shelf. Principal investigators reports for the year ending March 1976. Vol. 10 : Chemistry and microbiology, p. 147-1: ill., maps)

(NTIS PB-261 409, p. 147-191, ill., maps)

## References.

ASTIS document number 176451.

ACU

Our objectives are (1) to determine the microbial activity in the Beaufort Sea and the Gulf of Alaska by the heterotrophic potential technique before any accidental oil spill occurs, (2) to determine what effect crude oil might have on the microbiological picture in the sea by use of simulated in situ conditions, (3) to determine the change in microbial activity in seawater when crude oil is used to perturb the ecosystem under simulated in situ conditions, (4) to study the physiology of hydrocarbon degrading psychrophilic (cold loving) bacteria from the Beaufort Sea, and (5) to determine the occurrence of psychrophilic hydrocarbon oxidizers in the environment under study. (Au)

See also: 54, 287, 289, 290, 291, 292, 293, 294, 295, 300.

MORRIS, R.W.

See: 409.

MOWATT, T.C.

See: 327.

MOYSE, C.

See: 614.

MULKINS-PHILLIPS, G.J.

491

Effect of environmental parameters on bacterial degradation of Bunker C oil, crude oils, and hydrocarbons / Mulkins-Phillips, G.J. Stewart, J.E.

(Applied and environmental microbiology, v. 28, no. 6, Dec. 1974, p. 915-922, ill.)

References.

ASTIS document number 180912.

ACU

Mixed microbial cultures, previously enriched on Bunker C fuel oil, grew on and degraded Bunker C fuel oil at temperatures ranging from 5 to 28 C. At 15 C, 41 to 85% of the benzene-soluble components of Bunker C disappeared after incubation for 7 days; at 5 C the values ranged from 21 to 52% after 14 days of incubation. A *Nocardia* sp. isolated from a culture enriched on Bunker C oil grew on Venezuelan crude oil, Bunker C, hexadecane, and a hydrocarbon mixture at temperatures of 5 and 15 C. The 10-C decrease in temperature resulted in an average 2.2-fold decrease in generation time of the bacteria. Gas-liquid chromatographic measurements of Venezuelan and Arabian crude oils which had been incubated with the *Nocardia* sp. showed significant degradation of the n-alkane portion and the chromatographically unresolved components of the oils. The concentration of elemental nitrogen required to bring about the disappearance of 1 mg of hexadecane by the *Nocardia* sp. was 0.5 mg. The results confirm suggestions that the rate of natural biodegradation of oil in marine temperate-to-polar zones is probably limited by low temperatures and phosphorus concentrations, but suggest that the concentrations of nitrogen occurring naturally are probably not rate-limiting factors. (Au)

MULLIN, T.C.

See: 553, 554.

MUNGALL, C.

492

Oil seep in the Arctic / Mungall, C.

(Geos (Ottawa), 1979 [1] Spring, p. 2-4, ill., col. photos., map)

ASTIS document number 33081.

ACU, NFSMO

Describes oil contamination, first observed in 1976, of marine water off Scott Inlet, Baffin Island from a naturally occurring seepage source. Mapping the slick through various kinds of ice cover has helped determine the capability limits of currently available sensors used to monitor oil spills in an Arctic marine environment. (ASTIS)

MURPHY, D.L.

See: 697.

MYERS, J.C.

See: 697.

MYERS, M.S.

See: 457.

MYREN, R.T.

493

Natural variability in distribution of an intertidal population of *Macoma balthica* subject to potential oil pollution at Port Valdez, Alaska / Myren, R.T. Pella, J.J.

(Marine biology, v. 41, no. 4, 1977, p. 371-382, ill., map)

References.

ASTIS document number 178420.

ACU, NSDB

Natural variability in the abundance of an intertidal population of the lamelli branch *Macoma balthica* (Linnaeus, 1758) was measured during 1971 and 1972 in a study area near the proposed oil storage and tankship loading facility at the southern terminus of the Trans-Alaska pipeline in Port Valdez, Alaska. *M. balthica* were divided for analysis into a large and a small size category. Small temporal changes in population densities throughout the entire study area were detected for both size categories over several of the 7 sampling times of the 2-year period. Large and persistent differences in density were found among elevation contour intervals for either size category; however, variations in the density profiles on elevation occurred among sampling times. Large *M. balthica* became more equitably distributed and the small category less equitably distributed among elevation contours over the 2-year period. Densities of both size categories were more stable at the higher elevations of the study site. Large *M. balthica* were more homogeneously distributed along a given elevation contour interval than the small category. Mobility and time available to redistribute at a horizontal location would explain the more homogeneous distribution of large *M. balthica* if competition for food resources exists. (Au)

494

**Quantitative monitoring of an intertidal population of *Macoma inconspicua* for detection of the effects of oil pollution : within-season population variation, 1971 /**  
Myren, R.T. Pella, J.J.

(Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 51-52)

Abstract only.

ASTIS document number 175927.

ACU

Construction of a large pipeline terminus facility is planned at Port Valdez, Alaska. Operation of the terminus poses a serious pollution threat to marine biological resources of the area and the contiguous regions of Prince William Sound. One means of detecting disturbances to the biological systems in the area, such as those caused by oil pollution, is through changes in the sizes of populations of organisms. A large population of the clam *Macoma inconspicua* exists near the proposed site of the pipeline terminus and has been chosen as a pollution indicator. Annual and seasonal variations of *Macoma* populations in Port Valdez have been measured and analyzed by analysis of variance technique for a sampling design composed of 30 plots sampled four times during 1971. No detectable change occurred in the population densities or distribution of *M. inconspicua* among the four sampling periods. Spatial gradation in density related to beach elevation was detected. The sensitivity of the design to detect changes in population density was determined after these preliminary studies. For instance, we estimate that at the 95% significance level of testing, a 30 to 35% change in density of large *Macoma* subsequent to the time covered by our sampling has a probability greater than 0.85 of being detected. Greater changes have correspondingly greater probabilities of detection. Observations preceding operation of the terminus will be compared to conditions and events after the development. (Au)

NADEAU, S.

See: 200.

NAIDU, A.S.

495

**The effect of Prudhoe Bay crude oil on a tidal-flat ecosystem in Port Valdez, Alaska /** Naidu, A.S. Feder, H.M.  
Norrell, S.A.

Tenth Annual Offshore Technology Conference, 1978 : proceedings, volume 1. - Dallas, Tex. : Offshore Technology Conference, 1978, p. 97-104, maps)

References.

ASTIS document number 173002.

ACU. NFSMO

The tidal flat sediments of Port Valdez display significant lateral variations in lithological, chemical and biological subfacies. ... Simulated crude oil spills in an oxic muddy site resulted in no changes in sediment organic carbon and in the dissolved oxygen contents. Bacterial populations were also not significantly affected by application of up to 2000 ppm of crude oil for several days at a series of low tides. ... Harpacticoid copepods were not adversely affected by crude oil; on the other hand, a significant increase in density of one species (*Helectinosoma gothiceps*) was noted at chronic oil dosages. Nonetheless a significant decrease in the concentrations of Cu, Zn, Ni and V has been observed in the tidal deposits, subsequent to the oiling of the sediments. It is concluded that crude oil stranded on tidal flat surfaces even for a relatively short moment during tidal cycles probably alters the sediment pH and Eh relationships significantly to mobilize the heavy metals from the adsorbed/exchangeable sites of sediment particles to the

overlying tidal waters. (Au)

See also: 246, 248, 327.

NARAYANAN, S.

See: 38.

NAWWAR, A.M.

See: 30.

NEFF, J.M.

496

**Proposed research program (technical proposal) on Baffin Island experimental oil spill and dispersant studies : hydrocarbon bioaccumulation and histopathological and biochemical responses in two species of marine bivalve molluscs /** Neff, J.M. Hillman, R.E. Boehm, P.D.

Duxbury, Mass. : Battelle New England Marine Research Laboratory, 1981.

[62] leaves ; 28 cm.

"Proposed ... to National Oceanic and Atmospheric Administration OCSEAP Program Office ...".

References.

ASTIS document number 182001.

NSDB

[This paper outlines proposed research to be carried out in conjunction with the Baffin Island Oil Spill (BIOS) Project]. The primary objective of the proposed research is to assess and compare sublethal biological effects of dispersed and non-dispersed spilled oil on two species of marine benthic infaunal bivalve molluscs, *Mya truncata* and *Macoma calcarea*. The proposed research project has three component parts: accumulation by the molluscs of hydrocarbons (particularly toxic aromatic hydrocarbons and heterocyclics) from dispersed and non-dispersed spilled oil; sublethal biochemical/physiological responses of bivalves to dispersed and non-dispersed oil; histopathology of bivalve molluscs exposed in the field to dispersed and non-dispersed spilled oil. This research will determine if dispersed crude oil is more or less bioavailable to benthic infaunal bivalve molluscs than undispersed oil, and whether dispersed oil is more harmful than undispersed oil to these animals. ... (Au)

NEFF, S.E.

See: 130.

NELSON-SMITH, A.

497

**Biological consequences of oil-spills in arctic waters /** Nelson-Smith, A.

(The Arctic Ocean : the hydrographic environment and the fate of pollutants / Edited by L. Rey and Stonehouse. - London : Macmillan, 1982, p. 275- 293)

References.

ASTIS document number 168564.

ACU

This is a review of the biological effects of oil spills and blowouts

in Arctic waters and on Arctic shorelines, as well as the implications of cleanup techniques. (ASTIS)

## NELSON, J.G.

498

**The Scottish and Alaskan offshore oil and gas experience and the Canadian Beaufort Sea / Nelson, J.G. Jessen, S.**  
Ottawa : Canadian Arctic Resource Committee; Waterloo : Faculty of Environmental Studies, University of Waterloo, 1981.

xix, 155p. : ill., figures, tables : 23cm.

ISBN 0-919996-22-1.

Appendices.

References.

ASTIS document number 74132.

ACU, NSDB

This report is organized around the Management Assessment Model ... Chapters two, three, four, and five are devoted to the main divisions of the model: agency, planning, implementation, and general guides or characteristics. Most of the information pertains to Scotland, although much is also included on Alaska. In chapter six, the experience in the Shetlands - and to a lesser extent, Alaska - is considered in greater detail and some major points of comparison are made about the environment and the economic, social, and political circumstances within which oil development has taken place. Chapter seven includes detailed information on the major oil development effects in the Shetlands and the extent to which these have been controlled by the management system. The final chapter contains a summary of the major principles that have emerged, especially from the Shetlands experience. Recommendations are also made for the management of Canadian Beaufort Sea oil and gas development. (Au)

## NELSON, W.G.

499

**Control of oil spills under ice / Nelson, W.G.**  
(A Continuing Engineering Education Workshop on Ice Engineering, University of Alaska, June 4-5, 1981. - Fairbanks, Alaska : University of Alaska, School of Engineering, 1981, [8] leaves, figures)

References.

ASTIS document number 135992.

NFSMO

This workshop paper discusses the interaction of spilled oil with ice, the containment and the recovery of spilled oil. (ASTIS)

500

**Oil migration and modification processes in solid sea ice / Nelson, W.G. Allen, A.A.**

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 191-198, ill.)

References.

ASTIS document number 161993.

The migration of Prudhoe Bay crude oil and diesel fuel through first year sea ice and the effect of entrained oil on sea ice growth rates were examined. Physical and chemical changes within the oils were examined during and after the entrainment process. Several crude oil and diesel fuel injections beneath solid sea ice were conducted off Prudhoe Bay during the winter of 1979/1980. ... The sea ice growth under the injected oils was monitored. ... Each site was studied to determine the extent of vertical oil migration. The field results are compared to laboratory salt water ice growth experiments with entrained oil layers. ... These data illustrate the

relationships among oil layer thickness, temperature gradient across the oil layer, oil viscosity, and convective motion occurring within the oil layer. (Au)

501

**The physical interaction and cleanup of crude oil with slush and solid first year sea ice / Nelson, W.G. Allen, A.A.**

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS, Environmental Emergency Branch], 1982, p. 37-59, figures, tables)

References.

ASTIS document number 131032.

NFSMO

... studies have dealt with oil released during the transitions from open water to solid ice cover when a slush ice cover is often encountered, and with oil released on or under a growing ice sheet. The ABSORB research program was conducted on sea ice at Prudhoe Bay, Alaska, and at the University of Alaska, Anchorage (UAA) cold room facility. The research summarized in this paper concentrates on studies conducted from the fall of 1980 through the spring of 1982, with occasional reference to the earlier research conducted during the winter of 1979-80. Both field and laboratory tests were undertaken. (Au)

502

**Vertical temperature profiles within equilibrium thickness crude oil spills on water / Nelson, W.G.**

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 5-13, ill.)

References.

ASTIS document number 165050.

ACU

A numerical computation technique to facilitate the prediction of the temperatures of oil layers on water is demonstrated. Oil-air interface temperatures computed for weathered Prudhoe Bay crude oil are presented to demonstrate temperature gradients through oil layers on water during periods of low ambient air temperature. ... A relationship between the Rayleigh number and the start of convective mixing within the oil layer was presented. [It was shown that a significant decrease in the oil temperature near the oil-air interface is caused by low ambient air temperatures and increasing windspeeds. This will affect the physical properties of the oil and thus will impact on oil spill cleanup operations]. ... (Au)

See also: 18, 20.

## NEU, H.J.A.

503

**Assessment of tanker and slick drift following break-up of the tanker "Kurdistan" / Neu, H.J.A.**

(The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 33-38, ill., map)

ASTIS document number 177040.

NSDB

An overflight of the site of the KURDISTAN break-up and of the surrounding Cabot Strait provided an opportunity to assess the sea-state immediately after the accident, and if possible to make some

first-hand observations on oil sighting and oil drift in or near ice. [The author concluded that movement of the spilled oil was largely wind-dominated, while drift of the tanker halves was current-dominated.] ... (Au)

504

Wave climate over the continental shelf and its impact on the oilspills of the Arrow, Argo Merchant, and Kurdistan / Neu, H.J.A.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 10-16, maps)

References.

ASTIS document number 169595.

OON

In the open waters of the Continental Shelf of Atlantic Canada and New England States, waves are the most disturbing factor in tanker accidents and in the recovery of the oil which has been spilled. ... In this brief presentation, the impact of this seasonally varying seastate on the major tanker accidents, on salvage efforts and on recovery of the spilled oil is analyzed. (Au)

NEVILLE, R.A.

See: 254.

## NEWFOUNDLAND OCEANS RESEARCH AND DEVELOPMENT CORPORATION

505

Deep sea dispersion analyses / Newfoundland Oceans Research and Development Corporation. Loucks (R.H.) Oceanology Ltd. Imperial Oil Limited [Sponsor].

[Calgary : Distributed by APOA], 1977.

1 microfiche : ill., map ; 11x16cm.

(APOA project no. 149 : Oilspill and iceberg studies conducted for preparation of an environmental impact statement for Davis Strait. Report, no. 3)

(Eastern Arctic Marine Environmental Studies)

Appendix.

References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

AMES order no. ES71.

ASTIS document number 40835.

ACU, NFSMO

The objective of this work was to estimate horizontal plume and patch dispersion scales from four current meter records taken in 1976 in the Davis Strait region. The term 'patch' is used to mean instantaneously released diffusing material; the term 'plume' refers to continuously released material. ... (Au)

NILSSEN, O.

See: 221, 223, 630.

NILSSON, U.

See: 712.

NOBLE, D.L.

See: 327.

NOLL, C.J.

506

A perspective on oilspill modelling offshore Labrador / Noll, C.J. Davidson, L.W.

(Proceedings - Workshop on Research in the Labrador Coastal and Offshore Region, Goose Bay, Labrador, September 4-6, 1980 / Newfoundland Institute for Cold Ocean Science. [St. John's] : Memorial University of Newfoundland, 1980, p. 21-32, figure, table)

ASTIS document number 73458.

ACU, NFSMO

Following a distinction between scenario and real-time oilspill trajectory models the basic nature of trajectory modelling is discussed in terms of input, computation, and output. Specific problems related to such modelling attempts are noted. These include the availability and interpretation of input wind and surface current data, the lack of an appropriate data base with which to calibrate or compare various existing models, and problems of model output user education. Suggestions are made regarding possible solutions to these problems. (Au)

507

A predictive oil spill surface drift model for the Labrador Sea / Noll, C.J.

(Spill technology newsletter, v. 3, no. 2, Mar.-Apr. 1978, p. 22-31, figures, table)

References.

ASTIS document number 71277.

ACU, NFSMO, NSDB

A predictive oil spill surface drift computer model has been applied to the Labrador Sea in order to predict paths of spills originating from drilling locations in the area. Surface trajectories are determined for a one (1) month period. Only ice free periods are considered due to the limited knowledge of ice movements in the Labrador Sea and the effect of ice/oil interaction. Six to ten-year averaged wind data from surrounding coastal weather stations are employed to evaluate the wind and wave-induced currents. Available current data from charts and research cruises are used to determine the prevailing ocean currents. (Au)

See also: 262.

## NORCOR ENGINEERING AND RESEARCH LIMITED

508

The interaction of crude oil with Arctic sea ice / NORCOR Engineering and Research Limited.

Victoria, B.C. : Beaufort Sea Project, 1975.

[200]p. : ill., figures, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 27)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 27)

Appendices.



## References.

*ASTIS document number 16241.*

ACU, NFSMO

Presents a detailed study of petroleum pollution of sea ice and ice-covered waters by investigating several areas of oil and ice interaction: the plume, area of contamination, incorporation, migration, effect of oil on ice growth, effect of oil on ice depletion, clean-up, and environmental impact. (ASTIS)

509

**Probable behaviour and fate of a winter oil spill in the Beaufort Sea / NORCOR Engineering and Research Limited.**

[Ottawa : Environmental Protection Service, Dept. of Fisheries and the Environment]. 1977.

x, 11 p. : ill., diagrams ; 28cm.

(Technology development report. EPS 4-EC-77- 5)

ISBN 0-662-01029-9.

References.

*ASTIS document number 3972.*

ACU

With increasing levels of offshore petroleum exploration in the Beaufort Sea, there is an urgent need to be able to define the behaviour and fate of a major winter oil spill. Much of the drilling activity centers on the area of dynamic ice called the transition zone, between the 20 and 100-m water contours. This report combines data from a 4-months winter field study of ice conditions, with other sources such as AIDJEX and satellite photography. The resulting statistical description of ice conditions in the Beaufort Sea is then used to generate a model of oil disposition under a moving ice sheet in the event of an oil blowout. Major areas for future study are identified as oil migration in multi-year ice, the effects of gas on oil behaviour and hourly ice drift rates. Realistic spring oil migration rates through the ice sheet are applied to a typical set of ice conditions and a rough mass balance estimate is made of oil remaining at the end of the first summer. Oil films are generally thin (<0.5 cm). Based on available ice drift information, less than 15% of the contaminated area could be partially cleaned by burning. Evaporation would account for between 35 and 55% of the oil. By September it is estimated that about 30 to 50% of the original oil volume would remain on the water, ice or shore. (Au)

510

**Some aspects of weathering and burning of crude oil in a water-and-ice environment / NORCOR Engineering and Research Limited. Belicek, J. Overall, J.C.K. Canadian Marine Drilling Limited [Sponsor].**

[Calgary : Distributed by APOA], 1976.

1 microfiche : ill., figures, tables ; 11x16cm.

(APOA project no. 107 : Some aspects of weathering and burning of crude oil in water and ice environment. Report)

References.

*ASTIS document number 26450.*

ACU, NFSMO

This report summarizes results of field experiments designed to demonstrate some practical aspects of weathering and burning of crude oil in a water-and-ice environment. The program investigated: (1) weathering and burning characteristics of light (Norman Wells) and heavy (Swan Hills) crude oil; (2) effectiveness of burning as a method of clean-up as compared to weathering and losses through evaporation; (3) methods of ignition; (4) effectiveness of fire promotive and wicking agents; (5) characteristics of unburned residue. Experiments were carried out during the period from April 28 to May 28, 1976 at Yellowknife, N.W.T. (Au)

## NORGES TEKNISKE HOGSKOLE (TRONDHEIM)

511

**Onshore enhanced biodegradation experiments in Z-lagoon and assessment of biodegradation of oil in Bay 11 : postspill surveys / Norges Tekniske Hogskole**

(Trondheim). Eimhjellen, K. Josefsen, K.

Norway. Royal Ministry of Environment [Sponsor].

Canada. Baffin Island Oil Spill Project [Sponsor].

Ottawa : EPS, 1984.

1 microfiche : ill., maps ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project. 83- 6)

References.

Fiche heading title: Baffin Island Oil Spill Project. microbiology : 1983 study results.

Also available in paper.

*ASTIS document number 160164.*

ACU

Three sets of oiled plots for enhanced biodegradation experiments have been established in Arctic backshore sediments. The effect of artificial fertilizer is positive, but varies depending on the geomorphological conditions of the beach. ... Mechanical mixing of oil and fertilizer into the sediments gives further improvement of the biological self purification of the oiled sediment, in spite of a lower level of oil degrading bacteria. ... The highest counts of bacteria, 50,000,000-70,000,000 per ml sediment, are found in the sediments of high oil content. (Au)

## NORLANDS PETROLEUMS LIMITED

512

**Environmental impact statement for exploratory drilling in the Lancaster Sound region / Norlands Petroleum Limited.**

[Calgary] : Norlands Petroleum Limited, 1978.

lv. (various pagings) : ill., figures, maps, tables ; 29cm.

References.

Pallister order no. NR2.

*ASTIS document number 45179.*

ACU, NFSMO, NSDB(ENV.)

The purpose of this report is to provide the reader with a review of the most relevant information on all aspects of drilling in the Lancaster Sound. Considered in our studies are the drilling system to be used, the hazards of offshore drilling, the physical and biological environment, the fate and effects of an assumed oil well blowout on the Arctic biota and finally, the effectiveness of the oil spill counter measures. Other factors of importance are the social and economic implications which may mean the providing of some work for the native people in the area and the impact of world-wide attention to this exploration activity on the life style of the native people. This environmental impact statement however, does not consider the eventual development of this possible discovery into an oil field. ... (Au)

See also: 515.

## NORRELL, S.A.

513

**Characterization of the microbial component of an intertidal silt sediment ecosystem at Valdez, Alaska, and its failure to degrade added crude oil / Norrell, S.A. Johnston. M.H.**

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1976, p. Q23)

References.

**ASTIS document number 177431.**  
**NSDB**

The silt sediment ecosystem at Port Valdez, Alaska is composed of deposited glacial silt particles with a mean grain diameter of only 4 - 16nm, and is carbon-poor and sulfide-free. These properties have important biological consequences on the native bacterial population and markedly affect the ability of the sediment bacteria to degrade additional organic material, such as added Prudhoe Bay Crude. The bacterial population, usually limited to about 2300 CFU/gm, has been shown to be unaffected by single applications of up to 2000 PPM of oil, or by chronic applications of 500 PPM of oil applied for several consecutive days during several low tide series. However, when sediment is enriched in situ by algal growth and by seepage of oil from a buried tank, and in vitro model systems, the bacteria respond with an increase in biomass, an increase in respiratory oxygen uptake, and the formation of a sulfide system in model sediment/sea water columns. Although as many as 90% of the heterotrophic isolates produce hydrogen sulfide from peptone sources, other species of the sulfur cycle are not present or are only rarely isolated in enrichment cultures. We conclude that the added oil and other deposited organic matter is removed by tidal action because it is unable to penetrate the sediment, leaving an organically poor, biologically inactive sediment ecosystem. (Au)

514

**Effects of oil on microbial component of an intertidal silt-sediment ecosystem / Norrell, S.A. Johnston, M.H.**

(Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 305-327, ill.)

**References.**

Paper presented at: Environmental Assessment under Arctic Conditions, 3rd, University of Alaska, Fairbanks, 11-15 Aug., 1975.

**ASTIS document number 175110.**

**ACU**

The ability of crude oil to supply oxidizable soluble organic material to bacterial populations in marine sand ecosystems is significantly documented. In this chapter, a review is made of the fundamental relationships reported by others to exist between bacterial biomass and sediment properties. These observations are compared to the distinguishing characteristics of a glacial silt intertidal zone studied during 1973 and 1974 near Port Valdez, terminus of the trans-Alaska pipeline. Bacterial plate-count and respirometry data are used to estimate standing crop and activity response of microbial populations to oil contamination. The presence of various sulfur bacteria is also examined because of their known association with both marine environments and with oil deposits.

See also: 248, 495.

**NORSTROM, R.J.**

See: 106, 236, 371.

**NORTHWEST TERRITORIES. FISH AND WILDLIFE SERVICE**

515

**Possible environmental effects on polar bears of offshore drilling in Lancaster Sound / Northwest Territories. Fish and Wildlife Service. Schweinsburg, R.E.**

Oosenbrug, S.M. Canadian Wildlife Service.

Stirling, I. Kiliaan, H.P.L. Norlands Petroleum Limited [Sponsor].

(A status report on polar bear studies in Lancaster Sound / R.E. Schweinsburg, I. Stirling, S. Oosenbrug, and H. Kiliaan. - [Yellowknife, N.W.T.] : Northwest Territories Fish and Wildlife Service, 1977, p. 1-27 [i.e., 59-90], maps)

**References.**

**ASTIS document number 178144.**

... The purpose of this document is to assess the potential impact of the Norlands [1974 drilling] proposal on the polar bears of Lancaster Sound. Production drilling, subsea pipelines, and interrelationships with ongoing developments (such as Nanisivik) or proposed developments (such as the Arctic Pilot Project) are beyond the terms of reference of this study. However, because of the possible cumulative or additive effects of developments on wildlife populations, we consider this assessment (with its limited terms of reference) to be preliminary. In this report we shall: (1) describe the existing environmental conditions and information base prior to development, (2) assess the potential impacts [of marine transportation, aircraft disturbance, facilities, subsea blowouts, and cleanup operations] to polar bears, based upon assumptions and the available information, (3) recommend mitigating measures to deal with areas of concern, and (4) describe the impacts or concerns that cannot be resolved. (Au)

**NORTON, D.W.**

See: 633.

**NORWAY. ROYAL MINISTRY OF ENVIRONMENT**

See: 220, 221, 222, 223, 511.

**NOVAK, M.**

See: 667.

**NUMMEDAL, D.**

516

**Spilled oil retention potential - Beaufort Sea coast of Alaska / Nummedal, D. Ruby, C.H.**

(POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 3, p. 247-253, maps)

**References.**

**ASTIS document number 56111.**

**ACU, NFSMO**

Based on aerial photography and field sampling, the Beaufort Sea coast of Alaska has been classified with respect to its oil spill retention potential. A retention index, which is a measure of the ability of an environment to retain the oil once introduced, is developed. ... The oil spill retention potential of the entire Beaufort

coast from Pt. Barrow to Demarcation Pt. has been mapped at a scale of 1:50,000. Two reduced and slightly generalized sample maps are included in the paper. It is concluded that there is a close relation between the morphological and sedimentary characteristics of an environment and the biological concept of habitat sensitivity. (Au)

NUNES, M.J.

See: 641.

NUNES, P.

517

Acute toxicity of the water-soluble fraction of Cook Inlet crude oil to the Manila clam / Nunes, P. Benville, P.E.

(Marine pollution bulletin, v. 9, no. 12, Dec. 1978, p. 324-331, ill.)

References.

ASTIS document number 173754.

ACU, NSDB

Recognition of the inherent complexities of oil bioassays prompted the development of several apparatuses designed to deliver uniform solutions of the water-soluble components of crude oil and capable of system equilibration for both static and continuous-flow bioassays without the loss of the more volatile compounds and without the formation of emulsions. Clams from a relatively contaminated area exhibited greater resistance to the water-soluble fraction of Cook Inlet crude oil than specimens from a more pristine area. Behaviour was altered below lethal levels suggesting the possibility of using behavioural modifications as a concomitant criterion of toxicity with mortality. An increase in mortality with a longer exposure period and a significant rate of latent mortalities following the end of the 96-h exposure period suggest that future bioassays with bivalves should be determined over a longer exposure period. (Au)

518

Effects of the water-soluble fraction of Cook Inlet crude oil on the marine alga, *Dunaliella tertiolecta* / Nunes, P. Benville, P.E. United States. Bureau of Land Management [Sponsor].

(Bulletin of environmental contamination and toxicology, v. 21, no. 6, Apr. 1979, p. 727-732, ill.)

References.

ASTIS document number 172960.

ACU, NSDB

... This study attempts to determine the effects of the water-soluble components of Cook Inlet crude oil on the marine alga, *Dunaliella tertiolecta*, without the addition of emulsifying agents. [The results of this study indicate that low concentrations have a stimulatory effect on growth rate]. (Au)

519

Uptake and depuration of petroleum hydrocarbons in the Manila clam, *Tapes semidecussata* Reeve / Nunes, P. Benville, P.E.

(Bulletin of environmental contamination and toxicology, v. 21, no. 6, Apr. 1979, p. 719-726, ill.)

References.

ASTIS document number 178586.

ACU

... The Manila clam, *Tapes semidecussata*, is a commercially important shellfish occurring on the North American Pacific Coast from Alaska to California. To date, there have been no attempts to examine the sensitivity of this bivalve to petroleum hydrocarbons

and their ability to accumulate and store these materials in their tissues. Being sessile filter-feeders, clams are readily exposed to pollutants adsorbed on suspended particulate matter. Little is known of the extent to which petroleum hydrocarbons taken up by marine bivalves are retained and concentrated in their tissues. Such assimilation and concentration could pose a health threat to human consumers of edible marine shellfish as some of the polycyclic aromatic hydrocarbons have been reported to be carcinogenic. ... In this study we selected to look at six specific monocyclic aromatics of the water-soluble fraction (WSF) of Cook Inlet crude oil and the extent to which they are accumulated and retained by the Manila clam. (Au)

O'BOYLE, R.N.

520

Distribution of oil, chlorophyll, and larval fish on the Scotian Shelf during April and May 1979 following the Kurdistan spill / O'Boyle, R.N.

(Scientific studies during the "Kurdistan" tanker incident: proceedings of a workshop, June 26 and 27, 1979. Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S.: Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 167-192, ill., maps)

Appendix.

References.

ASTIS document number 169722.

OON

On March 15, 1979, the MV Kurdistan broke in two in rough seas just off Cape Breton. Of the 30,000 tons of Bunker C oil that she was carrying, approximately 7000 tons were released into the ocean. ... the Marine Fish Division of DFO carried out a number of sampling cruises through the affected area as part of its continuous Scotian Shelf Ichthyoplankton Program [which] is designed to examine temporal and spatial changes in the abundance and distribution of larval fish communities as well as changes in the Shelf hydrography, as these affect fish population stock-recruitment relationships. ... This report summarizes the observations made during these two SSIP cruises, the first occurring only 15 days after the breakup of the Kurdistan. ... (Au)

O'BRIEN, P.J.

See: 371.

O'DEA, S.

See: 321.

O'NEIL, R.A.

See: 254.

OGRODOWCZYK, W.

521

The effects of hydrocarbons on selected hydrobionts in the coastal zone of the Antarctic waters / Ogrodowczyk, W. (Polish polar research, v. 2, no. 1-2, 1981, p. 95-102, ill.)

References.

ASTIS document number 178284.

Total toxicity of two types of mineral oil (from Zakum and Kuwait) was determined with respect to hydrobionts of the

Antarctic ecosystem. Crustacean - *Euphausia superba* proved to be sensitive to hydrocarbon pollution of the sea environment (LC50 40  $\mu$ l = 7.62 ppm). Fish - *Notothenia rossi marmorata* showed much lower sensitivity. (Au)

## OLLA, B.L.

522

**Sublethal effects of oiled sediment on the sand worm, *Nereis (Neanthes) virens* : induced changes in burrowing and emergence / Olla, B.L. Bejda, A.J. Studholme, A.L. Pearson, W.H.**

(Marine environmental research, v. 13, no. 2, 1984, p. 121-139, ill.)

### References.

ASTIS document number 178314.

OON, NSDB

The burrowing and emergence behavior of sand worms, *Nereis (Neanthes) virens* Sars, in sediment contaminated with sublethal concentrations of Prudhoe Bay crude oil ranging from 74 to 5222 ppm, was studied in the laboratory. Initial burrowing in oiled sediment did not differ from that observed in unoled sediment. Emergence of exposed worms was related to the oil concentration and the extent of weathering of oiled sediment. Sand worms buried in unoled sediment did not emerge. Worms dug from oiled sediment after 12 hours' exposure and placed on unoled sediment were impaired, resulting in a significant increase in time to burrow. However, after 12 h, they recovered and burrowed at normal rates. Worms held in oiled sediment for 96 h also recovered. Possible causes for recovery are discussed. Results suggest that oil-induced aberrations may increase vulnerability to predation. (Au)

## OUSENBRUG, S.M.

See: 515.

## ORITSLAND, N.A.

523

**Effect of crude oil on polar bears / Oritsland, N.A.**

Engelhardt, F.R. Juck, F.A. Hurst, R.J.

Watts, P.D. Canada. Dept. of Indian Affairs and Northern Development [Sponsor].

Ottawa : DIAND, 1981.

v. 268 p. : figures, tables ; 28 cm.

Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 24)

Eastern Arctic Marine Environmental Studies)

ISBN 0-662-11835-9.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES73.

Appendices.

References.

ASTIS document number 84476.

ACU

It is widely perceived that accidental oil spills and oil well blow outs may occur in arctic marine areas as a result of offshore petroleum development and that these could have detrimental effects on wildlife populations. Although arctic research programs have contributed new knowledge on the extent or severity of such events, many aspects remain poorly understood. The impact on polar bears ... is one example. ... The general conclusion which may be drawn from this study is that the individual polar bear may be greatly affected when exposed to oil spills. An initial effect of coating with oil is that thermoregulatory and metabolic stresses develop which may cause serious disability if protracted in the wild.

Oil fouling of the fur led to grooming and licking of the oil from the fur, with consequent ingestion of the oil, and absorption into the body from the gut. Residence of oil in the fur may be expected to be long if the animal is not cleaned completely, prolonging exposure by grooming/ingestion activities. Uptake of petroleum hydrocarbons and their distribution to body tissues led to behavioural abnormalities and tissue damage. (Au)

524

**Insulation in marine mammals : the effect of crude oil on ringed seal pelts / Oritsland, N.A.**

(The effect of contact and ingestion of crude oil on ringed seals of the Beaufort Sea / T.G. Smith and J.R. Geraci. Technical report - Beaufort Sea Project, no. 5, p. 48-66, ill.)

### References:

At head of title: Appendix A.

ASTIS document number 180688.

ACU

The ringed seal *Phoca hispida* will, prior to and during the moult, haul out on the fast ice for periods of up to 24 hours at a time. ... During the haul out season (mid May to the end of July) the seals lose much of their fat reserves and are also subject to significant hunting pressure. ... Therefore, environmentally induced changes in the seals' insulation may have consequences beyond short term bioenergetics. We know that pelt insulation is of significance in the heat balance of seals in air ... while it is a negligible part of the total insulation in water. ... The present work concerns a quantitative evaluation of the ringed seal fur insulation in air and how it is influenced by crude oil. [... Oil did not significantly change the insulating values in air and at varying wind speeds. ... The major effect of Norman Wells crude oil on the fur of the ringed seal is to increase the solar heating of the animal's skin.] (Au)

See also: 330, 331.

## OVERALL, J.C.K.

See: 163, 510.

## OWENS, E.H.

525

**Arctic shoreline countermeasures : initial results and implications from the BIOS experiment / Owens, E.H.**

Foget, C.R. Robson, W.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 349-362, tables)

### References.

ASTIS document number 131105.

NFSMO

... This review focuses more on the applicability of available techniques, rather than upon their operational implementation or upon the requirements for cleanup or protection at specific locations. This review is based upon initial results obtained from a series of shoreline countermeasure experiments that were undertaken during 1981 as part of the Baffin Island Oil Spill (BIOS) program at Cape Hatt on northern Baffin Island. The countermeasures that were selected for the field experiments were: (a) burning, (b) dispersant application, (c) solidification, and (d) mixing. ... (Au)

526

**Baffin Island Oil Spill Project : 1981 shoreline component /**  
Owens, E.H. Harper, J.R. Foget, C.R.  
Canada. Environmental Protection Service [Sponsor].  
Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1982.  
ca. 100 p. (various pagings) : ill., maps ; 28 cm.  
(Working report - Baffin Island Oil Spill Project, 81- 4)  
Appendices.

Cover title: Shoreline countermeasures : 1981 study results.  
References.

*ASTIS document number 170070.*

ACU

Field studies conducted during 1981 on the intertidal and backshore control plots that were laid down 12 months previously indicate that wave action on the exposed coast was effective in removing oil from the plots, but that in the more sheltered environment, oil was still present in observable amounts on both the surface and subsurface of the intertidal plots. ... within 40 days, 80 percent of the oil on these control plots in the intertidal zone had been dispersed naturally. The use of incendiary devices to burn oil on the beach surface was attempted on a series of test plots, but failure of the devices to ignite the oil resulted in cancellation of this component of the countermeasures test. The use of dispersants and of a mixing technique was found to be effective in initially reducing the volume of surface oil on the beach sediments on the plots. However, after 40 days the total hydrocarbon values from the dispersed plots and from the mixing plots were essentially in the same range as those from the control plots. This indicates that natural cleaning is as effective as the countermeasure techniques during the open-water season, when storm-wave action can rework oil that is stranded within the intertidal zone. ... The results of the studies that have been conducted over 2 years indicate that on high-energy or moderate-energy exposed beaches, wave action is effective in dispersing oil within the intertidal zone at loading levels that are in the order of 2 percent oil in sediment by weight. (Au)

527

**Baffin Island Oil Spill Project : 1982 shoreline component /**  
Owens, E.H. Harper, J.R. Foget, C.R.  
Canada. Environmental Protection Service [Sponsor].  
Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : BIOS Project Office, 1983.  
ca. 100 p. (various pagings) : ill., maps ; 28 cm.  
(Working report - Baffin Island Oil Spill Project, 82- 4)  
Appendices.

Cover title: Shoreline countermeasures : 1982 study results.  
References.

*ASTIS document number 170089.*

ACU

The 1982 Shoreline Component of the Baffin Island Oil Spill (BIOS) experiment involved a continuation of the 1980 and 1981 studies and a series of field countermeasures experiments that were conducted in a sheltered, low wave-energy environment. ... The specific objectives of the 1982 phase of the Shoreline Component were as follows: resample and resurvey intertidal and backshore control plots that were established in 1980 ... to evaluate the persistence and weathering characteristics of aged crude oil and of emulsified crude oil on shorelines of differing wave-energy levels ... to evaluate variations between the countermeasure and the control plots and between the aged crude oil and emulsified crude oil plots ... to determine hydrocarbon levels in the [intertidal] sediments ... conduct a series of experiments on intertidal and backshore plots ... using selected countermeasure techniques (the techniques used were: dispersants, low-pressure flushing and Mechanical mixing) [and] monitor the distribution and character at stranded oil. ... (Au)

528

**The BIOS shoreline experiments : results from 1980-1982 field studies /** Owens, E.H. Robson, W. Foget, C.R. Harper, J.R.

(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 59-64, ill., maps)

References.

*ASTIS document number 159883.*

Field studies have been conducted over a period of 3 years in the vicinity of Cape Hatt, on Baffin Island, to assess selected shoreline cleanup countermeasures. It is now possible to reach some general conclusions regarding the relative efficiency and effectiveness of the countermeasures that were tested experimentally, and to relate these results to the fate of oil in the shore zone in terms of the expected residence time or persistence of stranded oil. The field program has produced an extensive data set that is available in the BIOS Working Report Series, available from the BIOS Project Office, Environment Canada, Edmonton. The objective of this paper is to present briefly some of the interesting results that have emerged to date. No attempt has been made here to document the experimental results in detail, but simply to present an outline of the project status. [This report covers physical fates of the spilled oil and touches on weathering and biodegradation. Also, the various countermeasure techniques tested are enumerated]. (Au)

529

**Coastal oil spills and their impact on land /** Owens, E.H.  
(Environment Canada Lands Directorate, Folio 6, no. 18, 1983, p. 123-140; ill., maps)

References.

*ASTIS document number 176982.*

OOFF

This general overview of the impacts of oil spills on Canada's coasts and coastal waters touches on the sources of spills, the effects of spills on the land and its biota, and the cleanup of spills. The differences between Arctic and non-Arctic spills are mentioned. Spill research and development, including the Arctic Marine Oilspill Program, is covered. (ASTIS)

530

**Factors affecting the persistence of stranded oil on low energy coasts /** Owens, E.H.

(Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 359-365, ill., maps)

References.

*ASTIS document number 162043.*

Mechanical dispersion by waves is usually considered to be the primary factor that controls the persistence of spilled oil reaching the coast. ... Rapid shoreline changes can occur in areas of low wave energy, so wave energy levels cannot be used alone as an indicator of oil persistence. Sections of the North American Beaufort Sea coast are undergoing net long term changes on the order of 10 meters per year, despite the short (3 Month) open water season and the small fetch areas. ... Rates of shoreline changes can be used as an indicator to estimate the residence time of stranded oil, irrespective of the shoreline character or the wave energy levels at the shoreline. Wave energy levels alone are an inadequate basis for estimating the residence time of stranded oil. (Au)

531

**Shoreline experiments and the persistence of oil on arctic beaches** / Owens, E.H. Harper, J.R. Foggt, C.R. Robson, W.

(Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 261-268, ill.)

References.

*ASTIS document number 170895.*

Experiments associated with the oiling of beaches in an arctic environment show that fetch and wave-energy conditions at the shoreline are primary factors in determining the persistence of stranded oil. Five intertidal sections of coast were oiled, each of which differed in terms of shoreline exposure and fetch. ... On the most exposed beach (fetch 90 kilometers) all oil was removed naturally after 80 days of exposure to open-water conditions. At a semi-exposed location, 85 to 95 percent of the oil was removed within 40 days, and at the most sheltered test sites (fetch less than 2 km) between 5 and 30 percent of the oil remained after an observation period of 160 open-water days. ... In this relatively low-energy wave climate environment, with an open-water season of about 60 days, most exposed beaches would be cleaned naturally to levels less than 500 milligrams/kilogram within 100 days, but where the fetch is less than 10 to 25 km the expected persistence of oil stranded in the intertidal zone could be greater than 10 years. (Au)

532

**Spill impacts and shoreline cleanup operations on arctic and sub-arctic coasts** / Owens, E.H. Robilliard, G.A.

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 305-309, ill.)

References.

*ASTIS document number 162019.*

Spill response operations in ice-infested or Arctic environments must take into account environmental factors or constraints that are not applicable in more temperate climates. In particular, the potential impact of oil on biological habitats or communities must be evaluated carefully in terms of species distributions and populations abundance at the time of a spill. The potential natural recovery from spilled oil is reduced because of the modifying effects of ice on mechanical (wave) processes at the shoreline. Stranded oil is likely to persist longer because of reduced thermal and mechanical energy levels and would, therefore, have a longer potential adverse effect on biological communities. Environmental conditions may constrain operational response in areas of ice-infested waters or of low temperatures. ... The development of spill response decisions in Arctic regions must focus on (1) the necessity for cleanup versus natural recovery, (2) assigning priorities for the protection and/or cleanup of specific sections of coast, and (3) consideration of logistic or other operational constraints resulting from climatic conditions. (Au)

See also: 304, 340, 743.

**PALLISTER RESOURCE MANAGEMENT LTD.**

See: 35, 401.

**PANARCTIC OILS LTD.**

See: 88, 89, 90, 564, 565.

**PAPLAWSKY, W.J.**

See: 541.

**PARASHAR, S.K.**

533

**Detection and monitoring of oil pollution in the ice environment through microwave techniques** / Parashar, S.K. Dawe, B.R. Worsfold, R.D.

St. John's, Newfoundland : C-CORE, 1978.

19p. ; 28cm.

(C-CORE publication, no. 78- 12)

Cover title.

Preprint for Fifth Canadian Symposium on Remote Sensing, Victoria, B.C., August 28-31, 1978.

Bibliography: p.16-19.

*ASTIS document number 12211.*

ACU, NFSMO

... The results show that the presence of oil on and in the top surface of ice is more likely to be detected through the identification of subtle changes in the tone and texture as possibly produced by increased melting of oil covered areas in comparison with oil-free areas. ... The situations where the use of microwave techniques are more likely to succeed than others in detecting oil are identified. The situations where the possibility of a false alarm exists are outlined. (Au)

See also: 199, 474, 475, 577, 664, 745.

**PARSONS, J.**

534

**Preliminary observations on the effect of Bunker C fuel oil on seals on the Scotian Shelf** / Parsons, J. Spry, J. Austin, T.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 193-202, ill.)

References.

*ASTIS document number 169730.*

OON

... this study was initiated to monitor mortality and extent of oiling of marine mammals after the wreck of the Kurdistan and to determine both the direct and indirect effects of Bunker C oil. The survey and study effort was directed primarily at two commonly occurring species of seal, the harbour seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*). The study region encompassed all areas which were hit by oil that had leaked from the Kurdistan. ... (Au)

**PARSONS, T.R.**

535

**Marine biological impacts** / Parsons, T.R. Beaufort Sea Environmental Assessment Panel [Sponsor].

[S.l. : s.n.], 1982.

19 p. ; 28 cm.

(Beaufort E.I.S. technical specialist report)

*ASTIS document number 108626.*

ACU

The author addresses specific inadequacies in the Beaufort E.I.S. with respect to marine biological impacts of hydrocarbon development in the Beaufort Sea. He feels that by far the most serious risk to the environment is the large oil spill or blowout, and this, as well as the potential chronic build-up of hydrocarbons from minor spills, formation and production waters, etc. must be evaluated for likely damage. To this end the author outlines specific deficiencies of information within the E.I.S. (ASTIS)

PATERSON, S.

See: 416, 419, 675.

PATTEN, B.G.

536

**Sublethal biological effects of petroleum hydrocarbon exposures : fish / Patten, B.G.**

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 319-335)

References.

ASTIS document number 169412.

ACU

The objective of this review is to present information on the behavioral and physiological responses of marine fishes to petroleum hydrocarbons at sublethal concentrations. Of major concern are marine species indigenous to arctic and subarctic waters; since this information is meager, data on organisms from other geographic environments will be included to demonstrate effects that may generally relate to a variety of species. (Au)

PATTEN, L.R.

See: 538, 539.

PATTEN, S.M.

537

**Effects of petroleum exposure on hatching success of Alaskan glaucous-winged gulls (Larus glaucescens) on Egg Island, Copper River Delta / Patten, S.M.**

(Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976. Vol. III, p. 149-152)

Volume published 1977.

ASTIS document number 173517.

ACU

... We are examining the effects of North Slope Crude Oil exposure on breeding success of the Glaucous-winged Gull, a common inshore and marine scavenger nesting in colonies. We are examining the largest gull colony in the MEGOA, Egg Island, which is located 10 km SE of Point Whithed and 20 km south of Cordova (60 23 N, 145 46 W). ... Oiling of eggs has been carried out during the 1976 breeding season. Onset of incubation was late May and incubation continued far beyond the normal period until mid-July in oiled clutches. [Nearly complete mortality was reported]. ... (Au)

538

**Effects of petroleum exposure on the breeding ecology of the Gulf of Alaska herring gull group (Larus argentatus x Larus glaucescens) and reproductive ecology of large gulls in the northeast Gulf of Alaska / Patten, S.M.**

Patten, L.R.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 151-309. ill., maps)

(NTIS PB80-130065, p. 151-309. ill., maps)

References.

ASTIS document number 176052.

ACU

This report is an investigation of primary and potential secondary effects of gas and oil development on large gulls (Larus) in the northeast Gulf of Alaska. Our research objectives are: to determine threshold levels of petroleum exposure effects to gull reproduction under field conditions; to test alteration of incubation behavior and ability to produce second (replacement) clutches following experimental mortality due to petroleum exposure; to analyze gull population ecology in order to determine factors influencing "normal" (e.g. control) reproductive success in other colonies in the northeast Gulf of Alaska; and to continue analysis of the previous data base on the reproductive ecology of large gulls in the northeast Gulf of Alaska. (Au)

539

**Evolution, pathobiology, and breeding ecology of large gulls (Larus) in the northeast Gulf of Alaska, and, Effects of petroleum exposure on the breeding ecology of gulls and kittiwakes / Patten, S.M. Patten, L.R. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 18 : Biological studies, [1982], p. 1-352, ill., maps)

References.

ASTIS document number 167916.

ACU

... This report provides information on the evolution, breeding ecology, disease aspects, and effects of petroleum exposure on the breeding ecology of the Gulf of Alaska Herring Gull group (Larus argentatus x Larus glaucescens), with supporting information on the effects of petroleum exposure on the reproductive productivity of Black-legged Kittiwakes (Rissa tridactyla). ... Future development in coastal Alaska, particularly in fisheries and petrochemical industries, will increase genetic contact between Larus populations and assist in the survival of hybrid forms in disturbed environments. ... Very small amounts (20 microliters) of North Slope Crude Oil exposure to gull eggs in the field, at early stages of incubation, lead to high embryonic mortality. ... The combination of high egg mortality and alteration of adult behavior virtually eliminates gull reproduction in experimental areas. ... while oil spills have a potentially depressing effect on gull reproduction, the net result of increased human development in coastal Alaska will be expanding populations of large gulls, with distinctly negative implications. (Au)

PATUREAU, J.P.

See: 321.

PAUL, A.J.

See: 247, 248, 648, 651.

PAUL, P.A.

See: 744.

PAYNE, J.R.

540

Multivariate analysis of petroleum hydrocarbon weathering in the subarctic marine environment / Payne, J.R.

Kirstein, B.E. McNabb, G.D. Lambach, J.L.  
de Oliveira, C. Jordan, R.E. Hom, W.

(Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 423-434, ill.)

References.

ASTIS document number 161985.

... A three-year oil weathering study of Prudhoe Bay crude oil has been completed under ambient subarctic conditions at the National Oceanic and Atmospheric Administration's lower Cook Inlet field laboratory in Kasitsna Bay, Alaska. Quantitative data from outdoor wave-tank and flow-through aquaria systems were collected on seasonal and time-series measurements of compositional changes in the oil and water column due to evaporation, dissolution, and water-in-oil emulsification, as well as alterations in rheological properties of the slick. These data are used for mathematical model development and verification of computer-predicted oil weathering behavior from a variety of spill scenarios. The oil-weathering mathematical models developed in this program are based on measured physical properties data, and they generate material balances for both specific compounds and pseudo-compounds (distillation cuts) in crude oil. These models are applicable to open-ocean oil spills, spills in estuaries and lagoons where the water column is finite, and spills on land. The oil weathering processes included in the mathematical model are evaporation, dispersion of oil into the water column, dissolution, water-in-oil emulsification (mousse formation), and oil slick spreading. ... (Au)

541

Multivariate analysis of petroleum weathering in the marine environment : sub arctic / Payne, J.R. Kirstein, B.E.

Jordan, R.E. McNabb, G.D. Lambach, J.L.  
Frydrych, M. Paplowsky, W.J. Smith, G.S.  
Mankiewicz, P.J. Redding, R.T. Baxter,

D.M. Spenger, R.E. Shokes, R.F. Maiero,  
D.J. United States. Bureau of Land Management  
[Sponsor].

Juneau, Alaska : U.S. National Oceanic & Atmospheric Administration, Office of Marine Pollution Assessment, Alaska Office, 1981.

ca. 521 p. : ill. ; 29 cm.

Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. III : Effects of contaminants)

References.

Bibliography: p. 377-383.

ASTIS document number 168130.

ACU

The purpose of this program has been to investigate the physical and chemical changes which occur to spilled petroleum in the marine environment .... Among the processes being examined and quantified are: evaporation, dissolution, microbial oxidation, photochemical oxidation, emulsification (mousse formation), adsorption onto particulate material, and the influence of a commercial dispersant on these processes. ... Ultimately, the goal of this program is to generate a ... model to simulate and predict spilled petroleum behavior as a result of physical/chemical weathering. ... (Au)

542

Multivariate analysis of petroleum weathering in the marine environment : sub arctic. Volume I : technical results /

Payne, J.R. Kirstein, B.E. McNabb, G.D.  
Lambach, J.L. Redding, R.T. Jordan, R.E.  
Hom, W. de Oliveira, C. Smith, G.S.  
Baxter, D.M. Gaegel, R. United States. Minerals  
Management Service [Sponsor].

Juneau, Alaska : U.S. National Oceanic and Atmospheric Administration, Ocean Assessments Division, 1984.

ca. 600 p. (various pagings) : ill., maps ; 28 cm.

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 21, February 1984)

Appendices comprise Volume II of this report and are contained in: Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Volume 22, February 1984.

References.

At head of title: Outer Continental Shelf Environmental Assessment Program.

ASTIS document number 168467.

ACU

When fresh crude oil and/or refined petroleum products are released to the marine environment, they are immediately subject to a wide variety of chemical and physical alterations. ... Among the processes examined and quantified [in this paper] are: evaporation, dispersion of whole oil droplets, dissolution of specific aromatics, microbial oxidation, emulsification (mousse formation), and adsorption onto suspended particulate material. Our investigations have been designed to provide qualitative and quantitative information on the rates of loss and fates of specific compounds and "pseudo-compounds" during oceanic weathering. Ultimately, the final product or objective of this program has been to generate a combined component-specific and pseudo-component (boiling point or "distillation cut") model to simulate and predict spilled petroleum behavior as a result of physical/chemical weathering. ... (Au)

543

Multivariate analysis of petroleum weathering in the marine environment : sub arctic. Volume II : appendices / Payne,

J.R. Kirstein, B.E. McNabb, G.D. Lambach,  
J.L. Redding, R.T. Jordan, R.E. Hom, W.  
de Oliveira, C. Smith, G.S. Baxter, D.M.  
Gaegel, R. United States. Minerals Management  
Service [Sponsor].

Juneau, Alaska : U.S. National Oceanic and Atmospheric Administration, Ocean Assessments Division, 1984.

ca. 160 p. (various pagings) : ill. ; 28 cm.

(Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 22, February 1984)

The appendices comprising this volume refer to: Vol. I : Technical results, in: Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Volume 21, February 1984.

References.

At head of title: Outer Continental Shelf Environmental Assessment Program.

ASTIS document number 168475.

ACU

The Appendices contained in this volume (II) are an integral component of the Oil Weathering Program Final Report [Volume I]. They document the complete Oil Weathering Model Computer Code; contain the Oil Weathering Model User's Manual; provide detailed descriptions of analytical methods not otherwise covered in Volume I, and present the results of X-ray diffraction



analyses on selected SPM samples and the analyses of subtidal sediments examined in support of another NOAA research unit. ... (Au)

See also: 343.

## PEAKALL, D.B.

544

**Endocrine dysfunction in seabirds caused by ingested oil /**  
Peakall, D.B. Tremblay, J. Kinter, W.B.  
Miller, D.S.

(Environmental research, v. 24, no. 1, Feb. 1981, p. 6-14, ill.)  
References.

ASTIS document number 170259.

ACU

In laboratory and field experiments, a single oral dose (0.1-1.0 ml) of certain [i.e., South Louisiana and Prudhoe Bay] crude oils or aromatic fractions caused elevated plasma corticosterone and thyroxine levels in nestling herring gulls and black guillemots. In gulls, plasma corticosterone levels were elevated within 1 day after dosing; the maximal effect was observed after 4 days (about 50% higher than control levels) and levels returned to control values after 2 weeks. Thyroxine levels did not increase until 6 days after dosing and they remained elevated after 2 weeks. Since only those oils which reduced seabird growth rates affected hormone levels, the data suggest that disruption of endocrine balance is one underlying cause of depressed growth in oil-dosed birds. (Au)

545

**A hazard assessment of chemically dispersed oil spills and seabirds : a novel approach /** Peakall, D.B. Wells, P.G. Mackay, D.

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 78-90, ill.)

References.

ASTIS document number 170844.

ACU

Seabirds as individuals and often as populations are vulnerable to oil pollution, as recently reemphasized by several Canadian impact assessment documents on the Beaufort Sea, Lancaster Sound and Hibernia Field, and reviews .... This assessment of the hazard of dispersed oil to seabirds integrates our knowledge of both aspects of hazard; that is exposure (in this case governed by the dispersion process, the exposure regimes on the surface and below, and the behavior of two types of feeding seabirds) and toxicity (governed by the oil, the dispersant and the exposure time). In this paper, the consequences of using dispersants at oil spills to protect seabirds is critically evaluated. (Au)

546

**The sublethal effects of oil and dispersants on seabirds /**  
Peakall, D.B. Gilman, A.P.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 182-189)

References.

ASTIS document number 174874.

ACU

The Canadian Wildlife Service work on seabirds and the effects of oil and oil plus dispersants on them has been carried out to provide a rational framework for decision-making when faced with an oil spill in Canadian waters, either at sea or inland. First, CWS has

put considerable effort into determining the numbers, distribution and population dynamics of seabirds. ... Information of this sort is of great importance when we attempt to assess the potential impact of hypothetical or real oil spills. For example, many species of seabirds, breeding in the Arctic, nest in huge colonies in only a few locations. ... The second thrust of CWS research on seabirds and oil has been directed toward determining the effects of oil and oil dispersant on the birds and their eggs. (Au)

547

**Toxicity of Prudhoe Bay crude oil and its aromatic fractions to nestling herring gulls /** Peakall, D.B. Hallett, D.J. Bend, J.R. Foureman, G.L. Miller, D.S.

(Environmental research, v. 27, no. 1, Feb. 1982, p. 206-215, ill.)

References.

ASTIS document number 170305.

ACU

The physiological effects of a single ingested dose of Prudhoe Bay crude oil (PBC), its aromatic fractions, and PBC/Clorexil emulsion were studied in nestling herring gulls (*Larus argentatus*). The data showed that the high-molecular-weight aromatic compounds were responsible for retardation of growth and increases in adrenal and nasal gland weight. Little difference was found between PBC and the PBC/Clorexil emulsion although the latter did have a somewhat more marked effect on plasma sodium levels. (Au)

548

**Weight loss of herring gulls exposed to oil and oil emulsion /**  
Peakall, D.B. Jeffrey, D.A. Miller, D.S.

(Ambio, v. 14, no. 2, 1985, p. 108-110, ill. (some col.))

References.

ASTIS document number 170291.

ACU, NSDB

... In this study we have examined the combined stress [to nestling herring gulls (*Larus argentatus*)], of exposure to oil or oil/dispersant emulsion and lack of food. ... Experimentals were given by intubation either a single dose of 1 ml Prudhoe Bay Crude Oil (PBCO) or 1 ml dispersant (Corexit 9527) or a 10:1 (by volume) PBCO/dispersant emulsion; controls were sham dosed. ... The effects of a single oral dose of oil, dispersant or emulsion on the rate of weight loss of food-stressed fledgling gulls are shown .... Experimentals were given by intubation either a single dose of 1 ml Prudhoe Bay Crude Oil (PBCO) or 1 ml dispersant (Corexit 9527) weight loss of gulls given oil was significantly greater than that of controls (26.2 percent of initial weight compared to 18.0 percent in controls.) The weight loss of birds given emulsion was not significantly different from that of birds given oil alone; nor were those given dispersant alone significantly different from controls. ... (Au)

See also: 367, 368, 371, 375, 376, 480, 695.

## PEARSON, J.D.

549

**Sublethal effects : effects on sea grass /** Pearson, J.D.

United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 377-383)

References.

ASTIS document number 169633.

ACU

The focus of this study is an evaluation of selected volatile petroleum hydrocarbons on photosynthesis in the marine plant

*Zostera marina*. The import of this study arises from the fact that in many Alaskan marine communities, *Z. marina* is the major contributor to primary productivity. [This annual report records no conclusions for 1976 because the entire experimental sample was lost in transit.] (Au)

PEARSON, W.H.

See: 522.

PEASE, C.H.

See: 267.

PELLA, J.J.

See: 493, 494.

PELTO, M.J.

See: 442.

PERCY, J.A.

550

Arctic marine ecosystems and oil pollution / Percy, J.A. (Circumpolar Conference on Northern Ecology : proceedings, Ottawa, 1975. - Ottawa : National Research Council of Canada, [1975], p. II- 87-II 98, ill.)

References.

ASTIS document number 175684.

ACU

... The present paper concerns itself chiefly with the direct impact of crude oil upon marine invertebrates. Emphasis is placed upon sublethal effects that although difficult to detect and interpret are nevertheless of greater ecological significance over the long-term than the more readily observable rapid mortality at high oil concentrations. An attempt is made to synthesize presently available data on oil effects and to interpret it in both an ecosystem and an Arctic context. Glaring inadequacies in our present knowledge and possible future directions of research are pin-pointed and briefly discussed. (Au)

551

Effects of chronic exposure to petroleum upon the growth and molting of juveniles of the arctic marine isopod crustacean *Mesidotea entomon* / Percy, J.A.

Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 650-656, ill.)

References.

ASTIS document number 172910.

ACU

Juveniles of the benthic marine isopod *Mesidotea entomon* were chronically exposed to different concentrations of water-soluble fractions of fresh and weathered Norman Wells crude oil and of fresh Pembina crude for 160 d. The 100% extracts contained 1.72, 1.12, and 0.56 ppm of oil (determined fluorimetrically), respectively. Most of the animals completed five or six molts before the end of the experiment. Long-term mortality was high in the 100% extracts of the oils (LT50 = 17, 17, and 41 d, for Norman Wells, Pembina, and weathered Norman Wells, respectively) but most of the animals molted at least once before dying. None of the deaths occurred in conjunction with the molt. Stimulation of the onset of the

subsequent molt occurred in some exposure groups. A significant increase in the duration of the intermolt period only occurred at the highest oil concentrations. Effects on growth were slight at concentrations lower than that which is lethal during chronic exposure. Exposure to fresh Norman Wells crude depressed growth slightly, while Pembina crude slightly stimulated growth. Weathered Norman Wells severely inhibited growth at the highest concentration but stimulated growth slightly at lower concentrations. (Au)

552

Effects of crude oil on arctic marine invertebrates / Percy, J.A.

(Marine ecology : Mackenzie Delta and Tuktoyaktuk Peninsula. - [S.l.] : Environmental-Social Committee Northern Pipelines, 1974. Task Force on Northern Oil Development (Canada) report, no. 74- 22, p. 31-99, ill.)

References.

ASTIS document number 179400.

ACU

... This study is designed to yield information about potentially harmful interactions between some of the dominant marine invertebrates found in shallow coastal waters in the vicinity of the MacKenzie Delta, and Arctic crude oil. Two Arctic crude oils have been utilized, one from Norman Wells and the other from the Atkinson Point Well, located on the Tuktoyaktuk Peninsula adjacent to the study area. A sample of Venezuelan crude (an oil that has received considerable study regarding its biological impact) has recently been obtained and used for comparative purposes in some experiments. ... Arctic marine invertebrates vary considerably in their tolerance of crude oils. Benthic species are generally tolerant of high concentrations of seawater soluble components of the oil. Indications are that planktonic species may be more sensitive and are killed at low to moderate concentrations of the oil. ... The overall general effect of a major oil spill will probably be the selective elimination of sensitive species from the habitat coupled with an increase in numbers of the more tolerant species as competition decreases. The natural balance of the ecosystem will probably not be re-established for several years. (Au)

553

Effects of crude oil on the locomotory activity of arctic marine invertebrates / Percy, J.A. Mullin, T.C.

(Marine pollution bulletin, v. 8, no. 2, Feb. 1977, p. 35-40, ill.)

References.

ASTIS document number 174890.

ACU, NSDB

The effects of exposure to seawater dispersions of northern crude oils on the locomotory activity of two Arctic marine invertebrates, the amphipod *Onisimus finis* and the coelenterate *Halitholus cirratus* have been examined. Low concentrations of the oils significantly impair activity in both species. The ecological implications of such sublethal effects may be important. (Au)

554

Effects of crude oils on Arctic marine invertebrates / Percy, J.A. Mullin, T.C.

Victoria, B.C. : Beaufort Sea Project, Dept. of the Environment, 1975.

iv, 167p. : ill., graphs, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 11)

(APOA project no. 72 : Beaufort Sea Environment Program. Report, no. 11)

Bibliography: p.115-122.

ASTIS document number 30279.

ACU, NFSMO

... This study addresses itself primarily to the question of just how

susceptible certain invertebrate components of the marine inshore ecosystem are to significant disruption by oil pollution. ... Oil-animal interactions in three distinct habitats are considered, namely, the sub-ice, the neritic and the benthic habitats. Biological effects of three general types are examined; short term lethal effects, sublethal physiological effects and sublethal behavioral effects. Considerable variability in the responses of different species occurred in all three categories. ... Behavioral studies were carried out to investigate the responses of several species to the presence of crude oil masses, crude oil tainted food and crude oil contaminated sediment. None of the species examined were attracted by the oil. ... Possible long-term ecological consequences of these behavioral responses are discussed in detail. (Au)

555

Effects of dispersed crude oil upon the respiratory metabolism of an arctic marine amphipod, *Onisimus* (*Boekisimus*) [sic] *affinis* / Percy, J.A.

(Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 192-200, ill.)

References.

ASTIS document number 175021.

ACU

Short-term lethality is an unsuitable criterion for assessing the ecological effects of pollutants. A variety of sublethal physiological effects may impair an organism's ability to function normally and lead to a reduction or elimination of sensitive populations in a polluted area. The effects of exposure to sublethal concentrations of dispersed crude oils upon the respiratory metabolism of a marine amphipod have been examined. At low oil concentrations metabolism is significantly depressed but with increasing concentration a reversal of the response occurs. A possible explanation for this complex response is presented. The effects of other factors, such as oil type, presence of dispersants, nutritional state of the animals and weathering of the oil, upon the metabolic response are also considered. (Au)

556

Effects of oil on arctic marine organisms: a review of studies conducted by the Arctic Biological Station / Percy, J.A.

[S.l.] : [s.n.], 1977.

24 p. : ill. ; 28 cm.

(International Council for the Exploration of the Sea. Fisheries Improvement Committee, C.M. 1977/E: 26)

References.

ASTIS document number 179450.

NSDB

Studies carried out by the Arctic Biological Station as part of the Beaufort Sea Project are briefly reviewed. Lethal and sublethal effects of northern crude oils on seals, invertebrates, phytoplankton, seaweeds and bacteria, and the petroleum biodegradation potential of the marine microbial flora are discussed. (Au)

557

Effects of petroleum in polar marine environments / Percy, J.A. Wells, P.G.

(Marine technology society journal, v. 18, no. 3, 1984, p. 51-61, ill., map)

References.

ASTIS document number 178535.

NSDB

The potential for oil pollution of the Arctic Ocean has grown steadily in recent decades as petroleum exploration has expanded

and moved from the land into coastal waters. Wide-ranging impact assessment studies have provided much useful information about the direct effects of petroleum hydrocarbons on marine organisms. However, impacts at the population and community levels are more uncertain because of the rudimentary state of knowledge of the structure and dynamics of polar marine ecosystems. Indications are that, in general, impacts in the Arctic will be more severe than in other regions. There is no evidence though that polar species are any more sensitive to petroleum hydrocarbons than comparable temperate ones. However, unique ice-associated habitats are important to many species and these habitats are very vulnerable to oil contamination. The difficulty of removing oil from ice-infested waters and the reduced rates of weathering and biodegradation at low temperatures will also undoubtedly result in longer exposure of populations to greater concentrations of toxic hydrocarbons than normally occurs in warmer ice-free waters. Furthermore, the recovery of polar marine populations is likely to be prolonged as a consequence of low fecundity, dispersal and growth rate. (Au)

558

Effects on polar environments / Percy, J.A.

[S.l.] : [s.n.], 1981.

74 p.

Working paper for National Academy of Sciences Workshop on Petroleum in the Marine Environment.

Document not seen by ASTIS.

ASTIS document number 180696.

559

Oil and arctic marine invertebrates / Percy, J.A.

(Oil and the Canadian environment : Proceedings of the Conference, 16 May, 1973, sponsored by the Institute of Environmental Sciences and Engineering, University of Toronto / Edited by D. Mackay and W. Harrison. - Toronto : Institute of Environmental Sciences and Engineering, 1973, p. 71-74)

References.

ASTIS document number 179418.

ACU

Recent developments in the Canadian Arctic have made it increasingly clear that our present understanding of both short- and long-term consequences of oil pollution upon Arctic marine ecosystems is far from adequate. The present research program is designed to gain some insight into the direct effects of oil on the marine estuarine fauna of the Western Arctic. Acute and chronic toxicity determinations are being conducted to pinpoint particularly sensitive species. Effects of sublethal concentrations of both emulsified oil and seawater soluble components on feeding, growth and metabolism of selected species are being investigated. ... (Au)

560

Responses of arctic marine benthic crustaceans to sediments contaminated with crude oil / Percy, J.A.

(Environmental pollution, v. 13, no. 1, May 1977, p. 1-10)

References.

ASTIS document number 172731.

ACU, NSDB

The responses of several arctic marine benthic crustaceans to sediments experimentally contaminated with crude oils have been examined. The amphipod *Onisimus affinis* overwhelmingly selected clean rather than oil-contaminated sediments. The response was most pronounced at low oil concentrations and the ability to discriminate was abolished at the highest concentrations tested. Weathering of the oiled sediment for 1 week reduced the avoidance response. Another amphipod and two isopod species tested did not discriminate consistently between oiled and clean sediments. Potential ecological consequences of these behavioural responses are discussed. (Au)

561

**Responses of arctic marine crustaceans to crude oil and oil-tainted food / Percy, J.A.**

(Environmental pollution, v. 10, no. 2, Feb. 1976, p. 155-162)

References.

*ASTIS document number 172758.*

ACU, NSDB

The responses of several arctic marine crustaceans to oil masses and oil-tainted food have been investigated. None of the species were attracted to crude oil. Amphipods tended to avoid oil masses; however, the response was significantly diminished if the oil was weathered or if the animals were pre-exposed to light crude oil emulsions. Untainted food was preferentially selected over oil-tainted food. In contrast, an isopod was generally neutral to the presence of oil masses and consumed oil-tainted food as readily as untainted material. (Au)

See also: 732.

**PERKINS, G.**

See: 409.

**PETERSEN, H.K.**

562

**Fate and effect of bunker C oil spilled by the USNS Potomac in Melville Bay - Greenland - 1977 / Petersen, H.K.**

(The proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 1, p. 331-343, ill.)

(NTIS AD-A-072 859, p. 331-343, ill.)

References.

*ASTIS document number 84255.*

ACU

On August 5, 1977, 380 tons of Bunker C fuel oil were spilled in Melville Bay, off Northwest Greenland. Studies of its fate and effects were conducted shortly after the spill occurred. The primary weathering mechanisms were evaporation and dissolution. Alkanes up to n-C17, and substituted naphthalenes, were depleted as much as 50 to 100 percent after 15 days of weathering. Tar flakes were observed sinking into the water column 10 days after the spill. Increased values of petroleum hydrocarbons in the water column were found in the immediate vicinity of the spill. Microbial degradation of the oil did not occur during the first two weeks. No immediate effect on the zooplankton was observed, but ingested oil was found in copepods and amphipods. No oiled birds and seals were observed, but oiled seals have been reported by local hunters. Oil from the seals has been analysed, and the oil might be identical to the oil spilled from the POTOMAC. (Au)

**PETERSON, E.B.**

See: 102.

**PETRO-CANADA**

See: 36, 38, 404, 687.

**PETRO-CANADA EXPLORATION INC.**

See: 42.

**PHILLIPS, C.R.**

See: 163.

**PHILOGENE, B.J.R.**

See: 367.

**PISTRUZAK, W.M.**

See: 118, 119, 156, 207.

**PIVOVAROV, S.V.**

See: 209, 210.

**PLATT, H.M.**

563

**Analysis of aliphatic and aromatic hydrocarbons in antarctic marine sediment layers / Platt, H.M. Mackie, P.R.**

(Nature, v.280, no.5723, Aug. 16, 1979, p. 576-578, ill.)

References.

*ASTIS document number 178276.*

ACU, NSDB

... With mineral resources being depleted in more accessible areas, those of remote regions (including polar ones) are being considered. But little is yet known of the effects that near-zero temperatures may have on the rate of biochemical or chemical alteration of hydrocarbons such as those found in petroleum. We report here our attempt to test the 'combustion source hypothesis' and to investigate the fate of hydrocarbons in sediments from a remote sub-Antarctic island with a well-documented history of localised industry pollution spanning the period 1904-65. Only very minor local inputs of pollutant hydrocarbons are likely to have occurred either side of these dates. ... (Au)

**PLURITEC CONSULTANTS**

564

**Jackson Bay, Ellef Ringnes Island, N.W.T. : baseline, environmental and resource data on flora, fauna, sediments and soils / Pluritec Consultants. Panarctic Oils Ltd.**

s.l. : Pluritec, 1975.

174 leaves : ill., figures, col. photos. tables ; 29cm.

Prepared for Panarctic Oils Ltd.

References and bibliography: p.143-174.

*ASTIS document number 42447.*

ACPO

The main objective ... was to gather baseline environmental and resource data on fauna, flora, sediments and soils in or utilizing the Jackson Bay area of Ellef Ringnes Island, N.W.T. The areas most likely to be affected by the drifting of an oil slick were determined and a study site, believed to be representative of these areas was selected. (Au)

565

**Jackson Bay, Ellef Ringnes Island, N.W.T. : oil and ice interaction / Pluritec Consultants. Panarctic Oils Ltd. [Sponsor].**

s.l. : Pluritec, 1975.

84 leaves : ill., figures ; 29cm.

Bibliography: p.60-84.

*ASTIS document number 42439.*

ACPO

A study to evaluate the possible environmental impact of an oil spill in Jackson Bay, with particular emphasis on the interactions between the sea ice and the oil. (ASTIS)

**POBLETE, B.**

See: 712.

**POLAR CONTINENTAL SHELF PROJECT (CANADA)**

See: 744.

**POTTER, S.G.**

See: 120.

**PRITCHARD, R.S.**

566

**Pollutant behavior, trajectories, and issues analyses / Pritchard, R.S. [Editor].**

(Proceedings of a synthesis meeting : Beaufort Sea, Sale 71 : synthesis report : Chena Hot Springs, Alaska, April 21-23, 1981 / Edited by D.W. Norton, W.M. Sackinger, J.G. Strauch, Jr. and E.A. Strauch. - Juneau, Alaska : Outer Continental Shelf Environmental Assessment Program, 1981, p. 137-154, maps)

References.

Contents: Behavior of spilled oil under different conditions / R.S. Pritchard. - Sediment resuspension, lateral transport and depocenters / A.S. Naidu and R.S. Pritchard. - Issue analyses / R.S. Redburn.

*ASTIS document number 169773.*

ACU

[This paper discusses the fate and behaviour of oil spills in and under sea ice at Harrison Bay]. ... scenarios of the fate and behavior were developed for 12 conditions. These conditions depended upon the size of the spill (40,000-50,000 barrels per day for 5 or 90 days), the location of the spill (under fast ice, deforming unmoving ice, or moving ice), and on season (at the start of freeze-up on 1 November or the start of breakup at 31 May). ... (Au)

567

**Transport and behavior of a Prudhoe Bay oil spill / Pritchard, R.S.**

(Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 103-109)

References.

*ASTIS document number 175188.*

ACU

The objective of the work discussed here is to determine the locations to which oil spilled in or under the ice cover near Prudhoe Bay, Alaska, would be transported, and to determine the behavior of the oil as the ice cover moves and deforms. The work is part of the Outer Continental Shelf Environmental Assessment Program (OCSEAP) and is being done by Flow Research Company in conjunction with Arctec, Incorporated and CRREL. Arctec is conducting laboratory experiments to determine how oil spreads under sea ice and how oil is incorporated into this ice. The CRREL research consists of field studies to determine the ice thickness profile, and therefore, bottom contour relief which will entrap oil. Two separate tasks have been undertaken by Flow Research Company. The first task is to determine a range of velocity fields which might be taken by the ice cover on the Continental Shelf of the Beaufort and Chukchi Seas by numerical modeling and synthesis of the results from manned and drifting stations. ... As part of this task, major breakouts of ice from the Chukchi into the Northern Bering Sea are being analyzed. The second task is for the overall management of the program as well as determining the likely trajectories and destination points of oil in twelve hypothetical scenarios by combining the relevant information obtained. (Au)

See also: 178, 179, 257.

**PURVES, W.**

568

**The interaction of crude oil and natural gas with first-year sea ice / Purses, W.**

(Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 12- 1- 12- 2)

*ASTIS document number 181641.*

ACU

In the event of an oilwell blowout beneath sea ice, oil and gas will collect in undulations under the ice sheet. ... With gas pocketed in the under-ice relief it is likely that oil will spread in quite a thin layer at the gas-water interface. The behaviour of oil and gas entrained within a growing ice sheet is unknown. In particular, the details of the potential release of these fluids to the surface through brine-drainage channels requires investigation. [Laboratory work has been initiated, but results are not available to date (1978)]. (Au)

**PURVES, W.F.**

See: 28, 29, 30, 176.

**RAHIMTULA, A.D.**

See: 371.

**RAMSEIER, R.O.**

569

**Oil pollution in ice-infested waters / Ramseier, R.O.**

(International Symposium on Identification and Measurement of Environmental Pollutants, Ottawa, Ontario, Canada, 14, 15, 16, 17 June, 1971. - Ottawa : National Research Council of Canada, 1971, p. 271-276. ill., map)

References.

*ASTIS document number 180424.*

## ACU

Two case studies of the behaviour of oil in ice-infested arctic waters are presented. The first deals with an accidental spill of Arctic diesel oil at Deception Bay, Hudson Strait. The second is concerned with the oil spill test program conducted by the U.S. Coast Guard in which North Slope crude oil was used. Comparative clean-up estimates based on past experience are presented for hypothetical oil spills in the Arctic in heavily ice-infested waters. [The 1970 Arrow spill in Chedabucto Bay, Nova Scotia is also discussed in the report]. (Au)

570

Oil spill at Deception Bay, Hudson Strait / Ramseier, R.O.  
(Arctic circular, v. 21, no. 1, 1971, p. 22-27)

Document not seen by ASTIS. Citation from AB.

ASTIS document number 171476.

ACU

Reports preliminary results of an investigation into the circumstances of this major oil spill, June 6, 1970. A slush avalanche destroyed an oil storage tank farm and swept almost 1/2 mill. galls of oil and gas on to shore-fast and sea ice. Much of the oil was retained under the ice, the rest being distributed in the ice itself, in puddles, on the ice, and in cracks and leads. The geomorphology of the location and the unusual snow and meltwater conditions causing the avalanche are described. Methods for dispersal of the oil pollution are outlined. (Au)

571

Oil spill at Deception Bay, Hudson Strait / Ramseier, R.O.  
Gantcheff, G.S. Colby, L.

Ottawa : Department of the Environment. Inland Waters  
Directorate, 1973.

60 p.

(Scientific series - Inland Waters Directorate, no. 29)

Document not seen by ASTIS.

ASTIS document number 181218.

572

Possible fate of oil in the Arctic Basin / Ramseier, R.O.  
(Proceedings : First World Congress on Water Resources,  
Chicago, 24-28 September, 1973, p. 58-70, maps)

References.

ASTIS document number 182303.

OON

This article reviews the research into the fate of oil in the Arctic Basin, including a projected increase in sea ice melting resulting in climatic changes. Marine transportation of oil and storage terminals are presented as potential causes of marine oil spills. Movement of oil into the Beaufort Gyre and Transpolar Drift Stream is discussed. (Au)

See also: 351.

RAUW, C.I.

See: 196.

REDDEN, G.D.

See: 366.

REDDING, R.T.

See: 541, 542, 543.

REICHERT, W.L.

See: 433, 437.

REID, B.

See: 650.

REIDY, S.K.

See: 638.

REIMER, E.M.

573

Anticipated oil dispersion rates in pack ice / Reimer, E.M.  
(Proceedings - 1981 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : March 2-5, 1981, Atlanta,  
Georgia. - Washington, D.C. : American Petroleum  
Institute, 1981, p. 199-201, ill., maps)

(C-CORE publication, no. 80- 20)

References.

ASTIS document number 166057.

As petroleum exploration and transportation systems move into increasingly difficult operating environments such as the Labrador Sea, there is a need for more sophisticated oil spill countermeasures and for new cleanup technology. The design of countermeasure systems compatible with pack ice conditions cannot be undertaken without some preliminary investigation of oil interactions with ice and, perhaps more crucially, without an estimate of oil dispersion processes in moving pack ice. The characterization of dispersion processes is complicated by seasonal and geographic variations in the physical and dynamic nature of the Labrador ice pack. Nevertheless, on the basis of field observations over the past two winters, it has been possible to generate order-of-magnitude estimates of the probable dispersion and mixing processes. These processes are low compared with open water dispersion processes. (Au)

574

Aspects of oil-ice interaction subsequent to the Kurdistan spill / Reimer, E.M.

(Oil, ice and gas : proceedings of a workshop held in  
Toronto, Canada, October 10 and 11, 1979 / Edited by  
D. Mackay and S. Paterson. - Toronto : University of  
Toronto Institute for Environmental Studies, [1979], p.  
75-86, ill., maps)

References.

ASTIS document number 175200.

ACU

... The break-up of the tanker Kurdistan in the Cabot Strait in March of 1979 resulted in extensive bunker C oil contamination of the local pack ice. Contaminated ice along the southeastern Cap Breton shore was intensively studied by a team of observers from C-CORE. The following observations provide a synoptic review of the predominant oil-ice interactions which were recorded. ... (Au)

575

**Oil in pack ice : the Kurdistan spill / Reimer, E.M.**  
(Proceedings of the Arctic Marine Oil Spill Program  
Technical Seminar, June 3-5, 1980, Edmonton, Alberta. -  
Ottawa : Environmental Protection Service, 1980, p.  
529-547, ill., maps)

References.

*ASTIS document number 174572.*

ACU

This paper discusses the 1979 Kurdistan oil spill in Cabot Strait, and the scientific response to the opportunity for oil in ice field research. Petroleum physical properties and distribution are outlined and loading estimates are given. Effects on shorelines are covered, and the implications of the spill for the Labrador Sea and Davis Strait are discussed. (ASTIS)

576

**The visual identification of Bunker-C oil in dynamic pack ice / Reimer, E.M.**

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 74-85, ill.)

*ASTIS document number 169668.*

OON

Subsequent to the Kurdistan oil spill, an unknown amount of Bunker-C oil was entrained in pack ice off the southeast Cape Breton shore in a variety of visually distinctive forms. The visual features associated with oil contamination were in many cases similar to features arising from other phenomena such as organic detritus in and on the ice. These similarities can frequently cause problems in the identification and tracking of oil in ice. As the result of a two-week period of aerial reconnaissance and observation (March 27-April 7) [this] catalogue of visual features has been compiled. ... (Au)

REIMNITZ, E.

See: 78, 79.

## REMOTEC APPLICATIONS

577

**The use of satellite imagery for tracking the Kurdistan oil spill / Remotec Applications.** Dawe, B.R.

Parashar, S.K. Ryan, J.P. Worsfold, R.D.

Canada. Environmental Emergency Branch [Sponsor].

Ottawa : Environmental Protection Service, Dept. of the Environment, 1981.

x, 31 p. : figures (some col.), tables ; 28 cm.

(Technology development report, EPS 4-EC-81- 6)

ISBN 0-662-11851-0.

References.

*ASTIS document number 94803.*

ACU

... Detailed in the report, are the satellite data available, theoretical reviews concerning the detection of oil from satellites, methodology used in the project, and results obtained. LANDSAT data which were analysed revealed images of the oil located on ice in the Gabarouse Bay area. Enhancement of these images was performed by various methods. Oil slicks on the water were not found on either LANDSAT or TIROS-N imagery. It was not shown whether this was due to low sun angle, poor spatial resolution or absence of oil during satellite overpasses. (Au)

See also: 664.

REQUEJO, A.

See: 107.

REY, L.

578

**The Arctic Ocean : the hydrographic environment and the fate of pollutants / Rey, L. [Editor].** Stonehouse, B. [Editor].

London : Macmillan, 1982.

x, 433 p. : ill., maps ; 24 cm.

Includes indexes.

References.

*ASTIS document number 178594.*

ACU, NSDB

This collection of conference papers deals with various aspects of the oceanography, climatology, and pollution of the Arctic Ocean. Interactions between ocean, ice, and atmosphere are covered, as well as the transport of air pollutants and the effects of oil spills in the Arctic Ocean and the Baltic Sea. (ASTIS)

RICE, S.D.

579

**Acute and chronic toxicity, uptake and depuration, and sublethal metabolic response of Alaskan marine organisms to petroleum hydrocarbons / Rice, S.D. Karinen, J.F.**  
(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 8 : Effects of contaminants, p. 25-47)

(NTIS PB-261 407, p. 25-47)

References.

*ASTIS document number 175846.*

ACU

This study was designed to determine the acute and chronic toxicity of crude oil and its component fractions on physiological and behavioral mechanisms of selected arctic and subarctic organisms and to determine recovery rates of selected organisms in laboratory and field studies. ... It involved physiological bioassay tests of applied research on species indigenous to the Gulf of Alaska, Bering Sea, and Beaufort Sea. ... Specific Objectives and Studies: (1) Determine acute toxicity of previously untested species such as amphipods, mysids, sandlances, and others. (2) Determine acute toxicity at different temperatures with several species such as scallops, pink salmon, and shrimp. (3) Determine the chronic toxicity to shrimp and herring eggs and the effects of oil on newly extruded eggs of crabs. (4) Determine the uptake and depuration of oil components for previously untested species. (5) Determine the effect of temperature on oil component uptake and depuration. (6) Determine the effect of oil on metabolic rate of fish and invertebrates. (7) Determine the effect of oil on scallop growth and behavior. (8) Determine the effect of oil on crab autotomy response. (9) Determine histopathology effects of oil using routine histology, enzyme histochemistry, and electron microscopy. (Au)

580

**Acute and chronic toxicity, uptake and depuration, and sublethal response of Alaska marine organisms to petroleum hydrocarbons / Rice, S.D. Karinen, J.F. Korn, S.**

(Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado: NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 11-24)

(NTIS PB-288 935, p. 11-24)

Document not seen by ASTIS.

ASTIS document number 181234.

581

Acute toxicity and uptake-depuration studies with Cook Inlet crude oil, Prudhoe Bay crude oil, No. 2 fuel oil, and several subarctic marine organisms / Rice, S.D.

Short, J.W. Brodersen, C.C. Mecklenburg, T.A.

Moles, D.A. Misch, C.J. Cheatham, D.L.

Karinen, J.F.

Auke Bay, Alaska: Northwest Fisheries Center Auke Bay Fisheries Laboratory, 1976.

viii, 90 p.: ill.; 28 cm.

At head of title: Northwest Fisheries Center Auke Bay Fisheries Laboratory Processed Report.

References.

ASTIS document number 177555.

NSDB(O.S.BIB.)

This report provides the results of a laboratory study of the effects of petroleum hydrocarbons on selected Alaskan fish and shellfish. ... Primary objectives were: To determine the acute toxicity of Cook Inlet and Prudhoe Bay crude oils and fuel oil to various life stages and species of fish and shellfish found in Kachemak Bay. To determine the rate and degree of uptake and depuration of hydrocarbons by these fish and shellfish when they were exposed to sublethal concentrations of the water-soluble fractions of Cook Inlet crude oil. To compare our results to published literature to determine to what degree, if any, Alaskan fish and shellfish differ from species in other areas in their response to oil contamination. Secondary objectives included the identification and determination of oil concentrations causing some sublethal behavioral and physiological effects in selected Alaska fish and shellfish. (Au)

582

Effect of petroleum hydrocarbons on breathing and coughing rates, and hydrocarbon uptake-depuration in pink salmon fry / Rice, S.D. Thomas, R.E. Short, J.W.

(Environmental assessment of the Alaskan continental shelf: Principal investigators reports for the year ending March 1976. Vol. 8: Effects of contaminants, p. 89-118)

References.

ASTIS document number 175862.

ACU

Pink salmon fry, *Oncorhynchus gorbusha*, were exposed to the water-soluble fraction of Cook Inlet and Prudhoe Bay crude oils, and No. 2 fuel oil [at the Northwest Fisheries Center Auke Bay Laboratory.] Concentrations of oil in water were measured by ultraviolet and infrared spectroscopy. Breathing and coughing rates were measured in free swimming fry without anesthesia or surgery. During 22 h exposures, breathing and coughing rates initially increased as the dose increased but then decreased after several hours. Breathing and coughing rates increased significantly during exposures to oil concentrations as low as 30% of the 96 h median tolerance limit as determined by ultraviolet spectroscopy. ... Tissues of fry exposed for up to 96 h to the water-soluble fraction of Cook Inlet crude oil were analyzed by gas chromatography for nonpolar hydrocarbons. Toxic aromatic hydrocarbons were accumulated but were apparently being eliminated from the tissues during the exposures. We speculate that the increased respiration rate reflects an increased energy demand for enzyme synthesis. Chronic exposure requiring elevated energy demands may be detrimental to the survival of a population. (Au)

583

The effect of Prudhoe Bay crude oil on survival and growth: eggs, alevins, and fry of pink salmon, *Oncorhynchus gorbusha* / Rice, S.D. Moles, D.A. Short, J.W. (Proceedings of the Conference on Prevention and Control of Oil Pollution, San Francisco, California, 1975, p. 503-507, ill)

References.

ASTIS document number 177580.

NSDB

Standard 96-hour bioassays with "total" oil solutions in fresh water and seawater determined differences in sensitivity of the developing life stages of pink salmon (*Oncorhynchus gorbusha*). Eggs were the most resistant and emergent fry (yolk sac absorbed) the most sensitive to acute 4-day exposures. In fresh water, the 96-hour median tolerance limit (TLM) of fry was 0.4 ml oil/liter mixed mechanically (12 ppm as measured in subsurface water by infrared spectrophotometry). In seawater, it was 0.04 ml oil/liter mixed mechanically (6 ppm as measured in subsurface water by infrared spectrophotometry). Three life stages of alevins were exposed to 10-day sublethal exposures of the water-soluble fraction to determine what doses might affect growth. Growth was affected most severely in alevins exposed during later developmental stages. Decreased growth was observed in fry after 10 day exposures at the lowest dose tested - 0.075 ml oil/liter mixed by water agitation (0.73 ppm in subsurface water by infrared spectrophotometry - less than 10% of the 96-hour TLM limit for that life stage). In fresh water, susceptibility of early life history stages of pink salmon to oil pollution is great at the time of emergence (completion of yolk absorption). Susceptibility is even greater in seawater after fry migration. (Au)

584

Effects of oiled sediment on juvenile king crab / Rice, S.D. Karinen, J.F. Brodersen, C.C. United States. Minerals Management Service [Sponsor].

(Outer Continental Shelf Environmental Assessment Program: Final reports of principal investigators. Vol. 29, January 1985, p. 287-310, ill.)

References.

ASTIS document number 168971.

ACU

... Juvenile king crab (*Paralithodes camtschatica*) were exposed to the water-soluble fraction of Cook Inlet crude oil (flow-through, stable concentrations for 30 days) or to oiled sediments for 3 months. The higher exposure concentrations of the water-soluble fraction were toxic and affected survival, growth, feeding rate, and scope for growth. Adverse effects were visible in just a few days. In contrast, the oiled sediments did not cause any measurable adverse effects on survival, feeding rate, growth, molting success, or scope for growth during the 3-month exposure, including those crabs exposed to the highest concentration--2%. Aromatic hydrocarbons were detected in some tissues of the crabs, including the crabs exposed to oiled sediment. ... (Au)

585

Effects of petroleum hydrocarbons on Alaskan aquatic organisms: a comprehensive review of all oil-effects research on Alaskan fish and invertebrates conducted by the Auke Bay Laboratory, 1970-81 / Rice, S.D. Moles, D.A. Karinen, J.F. Korn, S. Carls, M.G. Brodersen, C.C. Gharret, J.A. Babcock, M.M. United States. Minerals Management Service [Sponsor].

(Outer Continental Shelf Environmental Assessment Program: Final reports of principal investigators. Vol. 29, January 1985, p. 311-427, ill.)

Appendices.



# References.

ASTIS document number 169153.

ACU

This report summarizes all the research on effects of oil on Alaskan organisms conducted by the Auke Bay Laboratory from the first study in 1970 through 1981. Most of the research was conducted in the laboratory. The report includes all the major findings from 62 studies, regardless of funding source. Emphasis in earlier years was on short-term toxicity of crude oil to fish and invertebrates. More recently, most of the studies have been long term and have determined sublethal effects of crude oil and its components on fish and invertebrates. Several field studies were conducted at the Trans-Alaska Pipeline System terminal at Port Valdez, Alaska, to determine the effects of effluent from the ballast-water treatment plant on the marine environment. We also evaluated the toxicity of drilling muds to several species of crustacean larvae found in Alaska. ... (Au)

586

**Lethal and sublethal effects on selected Alaskan marine species after acute and long-term exposure to oil and oil components / Rice, S.D. Korn, S. Karinen, J.F.**  
United States. Bureau of Land Management  
[Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 1-12)

# References.

ASTIS document number 168254.

ACU

The research was addressed to the question: Are arctic organisms more sensitive to oil than subarctic animals. To answer this, we first determined the sensitivity of six benthic arctic animals (2 fish, 4 invertebrates) to oil and oil components and compared results with previously generated sensitivity data with subarctic animals. Second, we determined the effect of temperature on the sensitivity of arctic animals to oil and their ability to acclimate to temperature change. ... results indicate little difference in sensitivity of arctic and subarctic animals to oil. ... [However] the arctic habitat is probably more vulnerable, and once changed, less able to adjust, even though individual species are generally very hearty and tolerant of natural environmental extremes and limited amounts of pollution. (Au)

587

**Lethal and sublethal effects on selected Alaskan marine species after acute and long-term exposure to oil and oil components / Rice, S.D. Korn, S. Karinen, J.F.**  
United States. Bureau of Land Management  
[Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 61-78)

# References.

ASTIS document number 169170.

ACU

This report consists of an Annual Report that summarizes status and programs for FY 80 [fiscal year 1980] studies, followed by a Quarterly Report summarizing status of FY 81 studies. The OCSEAP research ... addressed the general question, "What are the effects of petroleum hydrocarbons on subarctic animals?" All of our studies are applied laboratory studies, where we expose a variety of marine species and life stages, to determine survival and effects of short and long-term exposures to water-soluble fractions of oil. Our methodology includes flow-through exposures and quantitation of individual hydrocarbons by gas chromatography. We had two major objectives in FY 80: (1) to determine the vulnerability of pink

salmon alevins exposed to oil in a simulated intertidal spawning environment. (2) to synthesize and publish results of previous OCSEAP research. ... (Au)

588

**Lethal and sublethal effects on selected Alaskan marine species after acute and long-term exposure to oil and oil components / Rice, S.D. Korn, S. Karinen, J.F.**  
United States. Bureau of Land Management  
[Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 27-59)

# References.

ASTIS document number 169790.

ACU

The research is addressed to the general question, "What are the effects of petroleum hydrocarbons on arctic and subarctic biota"? It involves physiological and bioassay tests of applied research on species indigenous to the Gulf of Alaska, Bering Sea, and Beaufort Sea. ... Our studies can be broken down into two basic themes. (1) toxicity challenge experiments, where we attempt to identify sensitive species, life stages, factors that affect toxicity, or components that are most responsible for toxicity, and (2) sublethal physiological response, where we attempt to identify, measure, and characterize physiological responses that are indicative of oil stress. ... (Au)

589

**Prudhoe Bay oil toxicity and avoidance behavior in pink salmon fry / Rice, S.D. Smith, C.W.**

(Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 51)

Abstract only.

ASTIS document number 175919.

ACU

There is virtually no published information on the toxicity of Prudhoe Bay crude oil to sub-arctic species or information concerning the effects of oil on salmon or other fishes. Oil pollution may have a deleterious effect on the migration patterns of salmon even at sublethal levels. Experiments were conducted at the Fisheries Service, Auke Bay Fisheries Laboratory to measure the acute toxicity of Prudhoe Bay crude oil to pink salmon fry in fresh-water and seawater and to relate those oil concentrations to the oil concentrations that pink salmon fry will avoid. The 96-hour TLM's for pink salmon fry in freshwater was 0.1 ml of oil/l and in seawater 0.24 ml of oil/l. Pink salmon fry in seawater appear to be slightly more tolerant of oil than their fresh-water counterparts, and the fry in seawater avoided lower sublethal doses of oil than the fry in freshwater. The avoidance behavior exhibited was quite dramatic and implies that pink salmon fry emigration patterns could be affected by sublethal levels of Prudhoe Bay crude oil in the water. (Au)

590

**A review of oil toxicity studies conducted at the Auke Bay laboratory / Rice, S.D.**

(Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977: Sea grant report (College), 77- 8, p. 111-113)

(NTIS PB-277 060, p. 111-113)

# References.

**ASTIS document number 177342.**  
**NSDB**

[The National Marine Fisheries Service Auke Bay Laboratory] ... has been involved in oil toxicity research since about 1971, but not significantly until after the state held the Kachemak Bay Oil Lease Sale in December 1973. ... Generally, we have found the Alaskan species to be more sensitive to oil than animal sensitivities reported in the literature, but probably because of the temperature differences used in the exposures. Temperature changes may affect an animal's ability to metabolize and excrete toxic hydrocarbons. However, the toxic components persist in oil-water solutions longer at colder temperatures, because losses through volatility and biodegradation are less than at higher temperatures. Our research efforts on oil effects have several facets, and are described in the references [which make up the bulk of this brief paper]. ... Although each of our publications has specific conclusions, the two most significant general conclusions are: 1. We have generally found crustacean larvae to be the most sensitive life stage, especially when molting. 2. Alaskan species may be more vulnerable to oil than species from warmer waters, since colder temperatures cause toxic aromatics to persist longer. Temperature effects on oil toxicity and animal sensitivity are complex and warrant further study. (ASTIS)

**591**

**Sensitivity of 39 Alaskan marine species to Cook Inlet crude oil and no. 2 fuel oil / Rice, S.D. Moles, A.**  
 Taylor, T.L. Karinen, J.F.

(Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 549-554, ill.)

References.

**ASTIS document number 177601.**  
**NSDB**

The sensitivities of 39 subarctic Alaskan species of marine fish and invertebrates to water-soluble fractions of Cook Inlet crude oil and No. 2 fuel were determined. This is the largest group of animals ever tested under similar test conditions with the same petroleum oils and analytical methods. Organisms bioassayed represent several habitats, six phyla, and 39 species including fish (9), arthropods (9), molluscs (13), echinoderms (4), annelids (2), and nemertean (2). ... Although sensitivity generally increased from lower invertebrates to higher invertebrates, and from higher invertebrates to fish, sensitivity was better correlated to habitat. Pelagic fish and shrimp were the most sensitive animals to Cook Inlet crude oil with 96-h median tolerance limits (TLM's) from 1-3 mg/l total aromatic hydrocarbons. Benthic animals, including fish, crabs, and scallops were moderately tolerant (TLM's to Cook Inlet crude oil of 3-8 mg/l total aromatic hydrocarbons). Intertidal animals, including fish, crabs, and starfish, and many molluscs, were the most tolerant forms to water-soluble fraction of petroleum (TLM's greater than 8-12 mg/l of total aromatic hydrocarbons). Most of the intertidal animals were not killed by static oil exposures. No. 2 fuel oil was more toxic to most species than Cook Inlet crude oil. Sensitive pelagic animals are not necessarily more vulnerable to oil spills than tolerant intertidal forms - oil may damage intertidal environments more easily and adverse effects may persist longer than in damaged pelagic environments. (Au)

**592**

**Toxicity and avoidance tests with Prudhoe Bay oil and pink salmon fry / Rice, S.D.**

(Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13-15, 1973, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1973, p. 667-670, ill.)

References.

**ASTIS document number 175072.**  
**ACU**

With the potential of oil pollution harming Alaska's marine resources, experiments were conducted at the National Marine Fisheries Service, Auke Bay Fisheries Laboratory to determine concentrations of Prudhoe Bay crude oil that are acutely toxic to pink salmon fry in fresh water and seawater and also the concentrations of this oil that the fry would avoid. Observed 96-hour TLM values were 88 mg of oil/liter of water in fresh water and 213 mg/liter in seawater in June and 110 mg/liter in seawater in August. Among fry held in seawater, older fry were more susceptible to oil toxicity than younger fry and older fry were also more sensitive in their detection and avoidance of oil; older fry in seawater avoided oil concentrations as low as 1.6 mg of oil/liter of water. The avoidance of oil by salmon fry was quite apparent and suggests that there is potential for oil pollution to change their migration behavior. (Au)

**593**

**Toxicity of ballast-water treatment effluent to marine**

**organisms at Port Valdez, Alaska / Rice, S.D. Korn, S. Brodersen, C.C. Lindsay, S.A. Andrews, S.A.**

(Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 55-61)

References.

**ASTIS document number 161977.**

Approximately 12 million gallons of oily ballast water is taken ashore and treated daily at the Alyeska treatment plant, where tankers take on crude oil at the terminus of the Trans Alaska pipeline near Valdez, Alaska. Most oil is removed, but some light aromatic hydrocarbons (1 to 16 parts per million) remain in the large volume of discharged effluent. Between May and July, concentration of aromatic hydrocarbons in the treated effluent (measured by gas chromatography) generally declined as seasonal temperatures increased. We measured the toxicity of the effluent on site at Valdez. For the larvae of crustaceans and of fish the median lethal concentration LC50 was between 10 and 20 percent of treated effluent in 96-hour static tests. For salmon fry and shrimp in repeated acute flow-through assays, the (LC50) was quite consistent, between 20 and 40 percent of treated effluent. Because the concentration of aromatic hydrocarbons was much lower in the later tests but the toxicity of the effluent was not lower, toxicants other than aromatic hydrocarbons must contribute significantly to the toxicity of the effluent from the ballast-water treatment plant. (Au)

**594**

**Toxicity of Cook Inlet crude oil and No. 2 fuel oil to several Alaskan marine fishes and invertebrates / Rice, S.D.**

Short, J.W. Karinen, J.F.

(Sources, effects and sinks of hydrocarbons in the aquatic environment : proceedings of the symposium, American University, Washington, D.C. - Washington, D.C. : American Institute of Biological Sciences, 1976, p. 395-406)

References.

**ASTIS document number 178438.**

**OON**

We used a 96-hour static bioassay method to determine the TLM's (median tolerance levels) of 27 different invertebrate and vertebrate Alaskan marine species exposed to WSF's (water-soluble fractions) of Cook Inlet crude oil and No. 2 fuel oil. Concentrations of oil in the exposure doses of the WSF's were determined by infrared spectrophotometry. The two different oils were about equally toxic, No. 2 fuel oil being somewhat more toxic than the Cook Inlet crude oil to some of the species. Fish were consistently among the more sensitive species with 96-hour TLM's from 0.81 to 2.94 ppm. Some invertebrates were as sensitive as fish, while others were quite resistant. Intertidal invertebrates were consistently among the most

resistant species. It appears that Alaskan marine species may be slightly more sensitive than similar species residing in more temperate regions. However, the differences in observed sensitivity may be due to the greater toxicity of oil at lower temperatures (because of greater persistence of hydrocarbons) rather than to actual increases in the sensitivity of the animals. (Au)

See also: 110, 161, 347, 359, 472, 473, 488, 489, 682, 683.

#### RICHARDSON, P.

595

**ABSORB tests oil/ice interaction** / Richardson, P.  
(Alaska construction & oil. v. 21, no. 5, May 1980, p. 18-20, ill.)

ASTIS document number 44253.

ACU, NFSMO

This article describes various experiments conducted by the Alaskan Beaufort Sea Oilspill Response Body (ABSORB) last winter at Prudhoe Bay. Two major objectives were to measure the growth rate of ice formed beneath oil injected under an existing ice cover and to analyze any changes in the chemical makeup of spilled oil after a winter's entrapment. (ASTIS)

#### RICHARDSON, W.J.

See: 399.

#### RILEY, R.G.

596

**Changes in the volatile hydrocarbon content of Prudhoe Bay crude oil treated under different simulated weathering conditions** / Riley, R.G. Thomas, B.L. Anderson, J.W. Bean, R.M.

(Marine environmental research, v. 4, no. 2, 1980-1981, p. 109-119, ill.)

References.

ASTIS document number 178306.

OON, NSDB

Changes have been determined in the concentrations of volatile saturate and aromatic hydrocarbons in Prudhoe Bay Crude Oil (PBC) weathered under three different simulated environmental conditions. A combination of light and water sprayed upon the surface of the oil produced the largest relative decreases in volatile saturate and most aromatic hydrocarbons. After 24 days, detectable amounts of monoaromatic hydrocarbons were absent in all three weathered oils, as were the saturate hydrocarbons from C8 to C10. Retention of aromatic hydrocarbons appeared to be related to molecular weight, as enrichments of triaromatics (phenanthrenes) were observed in weathered PBC relative to the original crude oil. These data are discussed with respect to effects resulting from spilled oil impacting benthic organisms residing in intertidal and shallow subtidal communities. (Au)

See also: 24, 25, 26.

#### ROBERTSON, B.R.

597

**Hydrocarbon biodegradation** / Robertson, B.R. Arhelger, S.D. Law, R.A.T. Button, D.K.  
(Environmental studies of Port Valdez / Edited by D.W.

Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska, Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 449-479, ill., map)

References.

ASTIS document number 178470.

ACU

An assessment of biodegradation rates in Port Valdez is presented in response to the suggestion that the inlet may receive an increased hydrocarbon load from the proposed pipeline. Techniques developed and used in this study were based on results obtained earlier in Cook Inlet (Kinney et al. 1969), at which time hydrocarbon biodegradation was not widely recognized as an important marine oil removal mechanism .... Information obtained during the Cook Inlet study led to the development of two new techniques for estimating potential biodegradation rates. Slicks on water samples quickly dispersed when agitated with seawater containing populations of hydrocarbon-oxidizing organisms, but this was not the case when sterile water was used. An estimate of the indigenous hydrocarbon-oxidizing population was made by observing how large a volume of seawater was necessary to contain sufficient organisms to initiate the biodegradation process. Since biodegradation appeared to occur in the water column, this process was studied by introducing radioactive oil and measuring the rate of resulting metabolic product formation. A general estimate was thus made of the hydrocarbon-oxidizing microflora population in Port Valdez and the rate at which it can be expected to metabolize oil. ... (Au)

598

**Hydrocarbon biodegradation in Alaskan waters** / Robertson, B.R. Arhelger, S.D. Kinney, P.J. Button, D.K.

(The microbial degradation of oil pollutants : workshop held at Georgia State University, Atlanta, December 1972 / Edited by D.G. Ahearn and S.P. Meyers. - Baton Rouge, La. : Louisiana State University, 1973. Center for Wetland Resources publication no. LSU-SG-73- 01, p. 171-184, ill., map)

(NTIS AD-760 716, p. 171-184, ill., map)

References.

ASTIS document number 175242.

ACU

Populations of hydrocarbon-oxidizing organisms were of the order of 1/cc in Alaska's Cook Inlet and Port Valdez, less in the Arctic Ocean. Distribution decreased with salinity in Cook Inlet and with depth in Port Valdez. In situ oxidation of 14C-dodecane (91 micro m C/liter) started within hours and proceeded at a rate of 1 micro m/liter-day. Storage of Cook Inlet crude oil for four years in sea water at 10 C effected removal of most visible components. Mixing had a major effect on oil slick stability. The solubilization process was little affected by added silt, a major component of many Alaskan estuaries. Isolated organisms had unique preferences for various components of kerosene, emulsified crude oil and responded in a normal way to incubation temperature, Ea 14.5 to 16 Kcal/mole. Some effects of crude oil inhibition are discussed. Calculations show that motility, particularly in combination with chemotaxis, is necessary for rapid slick inoculation. (Au)

See also: 43.

#### ROBILLIARD, G.A.

599

**Need for real world assessment of the environmental effects of oil spills in ice-infested marine environments** / Robilliard, G.A. Busdosh, M.  
(POAC 81 : the Sixth International Conference on Port and

Ocean Engineering under Arctic Conditions, Quebec, Canada, July 27-31, 1981, proceedings. - Quebec City : Universite Laval, 1981, v. 2, p. 937-944, ill.)

References.

ASTIS document number 167843.

ACU

The increase in oil-related activities in the arctic will result in one or more significant oil spills in ice-infested marine waters. These spills will probably be persistent and difficult to contain or clean up. ... The rate and time scale of oil degradation and impacts seem to be longer in the arctic, primarily due to the cold. However, for at least some macro-invertebrates, biological processes ... seem to take longer so the overall consequences are probably similar in all marine environments. With the increase in the oil exploration activities in arctic regions ... increased effort must be placed on documenting the "real world" impact of oil spills in arctic waters. ... (Au)

600

**Oil spill protection and cleanup countermeasures on arctic shorelines : are they biologically necessary? / Robilliard, G.A.**

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 325-330)

References.

ASTIS document number 131083.

NFSMO

[This paper shows oil spill countermeasures on shorelines in the Arctic may not be appropriate in most areas or during most of the year.] ... Oil spill countermeasures on shorelines may be appropriate in a few areas, primarily wetlands in river mouths and deltas during the open water season and the ice-edge of some polynyas or shoreleads during the ice-cover season. The major reason for shoreline cleanup of large amounts of spilled oil would be to prevent the oil from being moved offshore and contaminating potentially sensitive areas. Otherwise, the substantial costs that would be tied up in manpower, equipment and materials in anticipation of oil spill cleanup anywhere along hundreds to thousands of miles of biologically non-sensitive arctic coastline could be better spent in applied research to determine if even the wetlands or ice-edge communities are "biologically sensitive", as defined previously, to a significant oil spill. As important as knowing where the biologically sensitive resources are is knowing when they are present. One the one hand, most habitats will be present year round. The exception is the ice-edge shoreline of polynyas and shoreleads which may be considered seasonal; it is effectively not present in the open water season. On the other hand, many species, especially birds and fish in the river deltas and wetlands, are not present except for a few weeks, usually in the ice-free season. During the rest of the year, the area may not be considered biologically sensitive and may require no shoreline countermeasures in an oil spill. ... (Au)

See also: 304, 532.

**ROBISCH, P.A.**

See: 434.

**ROBSON, W.**

See: 525, 528, 531.

**ROCHE, C.**

See: 475.

**ROESIJADI, G.**

601

**Bioavailability of naphthalenes from marine sediments**

**artificially contaminated with Prudhoe Bay crude oil / Roesijadi, G. Woodruff, D.L. Anderson, J.W.**  
(Environmental pollution, v. 15, no. 3, Mar. 1978, p. 223-229)

References.

ASTIS document number 172723.

ACU, NSDB

Uptake of naphthalenes from sand and detritus contaminated with Prudhoe Bay crude oil was examined in the detritivorous clam *Macoma inquinata*. Concentrations of naphthalenes were determined by ultraviolet spectrophotometry and the use of radiolabelled 14C-2-methylnaphthalene. Exposure of *M. inquinata* to contaminated sediments indicated that uptake of naphthalenes as a result of consumption of sediment was insignificant. However, naphthalenes which were released from sediment to the surrounding water were available for uptake by the clams. Our results were consistent with the results of other studies which examined bioavailability of naphthalenes from oil-contaminated sediments. (Au)

602

**Uptake of hydrocarbons from marine sediments contaminated with Prudhoe Bay crude oil : influence of feeding type of test species and availability of polycyclic aromatic hydrocarbons / Roesijadi, G. Anderson, J.W. Blaylock, J.W.**

(Recovery potential of oiled marine northern environments. Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 608-614, tables)

Paper presented at Symposium on Recovery Potential of Oiled Marine Northern Environments held at Halifax, Nova Scotia, October 10-14, 1977.

References.

ASTIS document number 5851.

ACU

Selected benthic animals were exposed to marine sediments contaminated with Prudhoe Bay crude oil, and uptake of hydrocarbons was monitored under various experimental schemes. When uptake of aliphatic and diaromatic hydrocarbons by two deposit feeders, *Macoma inquinata* and *Phascolosoma agassizii*, was compared with that of a suspension feeder, *Protothaca staminea*, we found that the deposit feeders generally accumulated hydrocarbons to a greater extent than the suspension feeder. However, other factors, such as the intrinsic capabilities of species to accumulate hydrocarbons, also played an important role in the extent of contamination. ... Concentration factors for uptake from sediment were <- 0.2, while those for uptake from seawater were 10-1349. Additionally, the heavier molecular weight aromatic compounds tended to be more concentrated in tissue and retained for longer periods of time than the lighter compounds. (Au)

**RONNING, O.I.**

See: 632.

# ROOTS, T.

See: 177.

## ROSENBERG, D.M.

603

**Effect of crude oil on zoobenthos colonization of artificial substrates in subarctic ecosystems / Rosenberg, D.M.**  
Snow, N.B.

(Verhandlungen - Internationale Vereinigung für Theoretische und angewandte Limnologie, v. 19, 1975, p.2172-2177)

References.

*ASTIS document number 177571.*

NSDB

In 1972 we began investigating the use of basket-type artificial substrates treated with Norman Wells crude oil as a possible method of studying the effects of crude oil on zoobenthos. Hopefully, the method would be useful in predicting the effects of crude oil on a whole ecosystem basis. This would then provide a rapid, inexpensive method of studying the effects on zoobenthos of potential ecosystem contamination resulting from the construction, operation, and maintenance of gas and oil pipelines in the Canadian North. During the 1973 open-water season, the experiments begun in 1972 and reported in Brunskill et al. (1973) were repeated to confirm the effect of crude oil on the colonization by zoobenthos of artificial substrates. (Au)

## ROSENEGGER, L.W.

504

**The movement of oil under sea ice / Rosenegger, L.W.**  
Victoria, B.C. : Beaufort Sea Project, 1975.

81p. : ill., figures, tables, charts ; 28cm.

(Technical report - Beaufort Sea Project, no. 28)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 28)

Appendices.

Bibliography: p.20-23.

*ASTIS document number 15490.*

ACU, NFSMO

This report presents the results of laboratory tests to determine the interfacial tension and motion of crude oil bubbles under sea ice. ... An assessment has also been made of: a) the ability of oil to penetrate sea ice from beneath, b) the equilibrium thickness of a crude oil film on water under arctic conditions, and c) the redistribution of solutes in the oil. (Au)

605

**Oil-in-ice studies : progress report / Rosenegger, L.W.**

Calgary, Alta. : Imperial Oil Ltd., Production Research and Technical Service Laboratory, 1975.

27 p. : ill. ; 28 cm.

(Laboratory report - Imperial Oil Limited, no. L- 12075)

Appendix.

References.

*ASTIS document number 178217.*

The present report is in partial fulfilment of a contract to investigate the movement of oil under sea ice awarded to Imperial Oil Ltd. by the Frozen Sea Research Group, Ocean and Aquatic Affairs, Environment Canada. This work is part of the Beaufort Sea Project (Oil in Ice Studies program G2) and is meant to provide details on the surface tension, movement and absorption of oil at the sea ice/water interface. The terms of reference of this project ... can be summarized as follows: A. Investigate the

interfacial tension, movement and/or absorption of sessile drops at the ice/water interface. B. Investigate the movement of the leading edge of an oil film and oil penetration into a growing ice sheet. Progress to date on the first part of the study is reported herein. The study of the sessile drops will be continued along with the investigation of the movement of the leading edge of an oil film. ... (Au)

## ROSS, S.L.

606

**Countermeasures for oil spills in Canadian Arctic waters : the Arctic Marine Oilspill Program / Ross, S.L.**

Ottawa : Canadian Arctic Resources Committee, 1980.

4p. ; 36cm.

(Arctic seas bulletin, v. 2, no. 7, July 1980)

Excerpts from a paper prepared for the Arctic Marine Oilspill Seminar, Edmonton, 3-5 June, 1980.

*ASTIS document number 46566.*

ACU, NSDB

This short report describes the history and activities of AMOP. Details of five projects involving the experimental spilling of oil in a variety of Arctic marine environments are discussed. (ASTIS)

## ROUBAL, G.

607

**Use of 14C radiolabelled hydrocarbon spiked crude oil to assess oil biodegradation potential in the Beaufort Sea / Roubal, G. Atlas, R.M.**

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1977, p. 275)

Abstract only.

Alternate title: Use of carbon-14 radiolabelled hydrocarbon spiked crude oil to assess oil biodegradation potential in the Beaufort Sea.

*ASTIS document number 176842.*

Ice, water and sediment samples collected in the Beaufort Sea during winter and summer 1976 were incubated with Prudhoe crude oil spiked with 14C radiolabelled hexadecane and pristane. 14CO2 produced was trapped and quantitated during 2 months of incubation at 5 C, as an indicator of hydrocarbon biodegradation potential. Use of spiked oil is advantageous because cometabolic or sparing effects can be detected and because available radiolabelled hydrocarbons are maintained in liquid state even at low temperatures. In winter hydrocarbon biodegradation potentials were equal for sediment and water under ice samples; approximately 1% of added 14C hydrocarbon was converted to 14CO2 during 2 months. Surface ice samples averaged 75% less 14CO2 production than water or sediment; 50% of the ice samples showed negligible hydrocarbon biodegradation potential. Hydrocarbon biodegradation potentials in summer were surprisingly less than 20% of comparable winter water and sediment samples. Numbers of enumerable hydrocarbon degrading microorganisms did not show significant correlation with hydrocarbon biodegradation potentials. Of the total heterotrophs, hydrocarbon degraders averaged 0.1% in water and 1% in sediment in summer samples and 0.2% in water and 0.03% in sediment in winter samples. (Au)

## ROUBAL, G.E.

608

**Distribution of hydrocarbon-utilizing microorganisms and hydrocarbon biodegradation potentials in Alaskan continental shelf areas / Roubal, G.E. Atlas, R.M.**

(Applied and environmental microbiology, v. 35, no. 5, May 1978, p. 897-905, ill., maps)

## References.

ASTIS document number 178543.

ACU, NSDB

Hydrocarbon-utilizing microorganisms were enumerated from Alaskan continental shelf areas by using plate counts and a new most-probable-number procedure based on mineralization of <sup>14</sup>C-labeled hydrocarbons. Hydrocarbon utilizers were ubiquitously distributed, with no significant overall concentration differences between sampling regions or between surface water and sediment samples. There were, however, significant seasonal differences in numbers of hydrocarbon utilizers. Distribution of hydrocarbon utilizers within Cook Inlet was positively correlated with occurrence of hydrocarbons in the environment. Hydrocarbon biodegradation potentials were measured by using <sup>14</sup>C-radiolabeled hydrocarbon-spiked crude oil. There was no significant correlation between numbers of hydrocarbon utilizers and hydrocarbon biodegradation potentials. The biodegradation potentials showed large seasonal variations in the Beaufort Sea, probably due to seasonal depletion of available nutrients. Non-nutrient-limited biodegradation potentials followed the order hexadecane > naphthalene >> pristane > benzantracene. In Cook Inlet, biodegradation potentials for hexadecane and naphthalene were dependent on availability of inorganic nutrients. Biodegradation potentials for pristane and benzantracene were restricted, probably by resistance to attack by available enzymes in the indigenous population. (Au)

609

Hydrocarbon biodegradation in Cook Inlet, Alaska / Roubal, G.E. Atlas, R.M.

(Proceedings of the Thirty-fifth General Meeting of the Society for Industrial Microbiology held at Houston, Texas, August 14-18, 1978 / Edited by L.A. Underkofler. Developments in industrial microbiology, v. 20, 1979, p. 497-502, maps)

## References.

ASTIS document number 61000.

ACU

Hydrocarbon-utilizing bacteria were enumerated from water and sediment in Cook Inlet, Alaska, using a Most Probable Number (MPN) procedure with <sup>14</sup>C-hexadecane-spiked Cook Inlet crude oil. The distribution of hydrocarbon-utilizing bacteria correlated with known patterns of water flow and presence of hydrocarbons in the environment. Spring and fall samples exhibited similar geographic distribution patterns, but numbers of hydrocarbon utilizers were an order of magnitude higher in fall than in spring. Potential biodegradation activities were estimated by measuring <sup>14</sup>CO<sub>2</sub> production from <sup>14</sup>C-hexadecane, <sup>14</sup>C-pristane, <sup>14</sup>C-naphthalene, and <sup>14</sup>C-benzanthracene-spiked crude oil. Biodegradation potentials were higher in spring than fall. When incubated with most samples, pristane and benzantracene were not mineralized. For hexadecane and naphthalene, maximal biodegradation potentials did not exceed 20% mineralization. (Au)

ROUBAL, W.T.

See: 433, 437.

ROUDYBUSH, T.E.

See: 14, 15.

ROZYNOV, B.V.

See: 360.

RUBY, C.H.

610

Coastal morphology, oil spill vulnerability and sedimentation of the northern Gulf of Alaska / Ruby, C.H.

Columbia, S.C. : University of South Carolina. Dept. of Geology, Coastal Research Division, 1977.

233 p.

(Technical report - Coastal Research Division, Department of Geology, University of South Carolina, no. 15-CRD)

Document not seen by ASTIS.

ASTIS document number 180726.

611

Oil spill vulnerability index, Copper River delta / Ruby, C.H. Hayes, M.O.

(Coastal zone '78 : proceedings of the Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone Management, San Francisco, March 1978. - New York : American Society of Civil Engineers, 1978, v. 3, p.2204-2220, ill., maps)

## References.

ASTIS document number 177792.

NSDB

An index has been devised that ranks the relative impacts of potential oil spills on coastal environments. The index is a sliding scale ranging from very low to very high risk environments and is based primarily on the relative longevity of spilled oil within each of ten subenvironments. Assuming only natural cleansing processes, the index considers both the differential biological impact and the influence of local physical processes on the distribution of spill oil. Additionally, the potential for mechanized cleanup within the subenvironments has been analyzed. This evaluation system has been developed after detailed field studies of three major oil spills and two minor spills in coastal areas with heavy winter ice. To apply the system to a given study site, a relatively rapid and inexpensive baseline study is initiated, which classifies the shoreline into geomorphic "type-areas". This classification is based on sediment type, littoral processes, tidal range and currents, gross biological productivity, local climatic conditions and general coastal morphology. The index is then applied by analogy to studies of spill behavior within similar type-areas at actual major spill sites. The index provides information which enables cleanup programs to more efficiently deploy men and materials at a spill site. ... The index can be applied to any coastal area subject to hazardous liquid spills. The Copper River Delta, Alaska, a relatively complex coastal environment 70 km SSE of Valdez, is used here to demonstrate both the application of the Index and the logic behind the classification. It also demonstrates the direct applicability of this scheme to impact statements regarding pollutants in the coastal zone. (Au)

See also: 308, 516.

RUTH, E.

See: 346.

RYAN, J.P.

See: 199, 577.

**S.L. ROSS ENVIRONMENTAL RESEARCH LTD.**

See: 243.

**SAHOTA, H.S.**

612

**Prediction of the motion of oil spills in northern Canadian waters / Sahota, H.S. Venkatesh, S.**

[Downsview] : Atmospheric Environment Service, 1979.  
19p. : figures, tables ; 28cm.

(Canadian meteorological research reports, CMRR [79] 1/79)

References.

*ASTIS document number 27014.*

ACU, NFSMO

This paper describes a procedure for predicting the motion of oil spills in open Canadian waters. These spills are treated by the Mark I Version of a model which takes into account the effect of such factors as surface-water currents, turbulence in the water, spreading, and weathering, on oil movement and distribution. The model is to be integrated into a Computerized Forecast Support System to provide real-time prediction support in the event of an oil-spill emergency. (Au)

613

**Prediction of the motion of oil spills in northern Canadian waters / Sahota, H.S. Venkatesh, S.**

(Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 26- 1- 26- 26, ill., maps)

References.

*ASTIS document number 177849.*

NSDB, ACU

... This paper describes a system for the prediction of the motion of oil spills in Canadian waters. The Mark I vertical version described here considers spills in open waters. Though some initial work has already begun, the problem of predicting the motion of oil spills in ice-infested waters will be examined in greater detail in the next phase of the overall program. The model takes into account the effect of such factors as surface water currents, turbulence in the water, spreading, weathering of the oil etc. on the movement and distribution of the oil spill. The model is being integrated into a computerized Forecast Support System which will provide real-time prediction support in the event of an oil spill emergency in the Beaufort Sea area. (Au)

**SAMSON, A.L.**

614

**A selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment / Samson,**

A.L. Vandermeulen, J.H. Wells, P.G.

Moyle, C.

2nd ed.

[Ottawa] : Environmental Protection Service, Research and Development Division, 1980.

vii, 191p. ; 28cm + 2 microfiches in pocket ; 11x15cm.

(Economic and technical review report, EPS 3-EC-80- 5)

ISBN 0-662-51167-0.

A special project of the Standing Committee on the Fates and Effects of Oil.

*ASTIS document number 68080.*

ACU

... The bibliography is up to date to October 1, 1980. and replaces

the 1977 bibliography of the same name. References were selected from the international scientific literature on the basis of their relevance to Canadian marine temperate and northern/arctic waters. The bibliography consists of two sections - 1. a printed listing of all references arranged alphabetically by author; 2. a KWIC (keyword in context) index on microfiche which allows complete and rapid access to the listed references by author and title keyword. (Au)

**SAMUELS, W.B.**

615

**An oilspill risk analysis for the Beaufort Sea, Alaska (proposed sale 71) Outer Continental Shelf lease area / Samuels, W.B. Hopkins, D. Lanfear, K.J.**

[S.l.] : U.S. Geological Survey, 1982.

2 microfiches : figures, tables ; 11 X 15 cm.

(Open-file report - U.S. Geological Survey, 82- 13)

Appendices.

References.

*ASTIS document number 140813.*

ACU

An oilspill risk analysis was conducted to determine the relative environmental hazards of developing oil in different regions of the Beaufort Sea .... The probability of spill occurrences, likely movement of oil slicks, and locations of resources vulnerable to spilled oil were analyzed. The model predicted movement of the center of spill mass and estimated the times between spill occurrence and contact with various resources, to allow a qualitative assessment of oil characteristics at the time of contact; no direct computation was made of weathering and cleanup. The model also assumed that any oil spilled under ice would remain in place, unchanged, until spring breakup. Ice movements, or travel of oil under ice, if occurring, would affect the results in a manner not directly predictable at this time. The combined results of spill occurrence and spill movement predictions yielded estimates of the overall risks associated with development of the proposed lease area. Assuming that oil exists in the lease area ... it is estimated that the leasing of the tracts proposed ... will result in an expected 9.2 oilspills ... over the lease lifetime of 25 years. ... The estimated probability that land will be contacted by one or more oilspills ... that have been at sea for less than 30 days ... is greater than 99.5 percent. ... The results of a recent experimental cleanup operation for oilspills under the ice in Canadian Arctic waters showed a substantial degree of success; this should be considered in evaluating impacts of spills predicted by this model. ... (Au)

**SANBORN, H.R.**

616

**Effects of petroleum on ecosystems / Sanborn, H.R.**

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 337-357)

References.

*ASTIS document number 169420.*

ACU

... In this chapter the literature dealing with the consequences of petroleum on arctic and subarctic habitats, populations, and communities ... [is] reviewed. ... (Au)

See also: 434, 437.

SAYED, M.

See: 31.

SCARBOROUGH, A.

See: 248.

SCARRATT, D.J.

617

Anticipated fisheries impact of offshore hydrocarbon development on the Canadian east coast / Scarratt, D.J. (Proceedings of the American Society for Environmental Education Georges Bank Hydrocarbon Symposium, Nantucket, Mass., April 27-30, 1982. - [S.I.] : [s.n.], 1982, p. 281-287)

References.

ASTIS document number 179485.

OON

Hydrocarbon exploration is currently proceeding in three main areas off the Canadian East coast, off Labrador, on the Grand Banks, and around Sable Island. Development is anticipated on the Grand Banks for oil, and at Sable Island for gas and condensate within the next few years. Loss of access to productive fishing grounds can be minimized by careful rig-siting and pipeline routing. Credible scenarios for spills or blow-outs indicate that lethal and sublethal concentrations of hydrocarbons could occur but except for stocks of fish spawning in discrete shallow areas, no detectable reduction in fish stocks is likely to occur. [The general questions addressed in this paper are: what is the likelihood of spills, what are the subsequent physical and biological effects, what are the impacts on fisheries, and what are the effects, if any, of countermeasures.] The principal impact of a spill is likely to be the fouling of fishing gear, or the temporary displacement of fishing effort from oiled areas. Currently available cleanup technology is expected to be of minimal value in extreme weather conditions, but is not anticipated to impose constraints on fisheries management strategy. (Au)

SCHELL, D.M.

See: 77, 354.

SCHIEWE, M.H.

See: 437.

SCHLEUTER, R.S.

See: 196.

SCHNEIDER, D.E.

618

Physiological responses of arctic epibenthic invertebrates to winter stresses and exposure to Prudhoe Bay crude oil dispersions / Schneider, D.E. United States. Bureau of Land Management [Sponsor]. (Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. I : Receptors : birds, plankton, littoral benthos, p. 413-475, ill.)

References.

ASTIS document number 169552.

ACU

This study focuses on the tolerance and metabolic response of selected epibenthic and benthic arctic invertebrates to winter stresses, particularly hypersaline and crude oil stress. ... (Au)

SCHOFIELD, E.A.

See: 57, 61, 65, 67.

SCHULTZ, L.A.

619

The transport and behavior of oil spilled in and under sea ice : phase II of physical processes / Schultz, L.A. Cox, J.C. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 349-360, ill.)

References.

ASTIS document number 169498.

ACU

... The objective of this project has been to study the mechanisms of oil transport beneath an ice cover. ... The scope of the Phase II effort includes the level of oil containment possible behind major under-ice obstructions and the containment potential of meso-scale obstructions which would be found under rough (but not ridge) ice. The work was performed in an ice covered laboratory flume. ... (Au)

620

The transport and behavior of oil spilled in and under sea ice : task 1 / Schultz, L.A. Cox, J.C. United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 570-588, ill.)

(NTIS PB80-186885, p. 570-588, ill.)

References.

ASTIS document number 169501.

ACU

The objective of this project has been to study the mechanisms of oil transport beneath and through an ice cover. ... The purpose of the present study is to examine how oil from a spill will interact with the sea ice of the Beaufort and Chukchi Seas. The scope of the problem encompasses both the horizontal movement and the vertical migration of oil. The horizontal transport of oil has been studied in an ice covered laboratory flume. Conclusions of the vertical migration of oil in ice are based on observations made during both field and laboratory experiments. ... (Au)

See also: 33, 34, 183, 184, 185, 265, 446.

SCHULZE, R.

621

Oil spreading in broken ice / Schulze, R. (Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985,



Edmonton, Alberta. - [Ottawa : EPS], 1985. p. 1-4, ill.)  
References.

ASTIS document number 165000.  
ACU

There has always been a considerable amount of speculation, and concern, about the extent of spreading of oil spilled in a broken ice field. An oil spill scenario developed as a part of the U.S. Coast Guard "Field Guide of Arctic Oil Spill Behavior" provides an interesting, and perhaps useful, description concerning spilled crude oil spreading in a growing ice field during freeze-up .... The scenario involves an undersea pipeline leak of 1,000 barrels of North Slope crude oil that spreads into a field of pancake ice and grease ice growing on the surface. The schedule for spreading is based on a large-scale laboratory experiment performed by Seelye Martin in 1976 .... The information developed in the experiment is then used to estimate the extent of the spreading of the spill in the pipeline scenario. (Au)

622

An overview of a field guide for arctic oil spill behavior /  
Schulze, R. Lissauer, I.M.  
(Proceedings - 1985 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : February 25-28, 1985, Los  
Angeles, California. - Washington, D.C. : American  
Petroleum Institute, 1985, p. 399-403, ill., maps)  
References.

ASTIS document number 162876.

A field Guide for Oil Spill Behavior was developed to provide the On-Scene Coordinator with the spill behavior information needed to ensure timely and adequate containment and removal. The guide describes arctic ice conditions, the physical properties of oil as it weathers, oil spill behavior in cold water and ice conditions, and spill retention potential for the Alaskan shoreline. Six spill scenarios show the user how to apply spill behavior information to solve actual problems. (Au)

See also: 32.

SCHWARTZ, J.

See: 641, 643.

SCHWARTZ, J.P.

623

The effect of oil-contaminated prey on the energetics of pink  
salmon fry / Schwartz, J.P.  
(Proceedings of the Tenth Annual Aquatic Toxicity  
Workshop, November 7-10 1983, Halifax, Nova Scotia /  
Edited by P.G. Wells and R.F. Addison. Canadian  
technical report of fisheries and aquatic sciences, no.  
1368, p. 437-438)

Abstract only.

ASTIS document number 181820.

ACU

Previous experiments with pink salmon fry feeding on oil-contaminated prey demonstrated that fry feeding rate decreases as the concentration of oil-in-prey increases. ... The objective of ongoing research is to determine the energetic cost of feeding on oil-contaminated prey by subtracting the energy required for maintenance (energy loss from respiration and excretion) from the energy ingested (net caloric intake after absorption efficiency is measured) to find the net energy available for growth. The energy budget of pink fry was monitored daily while they were fed live brine shrimp nauplii contaminated with aromatic hydrocarbons by

exposure to the water soluble fraction (WSF) of Cook Inlet crude oil. Fry feeding rate, oxygen consumption, ammonia excretion, and fecal production were simultaneously measured to calculate fry energy budget. Two oil-in-prey concentrations were tested (0.5 micro g/g and 5 micro g/g) and a second control group was fed near-starvation rations to measure fry energetic with reduced food intake independently of exposure to oil-in-prey. Fry oxygen consumption decreases when food intake is reduced, and absorption efficiency of food increases. Fry fed oiled food experience reduced feeding rate but absorption efficiency decreases and ammonia excretion increases, resulting in a net loss of energy available for growth beyond what is lost from reduced feeding rate. The reduced growth rate of fry fed oil-contaminated prey results primarily from a reduction in energy intake. Additional energy for growth is lost in order to detoxify and excrete petroleum hydrocarbons. (Au)

SCHWEINSBURG, R.E.

See: 81, 329, 515.

SCIENCE APPLICATIONS, INC.

624

Environmental assessment of the Alaskan continental shelf :  
Interim environmental synthesis of the Northeast Gulf of  
Alaska / Science Applications, Inc. United States.  
Outer Continental Shelf Environmental Assessment  
Program [Sponsor].

[Boulder : NOAA Environmental Research Laboratories],  
1978.

vi, 199p. : figures, maps, tables : 28cm.

A report based on NEGOA Synthesis Meeting, Anchorage,  
Alaska, January 11-13, 1977.

Appendices.

Bibliography: p.153-157.

ASTIS document number 27316.

ACU, NSDB(ENV.)

Objectives of this report are: (1) to provide regional environmental information in a form useful to BLM and others in decision-making processes related to OCS oil and gas development in the Northeast Gulf of Alaska (NEGOA) lease area; (2) to increase and update scientific interdisciplinary understanding of the Northeast Gulf of Alaska region; and (3) to identify important gaps in knowledge of the Northeast Gulf of Alaska marine environment that are relevant to OCS development. ... (Au)

625

Environmental assessment of the Alaskan continental shelf :  
Lower Cook Inlet interim synthesis report / Science  
Applications, Inc.

Boulder, Colo. : U.S. Outer Continental Shelf Environmental  
Assessment Program, 1979.

xvi, 241p. : ill., maps ; 28x43cm.

Prepared under the guidance of the U.S. Outer Continental  
Shelf Environmental Assessment Program.

Bibliography.

ASTIS document number 33065.

ACU

OCSEAP identified six TASKS, which together provide a sound basis for evaluating the potential environmental impacts of OCS oil and gas development: ... EXISTING CONTAMINANTS ... SOURCES ... HAZARDS ... TRANSPORT ... RECEPTORS ... EFFECTS ... This volume represents an INTERIM edition of the Lower Cook Inlet Synthesis Report and is intended to present a multidisciplinary overview of information relevant to possible Alaskan Outer Continental Shelf oil and gas development. ... (Au)

## SCOTT, B.F.

626

Behaviour of oil under Canadian climatic conditions, Part 1 :  
Oil on water under ice-forming conditions / Scott, B.F.

Chatterjee, R.M.

Ottawa : Inland Waters Directorate, Water Quality Branch,  
1975.

vii, 21 p. : ill. ; 28 cm.

(Scientific series - Inland Waters Directorate, no. 50)

Appendix.

References.

Alternate title: Oil on water under ice-forming conditions.

ASTIS document number 181056.

ACU

Oil was poured onto a water surface under ice-forming conditions. Weather conditions were monitored continuously, as were the physical properties of the oil and the effect of the oil on its physical environment. Properties of the oil were investigated by gas chromatography and the following forms of spectroscopy: neutron activation (gamma-ray), infrared, ultraviolet, visible and fluorescence. The weathering of the oil and its influence on its environment were correlated with the weather parameters. An estimated 50% of the oil had evaporated before the oil was covered with snow, as determined by gas chromatographic analysis and supported by neutron activation analysis. A biological assessment was conducted during the following summer where the effect of the oil on one pond was compared with the control pond. In the oiled pond, the variety of biological species was substantially less than in the control pond. (Au)

627

Investigation of the weathering of a selected crude oil in a  
cold environment / Scott, B.F.

(Water Quality Parameters : a symposium cosponsored by  
the Canada Centre for Inland Waters and the Analytical  
Chemistry Division of the Chemical Institute of Canada,  
Burlington, Ontario, Canada, 19-21 November 1973.

ASTM special technical publication, no. 573, p. 514-525,  
ill.)

References.

ASTIS document number 181412.

ACU

In large ponds, two test oil spills using crude oil were made near Ottawa during the winter of 1972 through 1973. The first spill was carried out on water under ice-forming conditions, and the second was carried out on ice. While these spills were allowed to age naturally, the weather parameters of precipitation, wind speed, temperature, and light were monitored. The results of the monitoring were then correlated with the composition of the residues of the spills. In addition, the effects of precipitation and wind were correlated with the behavior and movement of the oil in the ponds. (Au)

## SCOTT, L.

See: 106.

## SEAKEM OCEANOGRAPHY LTD.

628

Baffin Island Oil Spill Project : chemistry component : final  
report on the 1983 oil spill experiments : volume 1,  
summary of field work and shoreline hydrocarbon analysis  
/ Seakem Oceanography Ltd. Humphrey, B.

Canada. Environmental Protection Service [Sponsor].

Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alta. : [BIOS Project], 1984.

1 microfiche : ill., maps ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 83- 1)

References.

Fiche heading title: Chemistry 1 : field sampling and  
measurements : 1983 study results.

Also available in paper.

ASTIS document number 159808.

ACU

The sampling for the Baffin Island Oil Spill [(BIOS)] Chemistry component is described. The analytical method for total hydrocarbons and the results of these analyses are presented. Samples taken in 1983 are listed with the results of corresponding analyses from 1980 to 1982. The statistical validity of the sampling protocol is examined. ... [Hydrocarbon content was measured in bottom sediments and in samples of five animal species taken from the study area: *Mya truncata*, *Astarte borealis*, *Macoma calcaria*, *Serripes groenlandia*, and *Strongylocentrotus droebachiensis*]. (Au)

## SEGAR, D.A.

See: 195.

## SEKERAK, A.D.

See: 77, 263, 393.

## SEMPELS, J.-M.

See: 460, 461.

## SENDSTAD, E.

629

Accelerated biodegradation of crude oil on arctic shorelines /  
Sendstad, E.

(Proceedings of the Arctic Marine Oil Spill Program  
Technical Seminar, June 3-5, 1980, Edmonton, Alberta. -  
Ottawa : Environmental Protection Service, 1980, p.  
402-416, ill.)

References.

ASTIS document number 174521.

ACU

... [Since an arctic oil spill] cannot be removed, then it has to be rendered less noxious in situ. A characteristic feature of stranded oil is, however, the decrease in total rate of decomposition compared to that of an offshore situation. Once the oil is stranded, it is no longer subjected to any mechanical energy input such as waves and currents, and soon the rate of decomposition declines. The total of decomposition of oil on the backshore is, therefore, of considerable interest. Of equal interest are any possible ways which this rate of decomposition may be accelerated. In this paper, data related to the effects of crude oil on the detrital foodchain are presented. The effects of adding a fertilizer to the oil slick, to optimize the chemical environment for microbial growth, are also

shown. (Au)

630

**Enhanced oil biodegradation on an arctic shoreline /**  
Sendstad, E. Hoddo, T. Sveum, P.  
Eimhjellen, K. Josefsen, K. Nilssen, O.  
Sommer, T.

(Proceedings of the Arctic Marine Oil Spill Program  
Technical Seminar. - [Ottawa : EPS. Environmental  
Emergency Branch], 1982, p. 331-340, figure, tables)

References.

*ASTIS document number 131091.*

NFSMO

These studies show that it is possible, by simple means, to enhance  
the oil biodegradation and restrict the negative environmental  
effects of oil. (Au)

631

**Final administrative report, the BIOSIS (sic) project, Canada,  
1980-1982 /** Sendstad, E.

[Trondheim, Norway : Norges Tekniske Høegskole], 1982.  
115 p. : ill.

(Report STF-21A82101)

Alternate title: Final administrative report, the BIOS project,  
Canada, 1980-1982.

References.

Text in English and Norwegian.

*Document not seen by ASTIS.*

*ASTIS document number 176478.*

The microbial degradation of oil on shore is studied. The natural  
occurrence of oil degrading microorganisms on an arctic shore was  
investigated [as part of the Baffin Island Oil Spill Project (BIOS).]  
The types and their mineralization capacity were determined. The  
shoreline sand and sediment contained low but detectable numbers  
of oil degrading microorganisms. A large increase in oil degrading  
bacteria could be registered a week after spraying with weathered  
Lago Medio crude oil or the same oil as 50% water-oil emulsion.  
Part of the microbial activity in the oil film can be increased about  
five times adding macro nutrients. The availability of macro  
nutrients more than the access to oxygen limited the oil degradation  
on the shores in question. Experiments with BP solidifying agent  
showed increase in heterotrophic activity compared to untreated oil  
film. It was also possible manually to remove about 50% of the oil  
from the sand and gravel covered beach. Mechanical mixing of oil  
sediments and the use of bark as an absorbing agent did not  
enhance the natural decomposition. (Au)

632

**Studies on a seven years old seashore crude oil spill on  
Spitsbergen /** Sendstad, E. Sveum, P. Endal, L.J.  
Brattbakk, I. Ronning, O.I.

(Proceedings of the Seventh Annual Arctic Marine Oilspill  
Program Technical Seminar, June 12-14, 1984,  
Edmonton, Alberta. - [Ottawa : EPS, 1984], p. 60-74,  
ill.)

References.

*ASTIS document number 164550.*

A small crude oil spill was simulated on a seashore at Spitsbergen  
in the summer of 1976 with the intention of studying both fate and  
ecological effects. Parts of the oil slick were fertilized in the summer  
of 1978. The short-term effects of oil on the Collembola  
community, and of fertilizer on the bio-degradation of oil has been  
reported earlier by Sendstad (1980). The aim of the present paper  
to supplement this paper with other initial results, as well as to  
give the follow-up results based on data obtained until 1983. These  
follow-up studies have also included measurements of parameters  
not initially included, i.e. quantitative treatment of microflora

(fungal hyphae and bacteria) and quantitative treatment of  
nematodes. The start-up data previously not published, includes  
studies on cryptostigmatid mites and notes on the vegetation. (Au)

See also: 158, 220, 221, 222, 223, 672.

SENNER, S.E.

633

**Shorebirds and oil development in the Copper River Delta  
area, Alaska /** Senner, S.E. Norton, D.W.

(Science in Alaska 1976 : proceedings of the Twenty-seventh  
Alaska Science Conference, Fairbanks, Alaska, August  
4-7, 1976. - Fairbanks, Alaska : Alaska Division,  
American Association for the Advancement of Science,  
[1978], vol. II, p. 208-295, ill., map)

References.

*ASTIS document number 178403.*

ACU

Projected activities relating to petroleum and natural gas in Prince  
William Sound and the northern Gulf of Alaska will include oil  
tanker traffic to and from Valdez and the exploration and possible  
development of outer continental shelf lease tracts in the north  
Gulf. Additionally, a natural gas liquefaction and tanker facility is  
proposed for Point Gravina, about 25 km northwest of Cordova. If  
this facility is constructed, there will be a large thermal discharge  
into the cold waters of Prince William Sound, with unknown  
consequences for intertidal and marine organisms (Federal Power  
Commission Staff, 1976). We have established that many millions  
of Western Sandpipers and Dunlins - representing significant  
fractions of their species populations - pass through the C-BRD  
[Copper-Bering River Delta] system. We must now address the  
more fundamental question of how the migratory shorebirds relate  
to their intertidal environment. We have done so by considering the  
food habits of Westerns and Dunlins in the C-BRD system and  
their physiological condition, in terms of body fat, upon entering  
and leaving the system. (Au)

SENTSOVA, O.YU.

See: 298.

SERGY, G.A.

634

**The Baffin Island Oil Spill (BIOS) Project : a summary /**  
Sergy, G.A.

(Proceedings - 1985 Oil Spill Conference : Prevention,  
Behavior, Control, Cleanup : February 25-28, 1985, Los  
Angeles, California. - Washington, D.C. : American  
Petroleum Institute, 1985, p. 571-575, map)

References.

*ASTIS document number 162060.*

After four years of multidisciplinary experimental investigations in  
the Canadian Arctic, the Baffin Island Oil Spill (BIOS) Project has  
successfully completed studies which address oil spill fate, effects,  
and countermeasures. In particular, the findings are relevant to  
decisions on the nearshore use of chemical dispersants and the  
cleanup of oiled shorelines. Much of the information gathered can  
be extrapolated to other geographic areas. Within the context of the  
project design, the experimental results offer no compelling  
ecological reasons to prohibit use of dispersants on oil slicks in the  
arctic nearshore environment and they enable recognition of  
situations in which dispersant use would be advisable. The results  
also suggest that for much of the arctic coastline the cleanup of  
stranded oil is not essential. Shoreline cleanup efforts should focus

on low energy beaches with characteristics conducive to the long term retention of oil, but there will be many situations where cleanup will be severely limited and impractical. (Au)

635

**Baffin Island Oil Spill Project status report / Sergy, G.A.**  
(Spill technology newsletter, v. 8, no. 4, July-Aug., 1983, p. 92-94)

*ASTIS document number 137758.*

ACU, NSDB

This status report covers the final year of a 4-year \$7 million major field study to compare the fate and effects of crude oil stranded on a typical Arctic beach to those resulting from the use of chemical dispersant near shore. The effectiveness of various shoreline cleanup techniques was investigated. The BIOS project is an internationally funded joint industry/government undertaking managed by the Environmental Protection Service. The study was designed to address concerns of native northerners that could not be answered satisfactorily without spilling oil in the Arctic. The site, some 50 miles southwest of Pond Inlet on Baffin Island, was found with the help of the Pond Inlet and Arctic Bay community councils. The cost was shared by Norway, the United States, BP International, the Canadian oil industry, and several departments of the Canadian Government. (Au)

636

**The BIOS Project : an experimental oil spill / Sergy, G.A.**  
(Proceedings of Offshore Environment in the 80's, St. John's, Newfoundland, December 2-4, 1980. - [St. John's, Nfld.] : [s.n.], 1980, [22] p., map)

References.

*ASTIS document number 171271.*

ACU

The Seventh Arctic Environmental Workshop held in Fairmont, British Columbia in 1978 provided the initial impetus behind the development of the Canadian experimental oil spill program. This paper describes the events which led to the present program and, in particular, the evolution of the Baffin Island Oil Spill (BIOS) Project. Further, the experimental design of the BIOS Project is summarized, the site selection process for the project is outlined, an overview of the 1980 field activities is provided, and a forecast of the future BIOS Project activities is made. (Au)

See also: 94, 95, 96, 97, 98, 243, 687.

**SEXSTONE, A.**

See: 56.

**SHANDONG COLLEGE**

See: 709.

**SHAW, D.G.**

637

**Arene and alkane hydrocarbons in nearshore Beaufort Sea sediments / Shaw, D.G. McIntosh, D.J. Smith, E.R.**

(Estuarine and coastal marine science, v. 9, no. 4, 1979, p. 435-449, ill., map)

References.

*ASTIS document number 177741.*

NSDB

A suite of nearshore arctic marine sediments whose alkane composition suggests only biogenic sources, contains complex mixtures of arenes (polycyclic aromatic hydrocarbons). Among the stations analyzed, distributions of arenes characteristic of both pyrolytic and fossil sources were observed. The geographic distribution of pyrolytic arenes and other lines of evidence suggest that their source may be long distance transport of anthropogenic combustion products. Fossil arenes are present at some locations in sufficient quantity to mask any pyrolytics present. (Au)

638

**Chemical and size fractionation of aqueous petroleum dispersions / Shaw, D.G. Reidy, S.K.**

(Environmental science and technology, v. 13, no. 10, Oct. 1979, p.1259-1263, ill.)

References.

*ASTIS document number 178233.*

ACU, NSDB

Prudhoe Bay crude oil has been dispersed into distilled and natural waters using a variety of mixing procedures. Gentle mixing results in a dispersion of droplets smaller than 0.03 micro m enriched in one- and two-ring aromatic hydrocarbons, phenols, and basic compounds tentatively identified as amines. Vigorous stirring produces dispersions of larger droplet size and composition similar to the parent crude oil. Addition of a commercial oil dispersant results in finer droplets that show little chemical fractionation. These results show that chemical and size fractionations of oil-in-water dispersions are related to each other and to the intensity of mixing. It is probable that aquatic organisms take up and store different chemical and size fractions of petroleum in different ways. Consequently, the mode of mixing of oil and water may influence the biological impact of an oil spill or its laboratory simulation. (Au)

639

**Hydrocarbon studies in the benthic environment at Prudhoe Bay / Shaw, D.G. Cheek, L.M.**

(Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 425-431, ill., map)

Reference.

*ASTIS document number 175129.*

ACU

Measurements of aliphatic hydrocarbons are reported for sediments and biota collected in and around Prudhoe Bay, Alaska, during the summer of 1974. The results of these measurements indicate that these hydrocarbons are largely, or totally, of biogenic origin. Special problems associated with carrying out the field work of this project are also discussed. (Au)

640

**Hydrocarbons : natural distribution and dynamics on the Alaskan outer continental shelf / Shaw, D.G. United States. Bureau of Land Management [Sponsor].**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 273-295)

References.

*ASTIS document number 168289.*

ACU

The objective of the work reported here has been to characterize the ambient concentrations of non-volatile hydrocarbons in the marine environment of Cook Inlet, Alaska and to provide

information about processes which control those concentrations. ... hydrocarbon concentrations in central Cook Inlet are extremely low. ... Experimental work indicates that in Cook Inlet association with suspended sediments is not an important pathway for the dispersion of petroleum hydrocarbons dissolved in water. (Au)

641

**Hydrocarbons : natural distribution and dynamics on the Alaskan outer continental shelf / Shaw, D.G. Else, P. Malinky, G. Mapes, G. McIntosh, D.J. Nunes, M.J. Schwartz, J. Wiggs, J.N.**  
United States. Bureau of Land Management [Sponsor].  
(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 547-596, ill.)  
(NTIS PB80-186851, p. 547-596, ill.)

References.

ASTIS document number 169870.

ACU

... This work has had two interrelated goals: to describe the ambient kinds and amounts of hydrocarbons in Alaskan marine environments which may be affected by potential petroleum development and to better understand the processes by which petroleum is dispersed and degraded in the marine environment regimes found around Alaska. ... [Biota and bottom sediment samples from Cook Inlet and the Beaufort Sea were also analyzed for hydrocarbon content.] (Au)

642

**Hydrocarbons : natural distribution and dynamics on the Alaskan outer continental shelf / Shaw, D.G.**  
(Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol. 10 : Chemistry and microbiology, p. 193-366, ill., maps)

Appendices.

Includes: Characterization of organic matter in sediments from Gulf of Alaska, Bering and Beaufort Seas / University of California, Los Angeles, California. Institute of Geophysics and Planetary Physics.

References.

ASTIS document number 176028.

ACU

The objectives of this continuing work are to determine the kinds and amounts of hydrocarbons in water, biota, sediment, and seston in the Alaskan OCS environments and to determine the extent to which hydrocarbons are adsorbed by suspended sediments of the Gulf of Alaska. These measurements provide the link between impacts, such as the decline of a biological population, and suspected causes of those impacts, such as the addition of petroleum to the system. Based on work so far completed, it appears that the levels of hydrocarbons in the Alaskan OCS environments are as low as, or lower than other areas of the world ocean not subject to obvious petroleum pollution. Information is still lacking about how hydrocarbons are dispersed and degraded in these environments. (Au)

643

**Hydrocarbons : natural distribution and dynamics on the Alaskan outer continental shelf / Shaw, D.G. Else, P. Gritz, R. Malinky, G. Mapes, G. McIntosh, D.J. Schwartz, J. Smith, E. Wiggs, J.N.**

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VIII : Contaminant baselines, p. 495-588, ill.)

(NTIS PB80-130073, p. 495-588, ill.)

Appendix.

References.

ASTIS document number 176109.

ACU

This annual Report presents work completed in our study of the distribution and dynamics of hydrocarbons on the Alaskan outer continental shelf during the period April 1977 through March 1978. A striking finding is the observation that sediments from the Beaufort Sea and from Cook Inlet contain suites of aromatic hydrocarbons. The data indicate that the sources of these hydrocarbons are multiple and complex. It appears that anthropogenic pyrolysis may be a contributing source. ... We report a preliminary statistical treatment of multiple determinations of hydrocarbons in sediment. ... A smaller study of the variability of hydrocarbon determination in biota is also reported. We report in detail on a study of the interaction of hydrocarbons with suspended sediments of Southcentral Alaska. ... We also report additional reconnaissance studies of the kinds and amounts of hydrocarbons in the biota of the Bering Sea and Cook Inlet. ... (Au)

644

**Hydrocarbons in Alaskan marine intertidal algae / Shaw, D.G. Wiggs, J.N.**  
(Phytochemistry, v. 18, no. 12, Nov. 1979, p.2025-2027)

References.

ASTIS document number 167797.

ACU

... [this paper reports] on the determination of hydrocarbons from probable anthropogenic sources in 11 species of benthic algae collected at 11 locations within lower Cook Inlet, Alaska. [Petroleum hydrocarbons from probable anthropogenic sources were identified on unwashed algae samples] ... (Au)

645

**Hydrocarbons in the intertidal environment of Kachemak Bay, Alaska / Shaw, D.G. Wiggs, J.N.**  
(Marine pollution bulletin, v. 11, no. 10, Oct. 1980, p. 297-300, ill.)

References.

ASTIS document number 170941.

ACU, NSDB

Intertidal animals and sediment from Kachemak Bay, Alaska were analysed to determine the concentrations of hydrocarbons. At Coal Point the herbivorous limpet *Collisella pelta* contained petroleum within its tissues while intertidal algae of the area have previously been shown to accumulate petroleum as a surface coating. At Coal Bay, a locality where both petroleum and coal are present, the filter feeding mussel *Mytilus edulis* contained petroleum hydrocarbons whereas the deposit feeding clam *Macoma balthica* contained an array of hydrocarbons suggesting detrital coal as the source. Animals higher in the food web including the gastropod *Nucella lima* and the urchin *Strongylocentrotus droebachiensis* showed no evidence of petroleum. All samples contained biogenic hydrocarbons of algal and planktonic origin. (Au)

646

**Hydrocarbons in the marine environment of Port Valdez, Alaska / Shaw, D.G. Baker, B.A.**  
(Environmental science and technology, v. 12, no. 10, Oct. 1978, p.1200-1205, map)

References.

ASTIS document number 163155.

ACU, NSDB

Saturated and unsaturated hydrocarbons were quantitatively determined in biota, water and sediments of Port Valdez, Alaska. These analyses show kinds and amounts of hydrocarbons typical of

unpolluted nearshore marine environments. Common, prominent compounds include pristane, heptadecane, odd chain length normal alkanes with 21-31 carbon atoms, and a triterpene tentatively identified as squalene. Environmental samples for this work were collected during the period of approximately one year prior to the completion of the trans-Alaska oil pipeline. The operation a tanker loading facility associated with that pipeline at Valdez will result in a controlled input of petroleum into Port Valdez. The results presented here provide a basis from which to investigate the fate of that added oil. (Au)

647

**Pelagic tar and plastic in the Gulf of Alaska and Bering Sea : 1975 / Shaw, D.G.**

(Science of the total environment, v. 8, no. 1, 1977, p. 13-20, ill.)

## References.

ASTIS document number 130451.

ACU, NSDB

Seventy-one tows of 740 sq m each were made in search of pelagic tar and plastics in the Gulf of Alaska and Bering Sea during the period October 1974 to October 1975. Tar was observed on nine occasions while plastics were found six times. The arithmetic mean value of tar abundance,  $3.3 \times 0.001$  mg/sq m, is considerably lower than most other oceanic areas for which values have been reported. Gas chromatographic analysis of this tar indicates that it is more extensively weathered than tar from the north Atlantic. An estimate of the abundance of tar lumps too small to be sampled by net tows is made based on the assumption that there are equal weights of particles in logarithmically equal size intervals. The abundance of pelagic plastics is also low. (Au)

648

**Responses of the clam *Macoma balthica* to Prudhoe Bay crude oil / Shaw, D.G. Paul, A.J. Smith, E.R.**

(Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 493-494)

## References.

ASTIS document number 177865.

NSDB, ACU

The responses of the bivalve mollusk *Macoma balthica* to crude oil have been studied under laboratory conditions designed to simulate the stranding of oil on intertidal sediments in which this animal resides. The relationship of dry tissue weight to shell length, an indirect indicator of general health and fitness, was not significantly altered by exposure to oil at a level which did result in significant mortalities. This suggests that death is caused by a metabolically specific mode of poisoning rather than by a general weakening of the animal. In a second experiment, animals were subjected to two temporarily separated oiling events. Neither in mortalities nor in gas chromatographic analysis of tissues for hydrocarbons were cumulative effects observed. It was also found that a previously-reported tendency of *M. balthica* to burrow to the sediment surface in the presence of oil increases with decreasing depth of available sediment. We suggest that this behavior may be used as a convenient indicator of oil pollution. (Au)

649

**Some effects of oil on Alaskan marine animals / Shaw, D.G.**

(Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 77-85, ill.)  
(NTIS PB-277 060, p. 77-85, ill.)

## References.

ASTIS document number 177334.

NSDB

This paper reviews lab and field work carried out on the effects of petroleum on *Macoma balthica* from Island Flats near Port Valdez, Alaska. Effects on mortality, dry tissue weight: shell length ratio, and burrowing behaviour are described. Possible cumulative effects of repeated oilings on the clams, and the rapid loss of petroleum, to the oiled beach site, are reported. (ASTIS)

650

**Some effects of petroleum on nearshore Alaskan marine organisms / Shaw, D.G. University of Alaska,**

Fairbanks. Institute of Marine Science. Clement, L.E. McIntosh, D.J. Stekoll, M.S. Reid, B. [Project Officer]. United States. Corvallis

Environmental Research Laboratory [Sponsor].

Corvallis, Or. : Corvallis Environmental Research Laboratory, 1981.

1 microfiche : ill. ; 11 x 15 cm.

(Report - United States. Environmental Protection Agency, EPA-600/3-81-018)

(NTIS PB81-159147)

## References.

ASTIS document number 175994.

ACU

The overall objective of this project was to better understand the effects of chronic, low-level oil pollution on nearshore Alaskan marine organisms. The bivalve mollusk *Macoma balthica* accumulated hydrocarbons during 180 days of continuous exposure to Prudhoe Bay crude oil in flowing seawater dispersions with nominal concentrations of 0.03 mg/l, 0.3 mg/l and 3.0 mg/l. The animal's ability to concentrate oil from seawater increased with decreasing oil in water concentration. Decreases in *M. balthica*'s oil burden began after 30 to 120 days (depending on the oil concentration) and continued for at least 60 days after oiling ceased. Aliphatic and aromatic hydrocarbons were fractionated in markedly different ways by the animal. Branched and cyclic aliphatics in the range dodecane through hexadecane were preferentially retained over their higher homologs; whereas larger and more substituted aromatics were selectively concentrated. *Macoma balthica* showed a number of physical, behavioral, physiological and biochemical changes during oil exposure. An oil in seawater concentration of 3.0 mg/l caused severe dysfunction in the clams including a decreased burial rate, increased respiration rate, and inhibition of growth leading to very high mortalities. The lowest concentration of oil tested, 0.03 mg/l, inhibited growth and caused abnormalities in gonad morphology. One group of adverse oil effects which was related to sluggishness and disorientation of the animals appeared after seven days' oiling; another group related to a negative energy balance was not observed until 60 days. We conclude that chronic exposure of *M. balthica* to oil-in-seawater concentrations as low as 0.03 mg/l will in time lead to population decreases. ... (Au)

651

**Uptake and release of petroleum by intertidal sediments at Port Valdez, Alaska / Shaw, D.G. Cheek, L.M.**

Paul, A.J.  
(Estuarine and coastal marine science, v. 5, no. 3, 1977, p. 429-436, ill.)

## References.

ASTIS document number 177768.

NSDB

The uptake and release of Prudhoe Bay crude oil by intertidal sediments at Port Valdez, Alaska have been studied. In two experiments designed to simulate the stranding of a light oil slick, oil was spread on sediments daily for 5 days. Hydrocarbon content of the top 1.0 cm of the sediments was monitored for 60 days from

the first oiling. The two experimental rates of oil application were 1.2 micro/l sq cm and 5.0 micro/l sq cm. In both experiments the added oil was no longer detectable on the sixtieth day. Possible reasons for this rapid loss of petroleum by sediments are discussed. (Au)

See also: 169, 246, 248, 429, 665, 708.

#### SHELSBY, R.A.

See: 33.

#### SHEPPARD, E.P.

652

The mutagenicity of Prudhoe Bay crude oil and its burn residues / Sheppard, E.P. Georghiou, P.E. (Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 195-213, figures, tables)

##### References.

ASTIS document number 80764.

ACU, NFSMO

... we believe that mutagenicity testing is a worthwhile endeavour and we have chosen the Ames test because it is the best validated and because it does not require a particularly high level of expertise or expensive equipment to perform; it is also inexpensive and short-term. ... The oils we are testing were samples of an experimental undersea blowout in McKinley Bay, undertaken by Dome Petroleum. The samples are those of precipitated plume from a control burn of June 7, 1980, and pre- and post-burn residues of June 20, 1980 and June 22, 1980. These pre- and post-burn residues derive from discharges under first-year ice in December 1979 (Phase I) and in May, 1980 (Phase IIA). As a control, we are also testing fresh Prudhoe Bay crude oil (PC); In this report we will focus on PC, a post-burn sample from the Phase IIA spill, and the precipitated plume from the control burn. (Au)

#### SHIELS, W.E.

653

Crude oil phytotoxicity studies / Shiels, W.E. Goering, J.J. Hood, D.W.

(Environmental studies of Port Valdez / Edited by D.W. Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska, Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 413-446, ill.)

##### References.

ASTIS document number 178489.

ACU

Toxicological studies were undertaken in this project to determine the effect of crude oil on the marine primary producers: the phytoplankton and seaweed, which form the base of the food-chain and as such are critical components of the marine ecosystem. ... As an initial effort to indicate basic trends in plant response to crude oil under varying environmental conditions, toxicological studies of the marine flora in Port Valdez were conducted over a 1-year period (May 1971 to June 1972). Experiments were designed to evaluate the effects of crude oil on phytoplankton and important species of macrophyte algae at concentrations in the range expected to result from treated ballast-water discharge (0.003-10 ppm). (Au)

See also: 313.

#### SHIU, W.Y.

See: 412, 667, 675.

#### SHOKES, R.F.

See: 541.

#### SHORT, J.W.

See: 110, 161, 581, 582, 583, 594.

#### SHUHY, J.L.

See: 22.

#### SIMARD, A.

See: 744.

#### SIMONS, M.

See: 236.

#### SINIFF, D.B.

654

Experiments on the response of sea otters *Enhydra lutris* to oil contamination / Siniff, D.B. Williams, T.D.

Johnson, A.M. Garshelis, D.L.

(Biological conservation, v. 23, no. 4, Aug. 1982, p. 261-272, ill., map)

##### References.

ASTIS document number 170445.

ACU

Two oiling experiments were conducted from 1977-1979 on sea otters *Enhydra lutris* in Prince William Sound, Alaska. In the first experiment, four captured otters were fitted with radio-transmitters and released following contamination of their pelage with 25 cc. of Prudhoe Bay crude oil; a fifth individual was oiled and cleaned with detergent prior to being released. For all experimental animals activity increased dramatically during the first week following treatment; this effect was accentuated in the otter cleaned with detergent. Most of the increase in activity corresponded to increased grooming, whereas the feeding pattern (as measured by dive time analysis) did not change. It appeared that all experimental otters survived the first experiment, probably because only a small portion of the pelage was treated, and because food resources in the study area were abundant. In the second experiment we observed behavioural reactions of two otters in an above-ground swimming pool which was partly covered with crude oil. Both otters spent very little time on the oiled side of the pool (less than 1 minute per hour), but occasionally surfaced in it for brief periods and eventually became contaminated. One of these individuals was not cleaned and died within 24 h of first encounter with the oil; the other was cleaned and released with a radio-transmitter that failed shortly afterwards. (Au)

SLENO, G.A.

See: 142.

SMAGIN, V.M.

See: 334.

SMART, D.R.

See: 735.

SMILEY, B.D.

655

The effects of oil on marine mammals / Smiley, B.D.

(Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 113-122)

References.

ASTIS document number 181250.

ACU

This article reviews the literature on oil spill and dispersant effects on marine mammals, from field and laboratory research. It covers effects from physical contact with the fur or skin of the animal, as well as physiological effects suffered after ingestion of oil. (ASTIS)

See also: 91, 483, 484.

SMITH, C.W.

See: 589.

SMITH, E.

See: 643.

SMITH, E.R.

656

Petroleum in benthic sediments in Prudhoe Bay, Alaska / Smith, E.R.

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 173)

Abstract only.

ASTIS document number 175978.

ACU

Prudhoe Bay, Alaska, is presently the site of extensive petroleum development. Recently it was found necessary to build a gravel causeway 4,000 ft (1,219 m) to service tankers that would be coming into the bay. Studies were begun in 1974 to ascertain the effects of this causeway which projected out into the bay. Sediment samples were collected in August of 1974 and August 1975. Analysis of these samples indicates that the hydrocarbons present in the sediments of Prudhoe Bay are both petroleum and biogenic in

origin. (Au)

See also: 637, 648.

SMITH, G.S.

See: 541, 542, 543.

SMITH, M.A.E.

657

Effects of oil exposure on the ultrastructure of king crab gill, antenna, and hepatopancreas / Smith, M.A.E.

(Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 366-376, ill.)

References.

ASTIS document number 176001.

ACU

Coastal areas of Alaska are faced with the potential for increased offshore oil exploration and drilling, with the accompanying possibility of increased oil spills. ... In this study, king crab (*Paralithodes camtschatica*) gill, antenna and hepatopancreas were examined by electron microscopy after animals were exposed to [Cook Inlet] crude oil water soluble fractions (WSF) for three days and allowed to recover for three days. Gills are the area of body of decapod crustaceans known to be permeable to material in the external medium; the antenna is chemosensory and would likely be affected by the presence of oil in the water; and the hepatopancreas would be involved in metabolizing the oil if it were ingested by the animal. (Au)

SMITH, R.L.

658

Acute effects : Pacific herring roe in the Gulf of Alaska / Smith, R.L. Cameron, J.A.

(Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1977. Vol. XII : Effects, p. 596-635, ill.)

References.

ASTIS document number 178519.

ACU

The objective of this project was to evaluate the potential impact of OCS oil development activities on a single species of Alaskan marine fish, the Pacific herring (*Clupea harengus pallasii*). This species occurs commonly in the Gulf of Alaska and Bering Sea, is of commercial importance in Alaskan waters and is particularly vulnerable to surface spills during its embryonic development. ... Since they are in shallow water and cannot escape, herring eggs will be adversely affected by hydrocarbon contamination of Alaskan surface waters. This project sought to simulate conditions of a crude oil spill to test the effects of low boiling point, water soluble hydrocarbon components of Prudhoe Bay crude on developing herring larvae. Initial hydrocarbon concentrations in the experimental containers were less than 1 micro.g/gm H<sub>2</sub>O (1 pp). Exposure for as little as 48 hours led to a significantly higher incidence of gross morphological abnormalities. Exposure for 7 days resulted in 100% mortality in the fertilized embryos. ... abnormalities usually consisted of flexures in the body which reduced or prevented locomotion. Results of scanning electron microscopy reveal other defects, such as improperly formed mouth, which adversely affect biological fitness, yet are difficult to detect. ... The findings of this study, if corroborated by other related



studies, should suggest a re-evaluation of water quality standards for Alaskan marine waters. Clearly, herring roe cannot tolerate continued exposure to ppm levels of hydrocarbon contaminations. (Au)

659

Effect of water soluble fraction of Prudhoe Bay crude oil on embryonic development of Pacific herring / Smith, R.L. Cameron, J.A.

(Transactions of the American Fisheries Society, v.108, no. 1, Jan. 1979, p. 70-75)

References.

ASTIS document number 168823.

ACU

This project sought to simulate conditions of a crude oil spill to test the effects of low boiling point, water-soluble hydrocarbon components of Prudhoe Bay crude oil on developing Pacific herring, (*Clupea harengus pallasii*) embryos. ... Exposure for 48 hours led to a significantly higher incidence of gross morphological abnormalities. Exposure for 6 days resulted in 100% mortality of the fertilized embryos. ... Exposure for 12 hours or longer led to reduced size of newly hatched larvae, suggesting hydrocarbon exposure adversely affects embryonic metabolism. (Au)

See also: 138.

SMITH, T.G.

660

The effect of contact and ingestion of crude oil on ringed seals of the Beaufort Sea / Smith, T.G. Geraci, J.R. Victoria, B.C. : Beaufort Sea Project, Dept. of the Environment, 1975.

ii, 66p. : ill., tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 5)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 5)

Cover title: Effect of contact and ingestion of crude oil on ringed seals.

References.

ASTIS document number 11592.

ACU, NFSMO

... This paper attempts to evaluate the effects of crude oil on ringed seals primarily, and on harp seal whitecoat pups. Studies were conducted on both the effect of immersion in oil and ingestion of oil on wild and captive seals .... (Au)

See also: 142, 237, 269, 270, 271.

SNELLEN, J.B.

See: 664.

SNOW, N.B.

See: 603, 687.

SOLSBERG, L.B.

See: 117.

SOMMER, T.

See: 220, 221, 222, 223, 630.

SONNTAG, N.

See: 77.

SORSTROM, S.E.

See: 69.

SPENCER, D.L.

See: 111.

SPENGER, R.E.

See: 541.

SPRAGUE, J.B.

661

Oil and dispersants in Canadian seas : recommendations from a research appraisal / Sprague, J.B. Vandermeulen, J.H. Wells, P.G.

(Marine pollution bulletin, v. 12, no. 2, Feb. 1981, p. 45-46) References.

ASTIS document number 169331.

ACU, NSDB

A Canadian multi-authored appraisal of research on oil and dispersants has been completed recently [1981]. It resulted in a number of recommendations concerning research on oil spills, on relevant physical-chemical factors, effects of chemically dispersed oil on marine organisms, and strategies to minimize effects of oil spills in northern marine waters. (Au)

662

Oil and dispersants in Canadian seas : research appraisal and recommendations / Sprague, J.B. [Editor].

Vandermeulen, J.H. [Editor]. Wells, P.G. [Editor].

Canada. Environmental Emergency Branch

[Sponsor].

[Ottawa] : Environmental Impact Control Directorate, 1982. xiii, 185 p. : ill. ; 28 cm.

(Economic and technical review report, EPS 3-EC-82- 2)

Bibliography: p. 145-185.

ASTIS document number 160180.

NSDB, ACU

This report evaluates knowledge of the fate and effects of oil spilled at sea and the implications of using dispersants, with special reference to Canadian marine environments. Almost 600 references from the scientific literature are utilized. Twelve chapters by individual scientists give perspectives on the Canadian oil industry; fate and behaviour of oil in the sea; microorganisms and degradation of oil; analytical chemistry; and effects of oil, dispersants, and chemically-dispersed oil on phytoplankton, macrophytes, zooplankton, fish, benthic and intertidal organisms, birds, marine mammals, and communities and ecosystems. Recommendations are given for further research that is required and strategies for minimizing effects of spills, again with emphasis on Canadian waters. (Au)

SPRY, J.

See: 534.

STANSBY, M.E.

663

Subject classified literature references on effects of oil  
pollution in arctic and subarctic waters / Stansby, M.E.  
Diamant, I.

Seattle, Wash. : NOAA, National Marine Fisheries Service,  
Northwest and Alaska Fisheries Center, 1978.

201 p. ; 28 cm.

References.

ASTIS document number 177539.

NSDB

Although the list of references compiled and classified in this report is quite extensive, it is by no means a complete list of all references in the field available in the literature. The list was compiled to give scientists at the NMFS Northwest and Alaska Fisheries Center, some of whom were not completely familiar with the literature in the oil pollution field, an introduction to some of the important literature in this research area. ... In order to assemble this partial list of references in this field, we leaned heavily upon existing recently-published bibliographical reports. In this connection, the most useful general publication which we found was the Marine Biological Association of the United Kingdom, Bibliography on Marine and Estuarine Oil Pollution, which was current up to April 1975 and contained about 2,300 references. Several other bibliographies were included as well as a computerized search of Biological Abstracts and Chemical Abstracts but covering only the recent years which our Agency's OASIS records have covered in their computerized data bank. [This bibliography is grouped by subject but not indexed]. ... (Au)

See also: 430.

STAPLETON, G.F.

664

Detection of oil under ice - a laboratory program /  
Stapleton, G.F. Parashar, S.K. Snellen, J.B.  
Worsfold, R.D. Remotec Applications.

(Proceedings of the Arctic Marine Oilspill Program  
Technical Seminar, June 16-18, 1981, Edmonton,  
Alberta. - Ottawa : EPS, 1981, p. 587-605, figures, table)

References.

ASTIS document number 80837.

ACU, NFSMO

The detection of oil spills under ice is a major problem that has been receiving increased consideration in the last year. Little is known about target/sensor interaction requirements when compared with other situations such as the sensing of oil on ice or water surfaces. During the past year a study was carried out using four different sensing systems and an experimental ice flume. The study was concerned with the feasibility of detecting oil under an ice sheet by one or more of the four sensors utilized. ... (Au)

STARR, S. J.

See: 16.

STEIN, J.E.

See: 434, 437.

STEINBAKKE, P.

See: 69.

STEINHAEUER, W.

See: 86, 107.

STEKOLL, M.S.

665

Sublethal effects of chronic oil exposure on the intertidal clam  
*Macoma balthica* / Stekoll, M.S. Clement, L.E.  
Shaw, D.G.

(Marine biology, v. 57, no. 1, 1980, p. 51-60, ill.)

References.

ASTIS document number 170216.

ACU, NSDB

When exposed to Prudhoe Bay crude oil in flowing seawater for 180 days, the small intertidal clam *Macoma balthica* showed behavioral, physical, physiological and biochemical changes. At a high concentration of oil in seawater (3.0 mg/l) burrowing rate increased, respiration rate increased, growth was inhibited, and high mortalities resulted. The lowest concentration of oil in seawater (0.03 mg/l) inhibited growth and caused reabsorption of gametes. ... (Au)

See also: 169, 650.

STEWART, J.E.

See: 491.

STICH, H.F.

666

The carcinogenic load of the environment : benzo(a)pyrene in  
sediments of arctic waters / Stich, H.F. Dunn, B.P.  
(Arctic, v. 33, no. 4, Dec. 1980, p. 807-814, figures, tables)

References.

ASTIS document number 60160.

ACU, NFSMO

Baseline levels of the chemical carcinogen benzo(a)pyrene were measured in arctic sediments. Levels were highest in samples from the Mackenzie River delta and adjacent areas of the Beaufort Sea. The distribution of carcinogen did not correspond to the location of inhabited areas - a natural rather than a man-made source for polycyclic aromatic hydrocarbons in arctic sediments is indicated. ... (Au)

STIRLING, I.

See: 329, 515.

STIVER, W.

667

Recent University of Toronto studies on the fate and effects of oil in the marine environment / Stiver, W. Novak, M. Shiu, W.Y. Mackay, D.  
(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 24-29)

References.

ASTIS document number 170984.

This paper gives a brief review of some of the on-going projects at the University of Toronto on aspects of oil pollution. ... The work described here has been or will be published in more detailed reports; thus, only a brief review is presented. The topics include studies of evaporation, water-in-oil emulsion formation, standard test protocols and models for crude oils, response to spills of opportunity, and a general review of the physical behaviour of oil in the Arctic marine environment. (Au)

See also: 675.

STOEVA, S.

See: 298, 360.

STONE, D.P.

See: 239.

STONEHOUSE, B.

See: 578.

STORIE, J.M.

See: 455.

STRAND, J.A.

See: 87.

STRAUGHAN, D.

668

Experiments with *Littorina* species to determine the relevancy of oil spill data from southern California to the Gulf of Alaska / Straughan, D. Hadley, D.  
(Marine environmental research, v. 1, no. 2, 1978, p. 135-163, ill., map)

References.

ASTIS document number 177733.

NSDB, OON

(1) *Littorina scutulata* were collected from Alaska, Canada and southern California and *L. sitkana* were collected from Alaska and Canada. These animals were exposed to a range of petroleum at a range of temperatures. (2) Gasoline was the most toxic of all compounds tested. (3) 6 degrees C and 29 degrees C temperatures both during and prior to experiments had a greater influence on survival and attachment rates a week after exposure to petroleum

than did the different types of petroleum. The temperature influence can be related to both zoogeographical distribution and seasonal temperatures. (4) Data obtained in the Santa Barbara Channel can be extrapolated to the Gulf of Alaska when differences such as temperature tolerance and type of oil are considered for the same and closely related species. (5) Attachment rates and mortality rates changed after the animals were removed from petroleum. This suggests a weakness in standard toxicity testing procedures when mortality rates are compared immediately after removal from test solutions. (Au)

STRINGER, W.J.

669

Studies of the behavior of oil in ice, conducted by the Outer Continental Shelf Environmental Assessment Program / Stringer, W.J. Weller, G. United States. Outer Continental Shelf Environmental Assessment Program. Arctic Project Office.

Fairbanks : Geophysical Institute, University of Alaska, 1980.

17 leaves ; 28cm.

References.

ASTIS document number 75990.

ACU

The Outer Continental Shelf Environmental Assessment Program has studied the behavior of oil in ice over a number of years. Early work in tanks in which ice was grown under the action of winds and waves was followed by research on the behavior of oil under ice of various degrees of roughness in a flume, simulating different current velocities. Satellite, laser profilometer, impulse radar and drilling data have allowed an assessment of the natural underside roughness of ice in the Beaufort and Chukchi Seas, and drifting buoys and satellite observation have given bulk displacements of the ice. From all these observations and some numerical modeling a picture of oil behavior in ice has been synthesized. A summary of the major results to date is presented. (Au)

670

Studies of the behaviour of oil in ice / Stringer, W.J. Weller, G. United States. Bureau of Land Management [Sponsor].

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 31-44)

References.

ASTIS document number 174726.

ACU

... Oil spills in ice are a potential environmental problem along half of the Alaskan coastline for 6-10 months each year. ... Research conducted under the U.S. Outer Continental Shelf Environmental Assessment Program has investigated the behaviour of oil spilled in ice. This review article describes research results concerning both small- and meso-scale behaviour, including oil movement through ice during ice formation, the effect of ocean currents on oil movement under rough and smooth ice, and the effect of surface winds on oil and ice movement. (ASTIS)

STRONG, C.S.

See: 14.

## STRUZIK, E.

671

Spilling oil in Arctic to study cleaning up / Struzik, E.  
(Canadian geographic, v.101, no. 6, Dec. 1981/Jan. 1982, p.  
24-29, col. photos.)

ASTIS document number 85073.

ACU, NSDB

The BIOS project is the most ambitious oil spill experiment ever undertaken. Its aim is to assess the environmental impact of a near-shore oil spill in the Arctic, and the effectiveness of using chemical dispersants to clean it up. This experiment consisted of deliberately releasing oil at two locations in the Arctic, one at Cape Hatt, in northern Baffin Island, and a few days later, at another small bay nearby. Some of the findings of this project are reported. (ASTIS)

## STUDHOLME, A.L.

See: 522.

## SVEUM, P.

672

Oil polluted seaweeds in the Arctic : short term effects on  
decomposers and fate of the oil / Sveum, P.

Sendstad, E.

(Proceedings of the Eighth Annual Arctic Marine Oilspill  
Program Technical Seminar, June 18-20, 1985,  
Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 59-77;  
ill., map)

References.

ASTIS document number 165085.

ACU

[This paper reports on a study of oil biodegradation in beached seaweed heaps on Spitsbergen, with emphasis on the effects on populations of bacteria, Nematoda, Enchytracidae, and Collembola resident in the vegetation.] ... The primary aims of the present study have been: (1) to create data for the evaluation of the possibility of microbial treatment of oily seaweed in situ as an alternative to actual removal of oily debris; (2) to study the decomposition of oil in a seaweed heap ... (3) to study the effect on the decomposer food chain, and the subsequent recolonization. ... (Au)

See also: 223, 630, 632.

## SWISS, J.J.

See: 217, 746.

## TAASEN, J.P.

See: 296.

## TANGUAY, M.

See: 744.

## TAYLOR, T.L.

673

Response of the clam, *Macoma balthica* (Linnaeus), exposed  
to Prudhoe Bay crude oil as unmixed oil, water-soluble  
fraction, and oil-contaminated sediment in the laboratory /  
Taylor, T.L. Karinen, J.F.

(Fate and effects of petroleum hydrocarbons in marine  
ecosystems and organisms : proceedings of a symposium,  
November 10-12, 1976, Olympic Hotel, Seattle,  
Washington / Edited by D.A. Wolfe, J.W. Anderson,  
D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. -  
Toronto : Pergamon Press, 1977, p. 229-237, ill.)

References.

ASTIS document number 175013.

ACU

The small clam, *Macoma balthica* (Linnaeus 1758), will likely be subjected to oil slicks layered on the mud and to water-soluble fractions of crude oil or oil-contaminated sediment. Groups of adult clams in or on their natural sediment were exposed in flow-through aquaria at 7-12 degrees C to various concentrations of Prudhoe Bay crude oil layered on the mud surface, the water-soluble fraction (WSF) of the crude oil, and oil-treated sediment (OTS). Gentle settling of crude oil over clam beds had negligible effects on clams observed for 2 months. Water-soluble and oil-treated sediment fractions of Prudhoe Bay crude oil inhibited burrowing and caused clams to move to the sediment surface. Responses were directly proportional to concentrations of the WSF or amount of OTS. The 1-hr and 72-hr effective median concentrations of the WSF for the responses of burrowing by unburied clams and surfacing by buried clams were 0.234 and 0.367 ppm naphthalene equivalents respectively. The interpolated amount of OTS needed for a 50% surfacing response within 24 hr was 0.67 g OTS/sq cm. Although short-term exposures of clams to the WSF of crude oil and caused few deaths, behavioral responses of clams to oil may be of great importance to their survival in the natural environment. In these laboratory tests, many of the clams recovered, but in nature clams that come to the sediment surface may be eaten by predators or die from exposure. (Au)

674

Response of the clam, *Macoma balthica* (Linnaeus), exposed  
to Prudhoe Bay crude oil as unmixed oil, water-soluble  
fraction, and sediment-adsorbed fraction in the laboratory  
/ Taylor, T.L. Karinen, J.F.

(Environmental assessment of the Alaskan continental shelf :  
Principal investigators reports for the year ending March  
1976. Vol. 8 : Effects of contaminants, p. 52-87, ill.)

References.

ASTIS document number 175854.

ACU

... This paper is a summary of the laboratory work done with *M. balthica* in 1975 at ABFL [Auke Bay Fisheries Laboratory.] The objective was to measure the response of the clam to exposure to Prudhoe Bay crude oil. The effect of oil on the clams was tested three ways, which involved three methods of mixing Prudhoe Bay crude oil into the environment of *M. balthica*. Experiment 1, representing a low level of mixing energy, was designed to simulate a crude oil spill stranded on a tideflat under calm conditions. Experiment 2, representing a moderate level of mixing energy, consisted of exposing clams to water-soluble fractions (WSF) of oil. Experiment 3, representing a high level of mixing energy, consisted of exposing clams to oil-contaminated sediments. Mortality and behavior were observed and recorded in all three experiments. Burrowing was the primary response observed in the second and third experiments. ... (Au)

See also: 591.

TEBEAU, P.A.

675

Oil weathering under arctic conditions / Tebeau, P.A.

Mackay, D. Shiu, W.Y. Stiver, W. Hossain, K. McCurdy, D. Paterson, S.

(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 15-24, table)

References.

ASTIS document number 131024.

NFSMO

In this paper we outline the nature and results of a research program which involved a collaborative effort between the U.S. Coast Guard and the University of Toronto. Full details of the results will be forthcoming in a contract report (Tebeau et al. 1982). Here we discuss the principles and approach used, and give an indication of the results. ... (Au)

TELFORD, A.S.

676

Oilspill workshop / Telford, A.S. Thornton, D.E.

(Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978 / Edited by S. James [and] D. Mackay. Toronto : Institute for Environmental Studies of the University of Toronto, [1978]. Publication - University of Toronto. Institute for Environmental Studies, EE 8, p. 103-117)

Contents: - Introduction, by A.S. Telford. - Results of panel discussions, by D.E. Thornton.

ASTIS document number 19364.

ACU, NFSMO

... items we will consider are spill conditions and logistics. ... methods of monitoring slick movement, ice movement, weather conditions and seastate. ... oil-ice interaction, spreading of oil between floes, slick movement and rates of evaporation and dispersion. ... tests to determine the effectiveness of in-situ burning, and the effectiveness of dispersants and whether we should perform any equipment tests at a spill site. ... (Au)

677

Preliminary study of the fate of oil from a subsea blowout on the east coast / Telford, A.S. Metge, M.

[Calgary : Distributed by APOA], 1977.

1 microfiche : figures, table ; 11x16cm.

(APOA project no. 138 : Environmental investigations and analysis in Davis Strait - second half 1977. Report, no. 15)

(Eastern Arctic Marine Environmental Studies)

References.

Produced as part of the Eastern Arctic Marine Environmental Studies program.

EAMES order no. ES70.

ASTIS document number 26573.

ACU, NFSMO

In open water, because of dispersive mechanisms and water currents, oil from a subsea blowout in the Davis Strait will be completely dispersed within less than thirty miles from the blowout source most of the time (65%). Within thirty miles of the blowout, some oil will be visible sporadically in thin films. A significant proportion of the hydrocarbons will be separated from the rising blowout plume by horizontal currents. When an ice cover is present, oil droplets from the blowout will probably coalesce to form thin films between the ice floes. The oil will weather and be pumped onto the edge of floes where it will be mixed with ice and snow. When floes containing oil reach the edge of the pack, the oil will

be released progressively and dispersed naturally into the water column in small concentrations. The possibility of oil from a blowout contacting the shore line is remote because of dispersive mechanisms, current direction, prevailing winds, and location and movement of the pack. The oil from a blowout will always move in a southerly direction. In both open water and ice cover situations, containment and recovery with conventional booms and skimmers will be ineffective, if not impossible, even under favorable wave conditions, which would be about 35% of the time in the open season. (Au)

See also: 93. 477.

THAYER, A.S.

See: 111.

THEBEAU, L.C.

See: 272.

THOMAS, B.L.

See: 26, 596.

THOMAS, D.R.

678

Behaviour of oil spills under sea ice, Prudhoe Bay / Thomas, D.R.

Flow Research Company [Sponsor].  
Kent, Wash. : Flow Research Company, 1980.

(Flow research report, no. 175, p. 61-187, figures)

References.

ASTIS document number 130923.

NFSMO

... The purpose of this report is to summarize relevant knowledge about Arctic sea ice and oil-ice interactions in order to provide the background information for creating oil spill scenarios. The variables and processes important in oil spills associated with sea ice are identified, as are important information gaps. This report is limited to the geographical area of the December 1979 joining state/federal lease sale near Prudhoe Bay. ... (Au)

679

Harrison Bay sea ice conditions relating to oil spills /

Thomas, D.R. Flow Research Company [Sponsor].  
Kent, Wash. : Flow Research Company, 1980-?

(Flow research report, no. 189, p. 275-327, figures)

References.

ASTIS document number 130958.

NFSMO

... The purpose of this report is to summarize relevant knowledge about sea ice conditions in the Harrison Bay, Alaska region. ... This report is limited to the geographical area of lease sale 71 near Harrison Bay. Generally, we restrict this report to factors which can be expected to play a major role in the sequence of events following an under-ice oil well blowout in the lease area. We begin by discussing in Section 2 the geography, climate, and oceanography of the lease sale area. ... In Section 3 we review the characteristics of the sea ice in the lease sale area. The area is divided into zones (undeformed fast ice, deformed fast ice, and deformed and moving pack ice) based upon the morphological traits of the ice. The chronological development of each zone is followed.

... And finally, in Section 4 we summarize the sequence of events following an under-ice blowout and review the important aspects of oil and sea ice interactions. (Au)

680

**Interaction of oil and arctic sea ice / Thomas, D.R.**

(The Alaskan Beaufort Sea : ecosystems and environments / Edited by P.W. Barnes, D.M. Schell and E. Reimnitz. - Orlando, Okla. ; Toronto, Ont. : Academic Press, 1984, p. 441-460)

**References.**

*ASTIS document number 161217.*

ACU

... This paper summarizes the relevant knowledge about the interactions between arctic sea ice and oil. ... An attempt is made to identify the major factors in the interaction between oil and arctic sea ice and to present them in a way that defines the scope of the problem. This report restricts itself to factors that can be expected to play a major role given a large under-ice blowout in the Beaufort Sea during winter. Blowouts that occur during the summer, in subarctic water, or beyond the continental shelf are not considered here. [Thermal effects of the oil from a blowout, oil spill movement, and surface containment in various kinds of ice is covered]. (Au)

681

**Prudhoe Bay oil spill scenarios / Thomas, D.R. Flow Research Company [Sponsor].**

Kent, Wash. : Flow Research Company, 1980.  
(Flow research report, no. 176, p. 189-273)

*ASTIS document number 130940.*

NFSMO

The purpose of this report is to describe the most likely sequence of events following an offshore oil well blowout during the ice season in the Beaufort Sea. The descriptions pertain specifically to the December 1979 joint state/federal lease sale area offshore of Prudhoe Bay, Alaska. ... Twelve hypothetical blowout scenarios are described in this report. The parameters which describe these blowouts were chosen by the Outer Continental Shelf Environmental Assessment Program (OSCEAP) and are intended to cover the range of ice conditions under which blowouts might occur in the lease area. ... Three blowout locations are used to cover the possible range of sea ice conditions occurring in the lease sale area. These locations are: (1) the fast ice zone ... (2) the stamukhi zone ... and (3) the pack ice zone .... The subject matter discussed in these scenarios is limited to the effect an ice cover will have on the spilled oil. The possible causes of a blowout and the probability of a blowout are not treated beyond assuming that the blowout occurs under an ice cover some distance away from any natural or artificial island being used as a drilling platform. ... (Au)

See also: 77, 81.

THOMAS, R.E.

682

**The effect of exposure temperatures on oxygen consumption and opercular breathing rates of pink salmon fry exposed to toluene, naphthalene, and water-soluble fractions of Cook Inlet crude oil and no. 2 fuel oil / Thomas, R.E. Rice, S.D.**

(Marine pollution : functional responses : proceedings of the Symposium "Pollution and Physiology of Marine Organisms", held on November 14-17, 1977 at Hobcaw Barony, Georgetown, South Carolina / Edited by W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J.

Vernberg. - New York : Academic, 1979, p. 39-52. ill  
**References.**

*ASTIS document number 180700.*

ACU

... The primary objective of this study was to measure breathing rates in pink salmon fry exposed to equivalent concentrations of aromatic hydrocarbon toxicants at 4 degrees and 12 degrees C to determine if the response at the lower temperature differs from that at the higher temperature. This experiment was of interest because spills in Alaskan waters will probably occur at lower temperatures than have been studied elsewhere, and little is known about the effects of aromatic hydrocarbons at these lower temperatures. ... (Au)

683

**Increased opercular rate of pink salmon (*Oncorhynchus gorbusha*) fry after exposure to the water-soluble fraction of Prudhoe Bay crude oil / Thomas, R.E. Rice, S.D.**

(Journal of the Fisheries Research Board of Canada, v. 32, no. 11, Nov. 1975, p.2221-2224)

**References.**

*ASTIS document number 172936.*

ACU

The opercular rates of pink salmon (*Oncorhynchus gorbusha*) fry were measured during 24-h exposure to sublethal concentrations of the water-soluble fraction of Prudhoe Bay crude oil. Opercular rates increased significantly for as long as 9 and 12 h after exposure to water-soluble fractions prepared from oil-water solutions of 2.83 and 3.46 ppm. The increases in rates were proportional to increases in dose. Recording changes in opercular rates appears to be a suitable method for detecting sublethal physiological effects of stress because the observed changes occurred at approximately 20% of the 96 h LC50. (Au)

See also: 582.

THOMPSON, D.B.

See: 326.

THOMPSON, I.

See: 89, 90.

THOMSON, D.H.

See: 77, 188, 189, 190, 191, 400, 404.

THOMSON, V.

See: 254.

THORNTON, D.E.

684

**Experimental oil spill : oil in arctic coastal environments / Thornton, D.E.**

(Spill technology newsletter, v. 4, no. 6, Nov.-Dec. 1979, p. 325-328, map)

*ASTIS document number 45438.*

ACU, NFSMO, NSDB

Two studies recommended by the Arctic Marine Oilspill Program, oil in arctic nearshore environments and oil on arctic shorelines, "have been combined into one project to minimize logistical costs, and to provide a direct comparison between chemical dispersion, other shoreline countermeasures, and the no-cleanup option. The latest status of the planning is summarized ...." (ASTIS)

685

**Experimental oil spills : the Baffin Island Oil Spill in particular** / Thornton, D.E. Blackall, P.J.  
(Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 486-494, maps)

References.

ASTIS document number 174564.

ACU

This paper outlines the location, objectives and general experimental design of the proposed BIOS project, including both nearshore and shoreline studies. (ASTIS)

686

**Oil-ice interaction** / Thornton, D.E.  
(Spill technology newsletter, v. 4, no. 3, May-June 1979, p. 160-161)  
ASTIS document number 174955.  
ACU, NFSMO, NSDB

This brief article outlines current (1977,1979) Arctic Marine Oilspill Program research into oil, gas and ice interactions, including the Arctec Canada lab work, University of Toronto lab experiments, the Griper Bay, N.W.T. test spill and the C-CORE Kurdistan investigation. (ASTIS)

687

**"On experimental oil spills" - a response** / Thornton, D.E.  
Blackall, P.J. Sergy, G.A. Canada.  
Environmental Protection Service. Snow, N.B.  
Hume, H. Petro-Canada.  
(Spill technology newsletter, v. 5, no. 5, Sept.-Oct. 1980, p. 137-146, tables)

References.

Response to ASTIS document number 62065, On experimental oil spills / D. Mackay in Spill technology newsletter, v. 5 no. 5, Sept.-Oct. 1980, p. 131-136.

ASTIS document number 62073.

ACU, NFSMO, NSDB

During the last few years an effort has been made in Canada to identify research needs which require experimental oilspills, in order to develop a coordinated and planned approach to such spills. During this process many specialists in Canada and overseas were consulted and the large consensus was that experimental spills are a necessary complement to other research approaches such as laboratory research or work on spills of opportunity. ... The Baffin Island Oil Spill (BIOS) project stems directly from the initial planning effort. ... The project involves an initial year of primarily baseline data gathering, followed by the main oil discharges in the second year and two additional years of monitoring. In the first year, some initial experience and data about the fate of oil will be obtained through a few small oil discharges close to shore. (Au)

See also: 95, 415, 676.

## THORSTEINSON, L.K.

688

**Proceedings of a Synthesis Meeting : the North Aleutian Shelf environment and possible consequences of offshore oil and gas development, Anchorage Alaska, 9-11 March, 1982** / Thorsteinson, L.K. [Editor].  
Juneau, Alaska : U.S. NOAA, 1984.  
xxiv, 159 p. : figures, tables ; 28 cm.  
(NTIS PB84-209428)

References.

Meeting also known as North Aleutian Shelf Synthesis Meeting.

ASTIS document number 141119.

ACU, NSDB(NTIS)

On 9-11 March 1982, OCSEAP principal investigators, other scientists conducting research in Bristol Bay, representatives of resource management agencies, and other interested parties, including those responsible for the Bristol Bay Management Plan, met in Anchorage, Alaska for the North Aleutian Shelf Synthesis Meeting. The meeting provided a forum for discussions on environmental concerns and multiple resource use conflicts and provided recommendations for the protection of marine and coastal resources from possible adverse effects of oil and gas development. At the meeting, available data were used to (1) describe the marine and coastal habitats and resources of the North Aleutian Shelf; and (2) discuss the environmental implications of the planned oil and gas development, including effects from hypothetical cases of oil spills and other pollution incidents. The environmental consequences of three hypothetical oil spills were considered .... The following topics were discussed in workshops and plenary sessions of the synthesis meeting ... pollutant transport and fate ... fisheries ... coastal and nearshore habitats and ecosystems ... (Au)

## THURIER, R.

See: 200.

## TOIMIL, L.J.

See: 78, 79.

## TOPHAM, D.R.

689

**The disposition of gas/oil mixtures trapped under ice** / Topham, D.R.

(Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 55-73, ill.)

ASTIS document number 175170.

ACU

In the event of an oil well blowout in ice covered waters a mixture of oil and gas is released which is eventually trapped beneath the ice sheet; the resulting area of ice contaminated by oil is of considerable practical importance to those attempting to control or clean up such a situation. ... [This article uses mathematical modeling to describe the characteristics of an oil/ice/water/gas system.]. (Au)

690

**Hydrodynamics of an oilwell blowout** / Topham, D.R.  
Victoria, B.C.: Beaufort Sea Project, 1975.

52p. : ill., figures, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 33)

(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 33)

#### References.

ASTIS document number 15520.

ACU, NFSMO

... The work described in this report concerns the behaviour of the oil/gas mixture as it leaves the pipe exit, its transport to the sea surface, and the locally induced water flows. ... Two separate experiments were undertaken, a full-scale simulation of the gas bubble plume in 60 m of seawater using air compressors, and a tank experiment investigating the behaviour of gas/oil mixtures at an underwater pipe exit. As these two experiments were separate investigations, they are presented as self-contained sections and the major consequences are delineated in a separate section describing a probable blowout scenario. (Au)

691

The interaction of oil with sea ice in an offshore environment / Topham, D.R.

(Proceedings of Offshore Environment in the 80's, St. John's, Newfoundland, December 2-4, 1980. - [St. John's, Nfld.] : [s.n.], 1980, [23] p., ill., maps)

#### References.

ASTIS document number 171239.

ACU

... This paper examines what is known at the present time as to the interaction of oil and gas mixtures with sea ice under various conditions. ... in the event of an oilspill disaster, some knowledge of the way in which the oil is disposed at and close to the sea surface is essential, and this in turn depends on the source of oil. Major spills are likely from two sources; tanker accidents and oilwell blowouts. ... [This paper includes a detailed picture of] the physical processes occurring at the blowout site itself ... as it is these which determine the form in which the oil reaches the surface, ice drop size and distribution, areal concentration of oil at the surface and the possibility of the formation of emulsions. (Au)

### TOTAL EASTCAN EXPLORATION LTD.

See: 44.

TRASKY, L.L.

692

Impact of oil on the Kachemak Bay environment / Trasky,

L.L. Flagg, L.B. Burbank, D.C.

Anchorage, Alaska : Alaska Dept. of Fish and Game, Marine/Coastal Habitat Management, 1977.

v, 123 p. : ill., maps ; 28 cm. + 1 folded map in pocket.

(Environmental studies of Kachemak Bay and lower Cook Inlet / Edited by L.L. Trasky, L.B. Flagg and D.C. Burbank. - Anchorage, Alaska : Alaska Dept. of Fish and Game, Marine/Coastal Habitat Management, 1977, v. 1)

#### References.

ASTIS document number 178110.

Kachemak Bay, located in southeastern Lower Cook Inlet ... has been the focus of considerable interest and environmental concern as a consequence of the discovery and proposed development of potential oil resources in the Bay. ... In response to legislative action, the Governor directed the Department of Fish and Game to conduct studies to determine the potential impacts which oil development might have on the fish and game resources of the Bay. ... The program was specifically designed to: (1) assemble existing information concerning the effects of oil on biological resources, with emphasis on fisheries; (2) obtain information on the biological

resources of Kachemak Bay and their sensitivity to the various impacts of oil development, and; (3) synthesize the information gained in (1) and (2) to provide a rational basis for regulation and enforcement activities during oil and gas exploration, development and production. Field work was initiated in August of 1974 and continued through October of 1976. The field studies were designed to: (1) identify the physical processes which control the movement of pollutants and larval marine life, and (2) provide baseline data on the biological resources of Kachemak Bay and Lower Cook Inlet. ... (Au)

See also: 16.

TRAXLER, R.W.

See: 194.

TREMBLAY, J.

See: 544.

TRITES, R.W.

693

Kurdistan spill movement / Trites, R.W. Vandermeulen, J.H. Lawrence, D.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979. Bedford Institute of Oceanography / Edited by J. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 33-57, ill., maps)

#### Appendices.

#### References.

ASTIS document number 169641.

OON

When the tanker Kurdistan broke into two on March 15, 1979 in the Cabot Strait about 7,000 tons of Bunker C fuel oil were spilled into the ice-infested waters. ... We became interested in the possible role played by the ice in these waters in the movement and dispersal of the spilled Kurdistan oil, and in the driving forces moving surface slicks. ... Specifically we have examined two possible oil movement scenarios, one in which the Kurdistan oil was entrapped by the ice and movement was ice-dominated, the other in which most if not all of the oil escaped entrapment and moved unhindered by ice over the Scotian Shelf .... Based on an analysis of ice-movement, current information, wind data and oil sightings we favor the second of these possibilities - that a considerable part of the Kurdistan oil moved freely of the ice. ... (Au)

694

Preliminary observations on oil/ice interaction from CSS Hudson / Trites, R.W.

(The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 39-47, map)

ASTIS document number 177067.

NSDB

On March 15, 1979 the oil tanker Kurdistan broke into two halves in Cabot Strait. She was carrying Bunker C Oil, and an estimated 7,000 tons of oil escaped. On March 22nd a large area of oil-



stained ice was reported and photo-documented by the Department of National Defence inshore along the south coast of Cape Breton Island (e.g. 45 40 N 60 13 W, and 45 38 N 60 21 W). The following are the reports of a helicopter reconnaissance flight and of a subsequent CSS Hudson visit to the area. These were arranged by the Bedford Institute of Oceanography for the purpose of: (1) acquiring samples of the oil and oil-ice mixtures (2) carrying out vertical sampling of the water column in those areas where oil was present at the surface (3) carrying out neuston net tows in open water to determine the amount and extent of oil present at the surface (4) making observations on oil-ice interaction (5) acquisition of a photographic record of the oil and oil-ice mixtures (6) determining desirability and feasibility of carrying out special research experiments related to the Kurdistan oil spill and to oil-ice mixtures. (Au)

# TRIVELPIECE, W.Z.

695

Reduced survival of chicks of oil-dosed adult Leach's Storm-petrels / Trivelpiece, W.Z. Butler, R.G. Miller, D.S. Peakall, D.B.

(The Condor (Los Angeles). v. 86, no. 1, Feb. 1984, p. 83-85, ill.)

## References.

ASTIS document number 181455.  
ACU

Birds with petroleum-coated plumage may ingest and/or inhale substantial amounts of the substance while preening .... In the present study, we examined the effect of sub-lethal oil ingestion by adult Leach's Storm-Petrels (*Oceanodroma leucorhoa*) on the survival and growth of their chicks. ... They are ideal subjects for the study of oil effects on reproduction because: (1) they feed on the surface, where oil slicks are located; (2) their burrow nest provides the chicks with a uniform environment, and allows easy access to both adults and chicks with little disturbance to the rest of the colony; and (3) like all procellariids, they lay only a single egg. Because of their low reproductive potential, members of this order may be particularly vulnerable to the impact of oil contamination. Our study was conducted during the 1979 and 1980 breeding seasons on an island 12 km off the coast of Maine. ... Adults from experimental burrows were given a single 0.1-ml dose of Prudhoe Bay crude oil (PBCO; chemical analysis in Peakall et al. 1982) by intubation. ... Our study shows decreased survival and reduced growth rates in chicks of oil-dosed adult Leach's Storm-Petrels. ... (Au)

# TROBAUGH, L.

See: 310.

# TRUETT, J.C.

See: 392.

# TURE, M.E.

See: 735.

## UNITED STATES. BUREAU OF LAND MANAGEMENT

See: 14, 24, 33, 47, 48, 49, 64, 105, 123, 133, 160, 170, 171, 178, 179, 180, 182, 189, 222, 281, 292, 293, 294, 302, 346, 356, 361, 362, 436, 438, 439, 440, 441, 449, 451, 453, 518, 539, 541, 549, 586, 587, 588, 618, 619, 620, 640, 641, 670, 704, 713, 747.

## UNITED STATES. COAST GUARD

See: 21.

## UNITED STATES. COAST GUARD. OFFICE OF RESEARCH AND DEVELOPMENT

See: 321, 455, 696, 697, 707.

## UNITED STATES. COAST GUARD. RESEARCH AND DEVELOPMENT CENTER

696

Aerial photographic surveys analyzed to deduce oil spill movement during the decay and breakup of fast ice, Prudhoe Bay, Alaska, final report / United States. Coast Guard. Research and Development Center. Lissauer, I.M. Baird, D.A. United States. Coast Guard. Office of Research and Development [Sponsor].

Avery Point Groton, Conn. : U.S. Coast Guard Research and Development Center [publisher]; Springfield, Va. : U.S. National Technical Information Service [distributor], 1982.

1 microfiche : ill., figures, tables ; 11 X 15 cm.  
(NTIS AD-A-126 395)

## Appendices.

## References.

ASTIS document number 128104.

NFSMO, NSDB(NTIS)

During the summers of 1979 and 1980 aerial photographs of the land fast ice north of Prudhoe Bay, Alaska, were taken. These photographs, covering two-week periods, highlight the decay and break-up of the land fast ice sheet. During the period of photography, wind speed, wind direction, barometric pressure, and tidal height measurements were recorded continuously. Several larger ice floes were "tagged" with colored plywood markers during 1979. Both these marked floes and other distinctively shaped floes were tracked on the photographic surveys to determine the effect the wind had on their movement .... In addition to the flow drift calculations the photographs provide information on melt pool formation and a comparison of the decay and breakup processes between the 1979 and 1980 seasons. The decay and breakup process appears to be triggered by strong wind events in early July. (Au)

697

Movement of satellite-tracked buoys in the Beaufort Sea (1979-1981) / United States. Coast Guard. Research and Development Center. Murphy, D.L. Lissauer, I.M. Myers, J.C. United States. Coast Guard. Office of Research and Development [Sponsor].

Groton, Conn. : U.S. Coast Guard, Research and Development Center [publisher] ; Springfield, Va. : NTIS [distributor], 1983.

1 microfiche : ill., maps ; 11 x 15 cm.

(Report - United States. Coast Guard, CG-D-30-83)

(NTIS AD-A-133 159)

Appendices.

References.

*ASTIS document number 175986.*

ACU

As part of an investigation into the fate of potential Arctic oil spills, the U.S. Coast Guard Research and Development Center and Canadian Marine Drilling Ltd. (CANMAR) released satellite-tracked platforms at the Canadian offshore drilling sites in the southeastern Beaufort Sea. During the first three years of joint research effort, which began in 1979, 21 trajectories were compiled, 15 from oceanographic drifters released in summer open water conditions and 6 from platforms deployed onto Arctic Ocean sea ice. The movement of the 15 oceanographic drifters showed considerable interannual variability. In 1979 the buoys moved offshore and to the west, paralleling the Alaskan coast, a direction which is consistent to the east-to-west motion of the southern portion of the Beaufort Sea Gyre. The 1980 and 1981 drift data show no such consistent behavior. In 1980 the buoys first moved to the east; three of the buoys then reversed directions and moved to the west in response to persistent winds from the east and northeast. The 1981 data exhibited the most dramatic easterly movement with five buoys grounding on or near the Tuktoyaktuk Peninsula, a short distance from the release site. Despite this remarkable yearly variability, at least one buoy drifted into U.S. waters in each of the first three years of the study. This, in addition to the fact that the ice movement data show a net westward motion, suggests that the Alaskan coast could be affected by a major uncontained blowout during Canadian offshore operations. ... (Au)

See also: 32.

## UNITED STATES. CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY

See: 34, 650.

## UNITED STATES. COUNCIL ON ENVIRONMENTAL QUALITY

698

**Oil spill trajectory studies for Atlantic coast and Gulf of Alaska / United States. Council on Environmental Quality.**

(OCS oil and gas : an environmental assessment : a report to the President, vol. 5 / United States. Council on Environmental Quality. - Washington, D.C. : U.S.G.P.O., 1974, [microfiches 5-7], ill., maps)

References.

*ASTIS document number 160008.*

The purpose of this study is to obtain insight into the likely behavior of oil spill trajectories emanating from each of the thirteen potential Atlantic outer continental shelf (OCS) production regions, ... and each of the nine potential production areas in the Gulf of Alaska .... Major emphasis in all these analyses will be placed on the probability of a spill's coming ashore, the time to shore, and ... the wind conditions at the time the spill first reaches shore. (Au)

699

**Potential biological effects of hypothetical oil discharges in the Atlantic coast and Gulf of Alaska / United States. Council on Environmental Quality.**

(OCS oil and gas : an environmental assessment : a report to

the President, vol. 5 / United States. Council on Environmental Quality. - Washington, D.C. : U.S.G.P.O., 1974, [microfiches 1-5], ill., maps)

References.

*ASTIS document number 178560.*

This report is an analysis of the primary biological effects of potential oil discharges resulting from hypothetical oil production activity on the Atlantic/Alaskan OCS. The results are intended for input to the Council on Environmental Quality as part of the information base to decide: (1) whether or not to recommend OCS oil exploration/drilling in these areas; and (2) if yes, where. Although emphasis is placed on analysis of impacts and recovery from large-volume infrequent accidental oil spills, small volume continuous discharges of hydrocarbons are also considered. Effects of oil releases from offshore platforms and spills occurring at coastal terminals are assessed. This study does not yield quantitative predictions of environmental impacts of oil discharges. ... However, qualitative predictions are attempted which are rough order of magnitude estimates of physical, chemical and biological changes likely to occur due to oil releases into the marine environment. ... (Au)

## UNITED STATES. DEPT. OF ENERGY

See: 21.

## UNITED STATES. ENVIRONMENTAL PROTECTION AGENCY

See: 21.

## UNITED STATES. FISH AND WILDLIFE SERVICE

See: 21.

## UNITED STATES. MINERALS MANAGEMENT SERVICE

700

**Draft environmental impact statement, April 1985 : proposed St. George Basin (sale 89) / United States. Minerals Management Service.**

[Anchorage, Alaska : Minerals Management Service, Alaska OCS Region, 1984].

1 v. (various pagings) : 5 ill. (folded), figures, tables ; 28 cm. (Outer Continental Shelf EIS, MMS 84- 0017)

Cover title: St. George Basin, sale 89 : draft environmental impact statement.

Appendices.

Bibliography: p. 1-23.

References.

*ASTIS document number 142018.*

ACU

This environmental impact statement ... discusses a proposal for oil and gas leasing in the St. George Basin, alternatives to the proposal, major issues determined through the scoping process and staff analyses, and potential mitigating measures. The proposal consists of 12,563 blocks (approximately 28.2 million hectares) to be offered for lease in the St. George Basin. The potential effects of this leasing proposal are based, in part, on the assumption that medium resource estimates of 660 MMBbls of oil would be discovered and produced in the St. George Basin. For this amount of oil, 2.08 oil spills of 1,000 barrels or greater are projected statistically over the 22-year life of the proposal. For this proposal, there is no higher than a 21-percent chance that one or more spills

of 1,000 barrels or greater would occur and contact land within 30 days. The risks from spills would be mitigated to the extent that weathering and decay of oil occurs at sea, and by the success of any spill countermeasures which would be attempted. ... This EIS is not intended, nor should it be used, as a local planning document by potentially affected communities. The facility locations and transportation scenarios described in this EIS represent assumptions that were made as a basis for identifying characteristic activities and any resulting environmental effects. ... Local control of events may be exercised through planning, zoning, land ownership, and applicable state and local laws and regulations. (Au)

701

**Final environmental impact statement, Volume 1 : Proposed Gulf of Alaska/Cook Inlet lease sale 88 / United States. Minerals Management Service.**

[Anchorage, Alaska] : U.S. Minerals Management Service, Alaska OCS Region, 1984.

2 v. (various pagings) : figures (some folded) ; 28 cm. Bibliography.

Volume 2: Appendices.

Cover title: Gulf of Alaska/Cook Inlet Sale 88.

ASTIS document number 143820.

ACU

This environmental impact statement (EIS) discusses a proposal for oil-and-gas leasing in the Gulf of Alaska/Cook Inlet, alternatives to the proposal, major issues determined through the scoping process and through staff analyses, and potential mitigating measures. The proposal consists of 4,796 blocks (10.40 million hectares; approximately 25 million acres) to be offered for lease in the Gulf of Alaska/Cook Inlet. Most of the lease area lies shoreward of the 2,000 meter isobath. ... (Au)

702

**Final supplemental environmental impact statement : supplement to Final environmental impact statement St. George Basin / United States. Minerals Management Service.**

[Washington, D.C.] : U.S. Government Printing Office, 1983.

1 v. (various pagings) : figures, tables ; 28 cm.

Appendices.

Bibliography.

Cover title: St. George Basin final supplemental environmental impact statement.

ASTIS document number 110191.

ACU

This final supplemental environmental impact statement (EIS) discusses the effects of geophysical seismic activities and evaluates the risk of a very large oilspill (100,000 barrels or greater) on gray and right whales within the St. George Basin lease offering area. Evaluation of probable impacts is based upon information derived from the Sale 70 FEIS (incorporated in this document by reference) and from new information made available since publication of the Sale 70 FEIS. The environmental analysis focuses on oil and gas leasing activities on 96 tracts that received bids .... The final level of preliminary seismic activity on these tracts in the St. George Basin will depend upon whether or not there is a discovery, the number of fields discovered, and the areal extent of the fields. Oilspill impacts are based upon an unrisksd mean resource estimate of 1.12 billion barrels of oil. ... (Au)

703

**Proposed Norton Basin Lease Sale 100 : final environmental impact statement / United States. Minerals Management Service.**

[S.l.] : U.S. Minerals Management Service, 1985.

2 v. : ill., maps (some col.) ; 28 cm.

(Outer Continental Shelf EIS/EA. MMS 85- 0085)

Appendices.

Cover title: Norton Basin Sale 100 : final environmental impact statement.

Includes index.

References.

ASTIS document number 181358.

ACU

This environmental impact statement (EIS) discusses a proposal for oil and gas leasing in the Norton Basin Planning Area, analyzes its potential effect on the environment, describes alternatives to the proposal, presents major issues determined through the scoping process and through staff analyses, and describes potential mitigating measures. ... The scenario used to assess the potential effects that petroleum exploitation may have on the environment describes possible activities and timing of events. ... [Oil and gas well exploration and production, as well as, crude oil and LNG marine transportation, and their impacts, are among the activities discussed.] ... (Au)

See also: 136, 196, 434, 437, 450, 542, 543, 584, 585, 737.

## UNITED STATES. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

See: 16, 21, 453.

## UNITED STATES. OFFICE OF NAVAL RESEARCH

See: 21, 320, 453.

## UNITED STATES. OUTER CONTINENTAL SHELF ENERGY ASSESSMENT PROGRAM

See: 47, 48, 49.

## UNITED STATES. OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM

704

**Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators / United States.**

Outer Continental Shelf Environmental Assessment Program. United States. Bureau of Land Management [Sponsor].

Boulder, Colorado : Environmental Research Laboratories, 1978- .

vol. : ill., tables, maps, figures ; 28cm.

Contents: v.1- Biological studies.

References.

ASTIS document number 13382.

ACU

Reports on research activities and results of the Alaska Outer Continental Shelf Environmental Assessment Program. (ASTIS)

705

**Outer Continental Shelf Environmental Assessment Program : comprehensive bibliography March 1984 / United States. Outer Continental Shelf Environmental Assessment Program.**

Juneau, Alaska : U.S. Dept. of Commerce, National Oceanic

and Atmospheric Administration, National Ocean Service, Office of Oceanography and Marine Services, Ocean Assessments Division, 1984.

iv, 607 p. : figure ; 28 cm.

ASTIS document number 143006.

ACU, NFSMO

[The Outer Continental Shelf Environmental Program (OCSEAP) was initiated to help ensure that proposed OCS development and production activities will not irreparably damage the marine environment and its resources.] ... The scientific objectives of OCSEAP research as well as individual research projects are planned according to combinations or subdivisions of the following general study elements: 1. Contaminant Distribution ... 2. Environmental Hazards ... 3. Pollutant Transport, Weathering, and Fate ... 4. Living Resources ... 5. Effects .... This bibliography is a compilation of publications and reports that have resulted from research funded by OCSEAP since its inception in 1975 and is an updated version of the Comprehensive Bibliography published in August 1980. Certain other publications that have appeared in other government documents, books, or refereed literature relating to environmental problems associated with oil and gas development are included in the bibliography. Geographic and disciplinary keyword descriptors are associated with each citation in the bibliography. The geographic descriptors include the original BLM proposed lease areas and the regional codes Arctic, Bering, and/or Gulf, or Non-Site as appropriate. The bibliography consists of three sections. Citations sorted alphabetically by author are followed by the citations sorted numerically by citation number. The Research Unit or RU associated with each citation is included at the end of each citation. The third section of the bibliography is a cross-reference of Area/Discipline codes which lists citation numbers for each Area/Discipline group. This bibliography has been produced from a computerized file which is routinely updated at the Alaska Office to include new citations on OCSEAP related research. ... (Au)

See also: 195, 361, 392, 624, 738.

# UNITED STATES. OUTER CONTINENTAL SHELF ENVIRONMENTAL ASSESSMENT PROGRAM. ARCTIC PROJECT OFFICE

706

Environmental assessment of the Alaskan continental shelf : interim synthesis report - Beaufort/Chukchi / United States. Outer Continental Shelf Environmental Assessment Program. Arctic Project Office.

Boulder : NOAA Environmental Research Laboratories, 1978.

ix, 362p. : figures, maps, tables ; 28cm.

Results of discussions at the Beaufort Sea Synthesis Meeting, Barrow, January 24-27, 1978.

At head of title: Outer Continental Shelf Environmental Assessment Program.

References.

ASTIS document number 27324.

ACU, NSDB(ENV.)

Areas of study include the sea ice environment, physical oceanography and meteorology, earth sciences, marine mammals, birds, marine biota, chemistry and microbiology. The interdisciplinary aspects of likely OCS impacts include species, habitats and processes sensitive to OCS development, trophic interactions, probable impacts and consequences of oil development, effects of gravel mining and construction of gravel islands and causeways, and environmental hazards to offshore operations. (ASTIS)

See also: 669.

## UNIVERSITY OF ALASKA (COLLEGE). INSTITUTE OF MARINE SCIENCE

707

Arctic oil biodegradation / University of Alaska (College). Institute of Marine Science. Button, D.K. United States. Coast Guard. Office of Research and Development [Sponsor].

Washington, D.C. : U.S. Coast Guard, Office of Research and Development, 1974.

1 microfiche : ill., map ; 11 x 15 cm.

(Report - United States. Coast Guard, CG-D-114- 75)

(NTIS AD-A-014 096)

References.

ASTIS document number 176958.

NSDB

The abundance of microbial hydrocarbon oxidizers is reported from measurements in three widely distributed marine systems in the far north. Population measurements, based on a modification of the dilution to extinction method, were in the range of 1,000 to 10,000 per liter. Concomitant in situ organic substrate oxidation rates measured by <sup>14</sup>CO<sub>2</sub> collection were 0.2 to 1.6 mg/l hr from an initial added concentration of 1.4 mg/l mixed amino acids and 2 to 50 mg/l hr from added dodecane solution. The solubility of dodecane in saline medium was determined as 1.78 mg/l at 25 degrees C, and the predictability of high molecular weight alkane solubility confirmed. This true solution was used to show that a relatively high molecular weight hydrocarbon can be co-metabolized along with another substrate (arginine) from the dissolved phase. Dodecane derived CO<sub>2</sub>, arginine and glutamic acid were recovered from the 1.78 mg/l <sup>14</sup>C-dodecane, 1.0 mg/l <sup>12</sup>C-arginine medium after having been supplied to a continuous culture of a marine hydrocarbon oxidizing isolate. In batch culture this pure isolate reduced the dodecane concentration to below 0.14 mg/l. Clay sorption experiments were conducted which showed that the catalytic role of suspended sediments was negligible. No dodecane sorption by bentonite could be detected in a 20% saturated hydrocarbon solution. These and other data presented support the assumption that direct dissolved phase organic material metabolism is a normal ubiquitous marine process having characteristics compatible with submicrogram per liter steady state hydrocarbon concentrations. (Au)

708

Environmental assessment of the northeastern Gulf of Alaska : chemical oceanography (hydrocarbons) / University of Alaska (College). Institute of Marine Science. Shaw, D.G.

Fairbanks : University of Alaska, Institute of Marine Science, 1975.

[5] leaves : figures, charts, tables ; 28cm. + 4 microfiches (11x16cm.).

Text in microfiche.

First year final report to the National Oceanic and Atmospheric Administration.

Appendices.

References.

ASTIS document number 22381.

ACU

Data has been collected concerning the kinds and amounts of hydrocarbons in surface water, benthic sediments, flotsam and coastal oil seeps in the northeast Gulf of Alaska. While similar measurements have been made in adjacent coastal waters the present work constitutes the first such measurements made in the open Gulf of Alaska. ... they indicate that the hydrocarbon levels in the Gulf of Alaska are as low as or lower than those found in other

areas of the world ocean which are free of obvious pollution. (Au)

**UNIVERSITY OF ALASKA, FAIRBANKS.  
INSTITUTE OF MARINE SCIENCE**

See: 650.

**UNIVERSITY OF BRITISH COLUMBIA. DEPT. OF  
OCEANOGRAPHY**

709

The effects and fate of chemically dispersed crude oil in a marine ecosystem enclosure : data report and methods / University of British Columbia. Dept. of Oceanography. Institute of Ocean Sciences, Patricia Bay. Ocean Chemistry Division. Shandong College. China (People's Republic of China, 1949- ). National Bureau of Oceanography. Whitney, F.A. [Editor]. International Development Research Centre (Canada) [Sponsor].

Sidney, B.C. : Institute of Ocean Sciences, 1984.

1 microfiche : ill. ; 11X15 cm.

(Canadian data report of hydrography and ocean sciences, no. 29)

References.

Also available in paper.

ASTIS document number 161110.

ACU

This report summarizes the experimental data collected in a study of the chemical fate and biological effects of Prudhoe Bay crude oil dispersed with Corexit 9527 in plastic enclosures. On July 17, 1983, three plastic enclosures of 2.5 m diameter with 16 m depth, were filled with sea water in Patricia Bay in Saanich Inlet, B.C. near the Institute of Ocean Sciences. The experimental conditions in the three enclosures were: (1) control, with a nutrient addition only, (2) nutrients plus chemical dispersant, and (3) nutrients plus chemically dispersed crude oil. Over 25 days, sampling and analyses were carried out to observe the impact of dispersed oil on pelagic marine organisms, and to study the removal rate and pathways of crude oil in the enclosed waters. (Au)

**UNIVERSITY OF TORONTO**

710

The effectiveness of chemical dispersants at low temperatures and in the presence of ice / University of Toronto. Mackay, D. Mascarenhas, R. Hassain, K. McGee, T. Esso Resources Canada [Sponsor]. (Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 317-327, ill.)

ASTIS document number 174700.

ACU

... [This report describes] a study of the effectiveness of chemical dispersants in Arctic marine conditions. The general objective was to provide information which would be useful in developing an aerial dispersant spraying capability as part of the contingency plans for the East Coast offshore region. The specific objectives were defined as: 1. Defining the minimum dose rates, i.e. volume of dispersant per volume of oil that will effectively disperse fresh and weathered oil at freezing conditions quickly (within 15 minutes) and over a longer period (within 4 hours). Effectively dispersed oil is taken to mean oil being fairly uniformly dispersed as fine droplets in the water column. 2. Determination of the effects of the presence of slush ice and solid ice blocks on the minimum dose rates that

effectively disperse fresh and weathered oil. 3. An insight into the dispersal behaviour of dispersant treated oil as it is released from the top of an ice block as the ice gradually melts. ... (Au)

**UNIVERSITY OF TORONTO. DEPT. OF  
CHEMICAL ENGINEERING AND APPLIED  
CHEMISTRY**

711

The fate and behaviour of oil in cold climates / University of Toronto. Dept. of Chemical Engineering and Applied Chemistry. Mackay, D. Canada. Environment Canada [Sponsor].

[Ottawa] : Environment Canada, [1985?].

1 v. (various pagings) : ill. ; 28 cm.

References.

ASTIS document number 180300.

ACU

This report is a review of the scientific literature concerning the behaviour and fate of oil spills in cold marine environments, typical of the Canadian Arctic. The issues addressed include oil types and characteristics, oil release conditions, interaction with ice, spreading and drift, evaporation from slicks and from water, dispersion (oil in water emulsification), mousse formation (water in oil emulsification), dissolution, chemical and biochemical conversion, and interaction with sediments. (Au)

**UNIVERSITY OF TORONTO. DEPT. OF  
CHEMICAL ENGINEERING AND APPLIED  
SCIENCE**

712

Behaviour of subsurface discharges of oil, gas and dispersants / University of Toronto. Dept. of Chemical Engineering and Applied Science. Mackay, D. Hossain, K. Chau, E. Poblete, B. Nilsson, U. Canada. Baffin Island Oil Spill Project [Sponsor].

Edmonton, Alberta : BIOS Project, 1983.

1 microfiche : ill. ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 82- 7, Part II)

References.

Fiche heading title: Baffin Island Oil Spill Program : special studies : 1982 study results.

ASTIS document number 159573.

ACU

This report contains descriptions of a number of research studies which culminated in the design of the discharge system for the dispersed oil spill in the Baffin Island Oil Spill Program (BIOS). Experimental data are reported on the oil droplet sizes resulting from laboratory discharges of: (i) oil alone, (ii) oil and gas mixtures, (iii) oil and dispersant mixtures, (iv) oil, water and dispersant mixtures. The use of dispersants reduces oil droplet diameter from millimetres to approximately 10 microns. Test results used to assist the design of the BIOS dispersed oil discharge are described. ... It is apparent from these studies that chemical dispersant can have a profound effect on the behaviour of subsea oil discharge thus enabling human intervention to substantially modify oil spill behaviour and thus effects. (Au)

**UNIVERSITY OF TORONTO. INSTITUTE FOR  
ENVIRONMENTAL STUDIES**

See: 419.

USHAKOVA, N.A.

See: 360.

UTTS, J.M.

See: 15.

UZUNER, M.S.

See: 34.

VAGNERS, J.

See: 455.

VALLAS, D.L.

See: 274.

VAN BAALEN, C.

713

Biodegradation of aromatic compounds by high-latitude  
phytoplankters / Van Baalen, C. Gibson, D.T.

United States. Bureau of Land Management [Sponsor].

(Environmental assessment of the Alaskan continental shelf :  
Annual reports of principal investigators for the year  
ending March 1981. Vol. IV : Effects of contaminants, p.  
661-663)

ASTIS document number 169293.

ACU

Microalgae, primarily diatoms, from the Kachemak Bay area and ice edge in the Bering Sea north of the Pribilof Islands have been collected and isolated into pure culture. ... The results suggest that cold water adapted diatoms can oxidize naphthalene and they reinforce the view that the capacity for oxidation of aromatic compounds is a general feature in the microalgae. Algal aromatic oxidation may be an important pathway for the degradation of spilled oil, especially in the upper water column (where bacterial activity is less than in sediments) and at the ice-edge where intense phytoplankton blooms can occur. Secondly, the consequences of this oxidation may be serious if mammalian-type reactive oxidation products are formed and persist for a sufficient time to impact higher trophic levels. (Au)

See also: 160.

VANCE, G.P.

714

Control of arctic oil spills / Vance, G.P.

(Ocean industry, v. 6, no. 1, Jan. 1971, p. 14-17, ill.)

ASTIS document number 177725.

NSDB

The discovery of oil in Arctic regions poses these serious questions: What will be the effect of an oil spill on the ice and in the Arctic waters? How can such spills be controlled and otherwise dealt with? ... [During the summer of 1971] the U.S. Coast Guard launched a research and development effort to determine the most effective

method to control oil spills in the Arctic. Tests were conducted small scale oil spills in water adjacent to the ice, on the ice and under the ice. All the tests were conducted from and on a huge polar ice floe. The primary objectives of the tests were to study the spread rates of crude oil in each of the environments, to evaluate containment methods and the various methods of cleaning up the oil. The oil used came from the wells at Prudhoe Bay on the north coast of Alaska. The tests were conducted about 20-30 miles southwest of Point Barrow, Alaska. (Au)

See also: 277, 278.

VANDERHORST, J.R.

715

Research to investigate effects from Prudhoe Bay crude oil on  
intertidal infauna of the Strait of Juan de Fuca /

Vanderhorst, J.R. Blaylock, J.W. Wilkinson, P.

Boulder, Colo.: Marine Ecosystems Analysis Program, 1979.  
1 microfiche : ill. ; 11 x 15 cm.

(NOAA technical memorandum, ERL MESA 45)

(NTIS PB80-160955)

Appendix.

References.

First annual report.

ASTIS document number 176915.

An experimental study was designed to measure the influence of oil, site, sediment type, tide level, and season, on in situ intertidal infauna recovery rate in the Strait of Juan de Fuca (Washington State). This progress report on the first year's activities provides details of effects on recovery rate by early colonizers due to oiling site, and sediment type in the late-summer - early-fall season. Data from the study, involving analysis of more than 400 individual core samples, indicate a significant effect on recovery rate for three of seven target species three months after treatment. The target species for which recovery rates were significantly retarded include two opportunistic polychaetes and an herbivorous snail. No effect from oiling on recovery by two bivalve species included as targets was observed. Computation of methodological sensitivity for these species indicates that quite small differences due to oiling would have been detected had they occurred. Significant reductions in sediment oil concentration during the first three months occurred in the two experimental sediment types and at both the experimental sites. (Au)

VANDERMEULEN, J.H.

716

BIO spill response / Vandermeulen, J.H. Buckley, D.E.

(The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 19-29, ill.)

ASTIS document number 177016.

NSDB

During the initial days of the Kurdistan spill the response from B.I.O. [Bedford Institute of Oceanography], as member of the interagency Regional Environmental Emergencies Team (REET), was primarily advisory. BIO staff provided information on slick and tanker drift trajectories, and on environmental sensitivities of coastal waters and shoreline ecosystems. This was provided, via E-mail intermediates, to the Coast Guard On-Scene Commander (OSC). As time went by B.I.O. involvement became in part more direct, with in-the-field observations on some of the aspects of oiling, both at sea and on-shore. As well observations on some oil-in-ice features

were initiated in response to questions that arose during discussions with the Canadian Coast Guard and the Environmental Protection Service. ... (Au)

717

**The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Vandermeulen, J.H. [Editor].**

Buckley, D.E. [Editor].

[Dartmouth, N.S. : Bedford Institute of Oceanography], 1985.

190 p. : ill., maps ; 28 cm + 2 sheets of slides.

(Canadian technical report of hydrography and ocean sciences, no. 35)

Appendices.

References.

ASTIS document number 177032.

NSDB

During the night of March 15 to 16, 1979, the tanker Kurdistan broke into two halves in the Cabot Strait, midway between Nova Scotia and Newfoundland, shortly after encountering heavy pack ice. During the break-up an estimated 7,000 tons of Bunker C fuel oil was spilled into the ice-infested waters of the Cabot Strait. This report contains preliminary observations made by Bedford Institute of Oceanography (BIO) scientific personnel during the days following the tanker break-up, including initial observations on oil-in-ice at sea, stranding of oiled ice, mapping of the nearby Nova Scotia coastline, assessment of clean-up operations, and preliminary observations on seabird mortalities. In addition the report includes three appendices listing wind and sea-state data for the spill period, spilled oil sighting reports, and a chronology of events surrounding the incident. (Au)

718

**Oil spills : what have we learned? / Vandermeulen, J.H.**

(Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 29-46)

References.

ASTIS document number 181285.

ACU

Of the hundreds of oil spills occurring annually in Canadian marine waters (run-off, industrial waste and accidents, ship bilge-washings, etc.) four spills have been the site of research studies - the 1970 Arrow spill, the 1973 Alert Bay spill, the 1973 Golden Robin spill and the recent 1979 Kurdistan spill. [Each spill and the information thus gathered is described, including the Kurdistan spill and its oil-in-ice interaction studies.] ... (Au)

719

**Oil-in-ice and oil-stranding observations / Vandermeulen, J.H.**

(The Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 49-61, ill.)

ASTIS document number 177075.

NSDB

Reports of oil-in-ice in inshore waters near the south-east Coast of Cape Breton shortly after the Kurdistan spill provided impetus to examine some of the various features of oil stranding on ice-covered shore-lines, particularly since the earlier reports indicated that much of the oil coming ashore was in the form of blobs and particles .... Accordingly an intensive helicopter overflight and sampling trip was

arranged for March 28 and 29 to examine the presence of offshore oil in or near ice, to examine some of the features of reported oil-in-ice "streaks" near Chedabucto Bay, and to examine some details of stranded oil on ice-covered beaches. [Some streaked ice turned out to be sediment-stained. Stranded ice that was oiled appeared to be melting differently from non-oiled shore-ice, presumably due to the heat absorption properties of the dark droplets. Due to the small particle size of stranded oil it will likely escape cleanup and become part of the shore debris]. (Au)

720

**Physical weathering of Kurdistan oil : droplet formation and effect on shore-ice melting / Vandermeulen, J.H.**

Amero, B. Ahern, T.P.

(Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 105-119, ill.)

References.

ASTIS document number 169684.

OON

Much of the Kurdistan oil that came ashore on Cape Breton Island came in, not as fluid oil or as 'chocolate mousse', but as blobs and smaller balls and particles, much of this smaller than twenty centimeters in diameter. At this time much of the Cape Breton coastline was covered with shore-ice, and during our visit to the area we noticed that such oiled ice-cover had a roughened or pitted surface different from that of non-oiled ice. In this report we present preliminary observations on this phenomenon, including some observations on particle size distribution and on the melting effect of particulate oil on shore-line. (Au)

721

**Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Vandermeulen, J.H. [Editor].**

Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980.

227 p. : ill., maps ; 28 cm.

(Report series - Bedford Institute of Oceanography, BI-R-80- 3)

ASTIS document number 169587.

OON

... As a result of the [March 15, 1979 breakup of the tanker Kurdistan], ... about 7,500 tons of Bunker C oil were spilled into the ice-infested waters of Cabot Strait. The spill represents Canada's first major oil-in-ice spill, and a number of scientific studies were carried out, both at sea and on shorelines. This publication represents the proceedings of a workshop convened at the Bedford Institute of Oceanography on June 26 and 27, 1979, to discuss preliminary observations and conclusions obtained in these studies. (Au)

See also: 273, 457, 614, 661, 662, 693.

VARANASI, U.

722

**Metabolism of petroleum hydrocarbons : accumulation and biotransformation in marine organisms / Varanasi, U.**

Malins, D.C.

(Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic

Press, 1977, p. 175-270, ill.)

#### References.

ASTIS document number 169390.

ACU

... our knowledge of the biochemical consequences of exposing marine life to petroleum hydrocarbons was acquired to a large measure in the last 15 years. In considering the narrower area of arctic and subarctic organisms and ecosystems, it should be emphasized that even less information exists which directly relates to biochemical effects of petroleum hydrocarbons under conditions pertaining to these geographic areas. Consequently ... we chose to cover studies conducted primarily on indigenous species and include, wherever possible, the relatively small amount of data which relate to the influence of environmental conditions (e.g., low temperatures). Much of the review will include discussion on the uptake, metabolism, and discharge of petroleum hydrocarbons in marine organisms exposed to sublethal levels of petroleum. We will discuss resultant biochemical alterations in challenged organisms to ascertain overall effects of long-term exposures to sublethal concentrations of petroleum hydrocarbons. Major emphasis will be on laboratory bioassay studies or simulated field experiments. In addition, certain relevant information about concentrations of petroleum hydrocarbons in animals obtained from known areas of petroleum contamination will be included. ... The present treatment of the subject should afford an understanding of the mode of accumulation, biotransformation, and discharge of petroleum and associated products in tissues of marine organisms. ... We will also delineate areas where more work is required to form a cohesive understanding of the biochemical consequences of exposing arctic and subarctic marine species and ecosystems to petroleum. (Au)

See also: 434, 437, 438, 440.

#### VENKATESAN, M.I.

723

Distribution and transport of hydrocarbons in surface sediments of the Alaskan Outer Continental Shelf / Venkatesan, M.I. Kaplan, I.R.

(*Geochimica et Cosmochimica Acta*, v. 46, no. 11, Nov. 1982, p.2135-2149, figures, tables)

Appendix.

#### References.

ASTIS document number 119563.

ACU, NSDB

The results reported here (from about 220 sediment samples collected during several cruises) represent probably the most extensive investigations on hydrocarbons from surface marine sediments of the Alaskan Outer Continental Shelf. (Au)

See also: 54, 346.

#### VENKATESH, S.

See: 612, 613.

#### VERMEER, K.

724

Oil threat to aquatic birds along the Yukon coast / Vermeer, K. Anweiler, G.G.

(*The Wilson bulletin* (Wilson Ornithological Society), v. 87, no. 4, Dec. 1975, p. 467-480, ill., map)

#### References.

ASTIS document number 180939.

ACU

A survey along the Yukon coast in August and September 1973 showed that approximately 5500 Oldsquaws and 4500 Surf Scoters use the reef-barrier-enclosed bay between Herschel Island and the mainland. No other such large sea duck concentrations were observed along the Yukon coast. Oldsquaws and Surf Scoters will be the most likely victims of potential oil spills because of their concentrations, long molting periods, reaction to spills, and nearness to expected oil exploration activities. Large numbers of brant and Northern Phalaropes, which stop during migration in coastal lagoons and river deltas, will also be vulnerable to oil pollution, although to a lesser extent than the sea ducks, because of their relatively short migratory stops. (Au)

#### WADHAMS, P.

725

Oil and ice in the Beaufort Sea / Wadhams, P.

(*Polar record*, v. 18, no.114, Sept. 1976, p. 237-250, ill., map)

#### References.

ASTIS document number 180971.

ACU

[This paper describes the studies conducted by the Beaufort Sea Project during 1974-1975, including research on the oceanography, biology and glaciology of the region, and assessments of the likely complications and cleanup methodologies of an underwater blowout.] ... It is clear that in the unlikely event of a blowout the consequences might be very serious. ... Its effects will be greatly exacerbated by three factors which act to spread the oil diffusely over a large and unpredictable area in the shear zone: (1) patchiness of deposition, caused by the droplets in the rising plume hitting a moving ice surface; (2) the subsequent random motion of the ice, with shear and longitudinal strains breaking up the continuity of the swath that is laid down; (3) inclusion of oil in pressure ridges due to lead closure, and subsequent 'oiled-hummock melting'. There is no reliable means of detecting the oil's presence under ice, so it is difficult to see any way in which the oil can be cleaned up while it is encapsulated in the winter ice. ... It seems inevitable that much of the oil will enter summer leads. Once in the leads the oil becomes more easily accessible but it will already be causing biological damage, especially since it will be relatively 'fresh' on account of its preservation from weathering and degradation during the winter. After a year part of the oil will have reached United States coastal waters, the Beaufort Gyre acting to hold it against the Alaskan coast. Major biological damage will be to marine birds in open leads, to fish and invertebrates in the vicinity of the blowout site, and to intertidal communities and nesting areas if the oil is driven ashore. Long-term chronic effects are unknown. No measurable climatic effects are expected, at least in a single year. ... (Au)

726

Oil and ice in the Beaufort Sea : the physical effects of a hypothetical blowout / Wadhams, P.

(*Petromar 80 : petroleum and the marine environment / EUROCEAN*. - London : Graham & Trotman Ltd., 1981, p. 299-318, figures, tables)

(*Canadian shipping and marine engineering*, v. 51, no. 8, May 1980, p. 23-35, map, ill.)

#### References.

ASTIS document number 47503.

ACU, NFSMO

... In this paper we describe the ice conditions in the southern Beaufort Sea and review the studies that have been carried out of oil-ice interactions. Applying the results to a Beaufort Sea blowout, we estimate the likely physical effects and the disposition of the oil after a winter. ... (Au)



727

Sea ice topography in the Beaufort Sea and its effect on oil containment / Wadhams, P.  
(AIDJEX bulletin, no. 33, Sept. 1976, p. 1-52, ill., tables, charts)  
(Technical report - Beaufort Sea Project, no. 36)  
(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 36)  
Originally appeared as Beaufort Sea Project Technical Report No. 36, with the title "Sea Ice Morphology in the Beaufort Sea."  
Bibliography: p.49-52.  
*ASTIS document number 3530.*  
ACU, NFSMO, NSDB

The topography of the Beaufort Sea ice cover has been examined from airborne laser profiles obtained in September and October 1974 by the Atmospheric Environment Service, Environment Canada, and in April 1975 by the Canadian Maritime Command, Department of National Defence. Mean ridge heights and spacings were deduced for the elements of a grid covering much of the Beaufort Sea. ... On the basis of these and other studies of the Beaufort Sea Project, a discussion is given of the extent to which sea ice deformation features may govern the long-term spread of oil under ice. (Au)

WALKER, E.R.

728

Oil, ice and climate in the Beaufort Sea / Walker, E.R.  
Victoria, B.C. : Beaufort Sea Project, 1975.  
40p. : figures, tables ; 28cm.  
(Technical report - Beaufort Sea Project, no. 35)  
(APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 35)  
Bibliography: p.35-39.  
Also available in microfiche.  
*ASTIS document number 15547.*  
ACU, NFSMO

The amount of crude oil which may be released to the environment during drilling in the Beaufort Sea is estimated. The effects of oil in terms of the Beaufort Sea surface heat budget are briefly discussed. Considering the amount of oil likely to be released in exploratory drilling, its movement, and its effect on the surface heat budget, it is estimated that no important climatic effects are likely. (Au)

WARD, J.G.

See: 405.

WATTS, P.D.

See: 330, 523.

WAY, S.J.

See: 161.

WEBER, D.D.

See: 434, 436, 437, 438, 439, 440, 441.

WEBSTER, J.L.

See: 72.

WEIR, C.R.

729

Heat budget of oil contaminated sea ice / Weir, C.R.  
(Florida scientist, v. 38, suppl. 1, 1975, p. 14)  
*ASTIS document number 181366.*  
CON

One aspect of a major oil spill in the Arctic Ocean is its effect on the ocean's heat budget and the equilibrium ice thickness, possibly causing large scale meteorological and oceanographic effects. Field studies of oil polluted ice were conducted in the Arctic to determine the physical effects of the contamination. Values of albedo, incoming short and long wave radiation, surface temperature, transmitted short wave radiation, relative humidity, and ice ablation rates were determined from an experimental site located off Pt. Barrow, Alaska during June of 1974. These measurements indicate that a contaminated ice field will be destroyed allowing an ice free ocean to absorb a large amount of previously unavailable energy. (Au)

WEISKOPF, F.B.

See: 34.

WEISS, H.V.

See: 327.

WELANDER, P.E.

See: 453.

WELLER, G.

730

Oil pollution in ice-covered arctic waters / Weller, G.  
(POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 1, p. 393-406, ill.)

References.

*ASTIS document number 55611.*

ACU, NFSMO

The problems of oil pollution in ice-covered arctic seas are discussed, based on the experiences and studies in the Beaufort Sea made by the United States' Outer Continental Shelf Environmental Assessment Program and by the Canadian Beaufort Sea Project. Problems of offshore petroleum operations in the Beaufort Sea are described in terms of sea ice hazards, subsea permafrost, ice gouging and climatic extremes, and the risks they pose, particularly in causing possible accidental oil spills. ... The probability of blowouts and other oil-spilling accidents in ice-covered waters are discussed and the likely transport pathways and behavior of oil spilled in and under the sea ice are reviewed. ... (Au)

See also: 669, 670.

## WELLS, P.G.

731

### Biological effects of chemically dispersed crude oils in inshore marine sediments : preliminary results from behavioural experiments with a post-larval crustacean in the laboratory / Wells, P.G. Abernethy, S.

(Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. - [Ottawa : EPS, 1983], p. 30-31)

#### References.

ASTIS document number 170992.

... [This brief summary outlines the objectives of an ongoing experiment, which addresses] two fundamental questions on dispersed oil in sediments: (a) Is it more toxic, more available, or both, to a post-larval crustacean, in our case lobsters (*Homarus americanus*) living on and in the sediments, compared to oil alone? (b) What effect does bioturbation of the oil-dosed sediments have on the residence time and behavioural toxicity of the dispersed oil? ... A series of acute experiments have been conducted to identify natural sediments compatible with lobster digging activity, including burrowing, under our laboratory conditions .... Factors other than oil which influence the digging activity have been identified. Two experiments have established an oil dosing procedure and have described the hydrocarbon concentrations in the sediment and in water over time, using fluorescence and UV spectroscopy. Experiments are now being conducted with settling fourth-stage lobsters over dosed sediments, repeating the chemistry, and describing the survival, digging behaviour, growth and development of the exposed lobsters. ... Our paper will present results of these current experiments. Our experiences with sediment behavioural toxicity tests will be described. The control and interpretation of exposure regimes for organisms continually digging and burrowing in artificially contaminated sediments is discussed, with implications for laboratory-based hazard assessments of chemically dispersed oils under temperate and Arctic marine conditions. (Au)

732

### Effects of oil on arctic invertebrates / Wells, P.G. Percy, J.A.

(Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 101-156)

#### References.

ASTIS document number 168637.

This is a review of oil effects on arctic marine zooplankton and benthos. (ASTIS)

See also: 545, 557, 614, 661, 662.

## WESTLAKE, D.W.S.

733

### Microbial degradation of CANMAR oils by northern marine microorganisms / Westlake, D.W.S. Cook, F.D.

[Calgary, Alta. : Distributed by APOA], 1980?.

1 microfiche : ill., map ; 11 X 15 cm.

(APOA project no. 161 : Microbial degradation of CANMAR oils by northern marine organisms. Report, no. 1)

(Beaufort E.I.S. reference work, no. RWB18)

Fiche heading title: Microbial degradation of CANMAR oils.

#### References.

ASTIS document number 107808.

ACU

... The object of this study was to obtain information on the

presence of and factors affecting the activity of oil-degrading microorganisms in inter-tidal sediment and beach samples from Tuktoyaktuk area of the Northwest Territories in the vicinity of Canmar camp. Microbial activity will be reported in terms of changes in the saturate fraction of Canmar oil brought about by microbial activity .... The effect of the amount of nitrogen and phosphorus added to representative sediment samples on the rate of change of the chemical composition of a Canmar oil will also be investigated. (Au)

734

### Microorganisms and the degradation of oil under northern marine conditions / Westlake, D.W.S.

(Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 47-54)

#### References.

ASTIS document number 181242.

ACU

This article reviews the available information on microbial degradation of oil in Canadian and northern marine waters, citing studies in the Pacific, Beaufort Sea, Gulf of Alaska, and Davis Strait. (ASTIS)

See also: 249, 250, 251, 259.

## WHIPPLE, J.A.

735

### Transport, retention and effects of the water-soluble fraction of Cook Inlet crude oil in experimental food chains /

Whipple, J.A. Yocom, T.G. Benville, P.E.

Smart, D.R. Cohen, M.H. Ture, M.E.

(Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado : NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 106-129, ill.)

(NTIS PB-288 935, p. 106-129, ill.)

#### References.

ASTIS document number 177717.

ACU, NSDB

The objectives of this study are to determine the accumulation and passage of petroleum constituents in experimental marine food chains and the effects of petroleum exposure on the test organisms. The specific objectives are: (1) To determine the accumulation, retention and transfer of petroleum constituents in experimental food chains consisting of up to four trophic levels including primary producers, consumers and primary and secondary carnivores. Exposure will be either from water-soluble fractions of petroleum accumulation from food and water exposure pathways. Adult and larvae food chains will be studied. (2) To determine mortality of experimental animals under various exposure conditions including mortality in eggs and larvae from exposed adults. (3) To determine morphological and behavioral abnormalities caused by selected exposure conditions. (4) To predict potential effects of crude oil on populations and communities in terms of reproductive success, energy utilization and growth. (5) To recommend maximum allowable levels of petroleum components in the water column and fish food organisms, and if possible, to identify components of crude oil with the greatest potential for adverse biological effects. (Au)

## WHITEHOUSE, B.

See: 187.

WHITNEY, F.A.

See: 709.

WIENS, J.A.

736

Information needs and priorities for assessing the sensitivity of marine birds to oil spills / Wiens, J.A. Ford, R.G. Heinemann, D.

(Biological conservation, v. 28, no. 1, 1984, p. 21-49, ill.)  
References.

ASTIS document number 168831.  
ACU

... In order to develop means of predicting the impacts of oil spills on seabirds, we suggest that colony- or site-specific information on the timing of reproduction and colony occupancy, chick growth rates and body weights, several metabolic parameters, flight speed, and food load size is of relatively low overall priority. Intermediate priority is assigned to the collection of specific data on the dynamics of oil spills, the age and breeding structure of the populations, reproductive success, foraging activity budgets and flight paths, flight costs, and the response of growing chicks to food deprivation. We suggest that studies of seabird biology should give highest priority to obtaining information on population sizes, the probability of adult death upon encountering a spill, age-specific fecundity and survivorship, the time required in foraging trips, the lag time in the response of birds to an oil spill, foraging rate as a function of resource density, and changes in the availability of resources to the birds as a consequence of oil spills. [Work was carried out at the Kodiak Islands, Alaska.] (Au)

737

Simulation modeling of marine bird population energetics, food consumption, and sensitivity to perturbation / Wiens, J.A. Ford, R.G. Heinemann, D. United States. Minerals Management Service [Sponsor].

(Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 30, April 1985, p. 599-644, ill., maps)

Appendices.

References.

Bibliography: p.644.

ASTIS document number 171875.

ACU

The objective of our research has been to develop methods of assessing the sensitivity of marine birds in Alaskan waters to petroleum-related environmental perturbations. Our approach has combined field observations and information with various analytic and computer simulation models. This report completes our documentation of the population energy flow patterns, at-sea distributions, and sensitivity to oil spills of the dominant marine bird species breeding at major colonies on Kodiak Island and using the surrounding oceanic areas for foraging. We employed data from 8 major colony locations of breeding Tufted Puffins and Black-legged Kittiwakes, in combination with other information obtained from the seabird literature, to conduct model analyses of the level of mortality of these species that might accompany selected oil-spill scenarios. ... The second part of this report reviews the general status of the information or data base on marine birds and their environments in Alaskan waters that we have found to be necessary to our modeling efforts. ... (Au)

See also: 261.

WIGGS, J.N.

See: 641, 643, 644, 645.

WILKINSON, P.

See: 715.

WILLIAMS, T.D.

See: 654.

WILTON, G.R.

See: 482.

WISHART, C.

See: 355.

WOLF, E.G.

See: 87.

WOLFE, D.A.

738

Marine biological effects of OCS petroleum development / Wolfe, D.A. [Editor]. United States. Outer Continental Shelf Environmental Assessment Program. Environmental Research Laboratories (U.S.). Boulder, Colorado : NOAA, Environmental Research Lab., 1978.

vii, 324p. : ill., figures, maps, tables ; 27cm.

(NOAA technical memorandum, ERL OCSEAP 1)  
(NTIS PB-288 935)

A program review of research supported under the NOAA Outer Continental Shelf Environmental Assessment Program, November 19 - December 1, 1977.

References.

ASTIS document number 22004.

ACU, NSDB(ENV.)

... The purposes of this program review were threefold: 1. To evaluate the past and recent results of the component research projects in terms of scientific quality and current national relevance, with special reference to assessment of potential environmental impacts of spilled petroleum in the marine environments. ... 2. To exchange recent results and progress to date .... 3. To discuss outstanding research needs and developing technology .... (Au)

See also: 81.

WOLFE, D.E.

See: 327.

## WOLFE, L.S.

739

Effects of oil under sea ice / Wolfe, L.S. Houtt, D.P.  
(Journal of glaciology, v. 13, no. 69, 1974, p. 473-488, ill.)  
References.

ASTIS document number 173762.

ACU, NSDB

This paper describes laboratory research performed to determine the effects of crude and diesel oils on the porous sub-structure of Arctic sea ice. It includes a qualitative description of what occurs when oil is placed under the ice and an evaluation of some quantitative measurements made to determine the maximum extent to which crude oil can spread in an Arctic environment. (Au)

See also: 321.

## WONG, C.S.

740

Distribution of tar and particulate pollutants along the  
Beaufort Sea coast / Wong, C.S. Macdonald, D.  
Cretney, W.J.

Victoria, B.C. : Beaufort Sea Project, 1976.

96p. : ill., figures, maps, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 13)

(APOA project no. 72 : Beaufort Sea Environmental  
Program. Report, no. 13)

References.

ASTIS document number 16233.

ACU, NFSMO

... The objectives of the study are: (1) to establish the baseline distribution of particulate pollutants, especially for tar and plastics, in the present-day Beaufort Sea marine environment, (2) to establish areas with natural seepage of crude oil and (3) to establish the chemical characteristics of hydrocarbons in the present-day beach sediment, nearshore sediment and marine organisms, including fish. ... (Au)

741

Hydrocarbon levels in the marine environment of the southern  
Beaufort Sea / Wong, C.S. Cretney, W.J.  
Christensen, P. Macdonald, R.W.

Victoria, B.C. : Beaufort Sea Project, 1976.

113p. : figures, map, tables ; 28cm.

(Technical report - Beaufort Sea Project, no. 38)

(APOA project no. 72 : Beaufort Sea Environmental  
Program. Report, no. 38)

Bibliography: p.108-113.

ASTIS document number 15555.

ACU, NFSMO

... The objectives of the investigation are: (1) to establish the baseline hydrocarbon levels in the Southern Beaufort Sea drilling area by measuring classes of hydrocarbons and identifying some specific hydrocarbons in sea water, marine organisms, fish and surface sediments, (2) to assess the origin of present day hydrocarbons, whether anthropogenic or naturally-occurring, and (3) to understand the probable hydrocarbon pathways in case an oil spill or blow-out occurs in the area. ... (Au)

See also: 187.

## WOODRUFF, D.L.

See: 72, 601.

## WOODWARD-CLYDE CONSULTANTS

742

Final report : Baffin Island Oil Spill Project shoreline  
component / Woodward-Clyde Consultants. Canada.  
Baffin Island Oil Spill Project [Sponsor].

Victoria, B.C. : Woodward-Clyde Consultants, 1981.

1 v. (various pagings) : figures ; 28 cm.

(Working report - Baffin Island Oil Spill Project, 80- 4)

Appendix.

Cover title: Shoreline countermeasures: Baffin Island Oil  
Spill Project, 1980 study results.

"Correct citation for this publication: ... Shoreline  
Countermeasures - 1980 Study Results".

References.

ASTIS document number 135747.

NFSMO

A small, controlled, oil spill experiment was conducted during August 1980 on the northern coast of Baffin Island, N.W.T., to investigate the fate of stranded oil in an arctic environment. This experiment involved a single oiling of eight test plots using an aged crude oil and a water-in-aged crude oil emulsion. The oils were spilled on backshore and intertidal test plots of varying wave exposure and sediment character; beach morphology and oil-sediment concentrations were monitored for an 8-day period following each spill. ... The results are described and analysed. (Au)

## WOODWARD-CLYDE OCEANEERING

743

Baffin Island Oil Spill Project : 1983 shoreline component :  
final report / Woodward-Clyde Oceaneering. Owens,  
E.H. Canada. Baffin Island Oil Spill Project  
[Sponsor].

Ottawa : EPS, 1984.

2 microfiches : ill., maps ; 11 X 15 cm.

(Working report - Baffin Island Oil Spill Project, 83- 4)

Fiche heading title: Baffin Island Oil Spill Project : shoreline  
countermeasures : 1983 study results.

"Correct citation for this publication: ... Shoreline  
Countermeasures - 1983 Study Results ...".

Also available in paper.

References.

ASTIS document number 160148.

ACU

The Shoreline Component of the Baffin Island Oil Spill (BIOS) Experiment was designed to evaluate selected shoreline countermeasure techniques in the event of oil reaching arctic coasts. ... investigations focussed upon the fate and persistence of oil stranded in the shorezone from the spills in the adjacent nearshore waters. ... The primary objective of [the 1983] phase was to resample and resurvey the oiled control and countermeasure plots and the beaches of Bays 9 and 11. (Au)

## WOOTTON, T.A.

See: 14.

# WORLDWIDE NATURAL RESOURCES MANAGEMENT COMPANY

744

Study and investigation on the knowledge to date of the effects of oil spills on the arctic environment / Worldwide Natural Resources Management Company. Allard, J.L. Baldocchi, F.M. Bergeron, R. Fincham, C.F. Gantcheff, G.S. [Coordinator]. Ladouceur, L.C. Laverdiere, C. Paul, P.A. Simard, A. Tanguay, M. Polar Continental Shelf Project (Canada) [Sponsor].

[Ottawa] : Energy, Mines and Resources Canada, 1976. 1 v. (various pagings) : ill., maps : 28 cm.

Appendices.

"Produced ... May 1971".

References.

ASTIS document number 181404.

ACU, NSDB

... [This paper reviews the knowledge of the effects of marine and terrestrial oil spills on the Arctic environment.] To achieve this purpose we have divided this report in three major parts: Part I: We have covered the general areas of knowledge which have to be considered when studying the Arctic: (a) Geography. (b) Behaviour of spills in the Arctic. (c) Review of spills. (d) Trans Alaska pipeline. (e) Characteristics [of] Arctic oil. (f) Legal aspects. Part II: Two main divisions cover the following: (a) Geological considerations. (b) Man made structures. Part III: Here we have considered the major aspects of detection and clean-up: (a) Detection methods. (b) Factors related to the use of aircraft for logistics and detection purposes. (c) Clean-up techniques. We consider the latest regulations set up for the Trans Alaska Pipeline System as a very important relevant document and have appended a copy in Part I. (Au)

## WORSFOLD, R.D.

745

A program for the detection of oil under ice / Worsfold, R.D. Parashar, S.K. Cammaert, A.B. (Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 479-484)

References.

ASTIS document number 174556.

ACU

Once an oil spill has occurred in an ice covered environment a major problem is how to find the oil under the ice. ... This brief paper outlines a program to be carried out under laboratory conditions to test various available sensors, those on the market and prototypes which have reached the field test state. The purpose of the program is to test sensors which are maybe able to detect an oil layer under an ice layer. Various sensors are available that have this potential. It is proposed that certain sensors available on the market will be rented and that government agencies or other groups developing prototype sensors will be asked if they would like to use the test facility for their sensor. Different oil types will be used with different ice conditions and different ice salinities. This test matrix will allow for initial testing of sensors to determine the most promising sensors for future field tests and more extensive laboratory tests. The background in the selection of sensors, description of the testing facility and accompanying instrumentation and the basic test plan are outlined in this paper. ... (Au)

See also: 199, 474, 475, 533, 577, 664.

## WOTHERSPOON, P.D.

746

Oil in ice computer simulation model / Wotherspoon, P.D. Swiss, J.J.

(Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 26-32, ill.)

References.

ASTIS document number 165069.

ACU

A computer simulation program which depicts the behaviour and distribution of oil spilled in or under sea ice has been developed by Dome Petroleum Limited. The program combines mathematical models developed in previous studies to describe the motion of oil in/under landfast, first-year and multi-year ice. By inputting or estimating such key parameters as oil type, spill type, spill duration, flow rate, ice type, relative under ice current speed and direction, under ice roughness and distinct ice features a time series of "maps" is generated showing the distribution of the spilled oil. ... The program is a tool which can be used to assist on scene commanders during spill response and to plan counter-measures for oil spills in/under sea ice. (Au)

## WRIGHT, E.M.

See: 89, 90.

## YOCOM, T.G.

See: 735.

## YOUNG, A.

See: 170, 173.

## ZEH, J.E.

See: 195.

## ZIMMERMAN, S.T.

747

Proceedings of a synthesis meeting : the Norton Sound Environment and Possible Consequences of Planned Oil and Gas Development, Anchorage, Alaska, October 28-30, 1980 / Zimmerman, S.T. [Editor]. United States. Bureau of Land Management [Sponsor].

Juneau, Alaska : U.S. National Oceanic and Atmospheric Administration, Office of Marine Pollution Assessment, 1982.

vi, 55 leaves : ill., maps ; 28 cm.

References.

ASTIS document number 168556.

ACU

... [In order] to assess the likely impacts of petroleum development on the Sale 57 area through the consideration of various oil spill and tract deletion scenarios [the following presentations were made and discussed at the synthesis meeting:] ... Physical oceanography and circulation in Norton Sound by Robin D. Muench; Potential interactions of oil and ice in Norton Sound by Seelye Martin; Sedimentary process and potential geologic hazards on the seafloor

of the Northern Bering Sea by Hans Nelson; Status of marine mammal populations in the Norton Sound Basin by Robert Nelson; Fishery resources of Norton Basin, their distribution, abundance and utilization by Robert Wolotira; Toxicity of oil in marine habitats by Donald Malins; Exploration and development techniques for Norton Sound Sale No. 57 by Larry Wolfson; Wind, waves, ice, and other environmental factors affecting oil and gas development in Norton Sound by Walter Spring; and Proposed alternatives and development scenarios by Ray Emerson. In the interest of brevity ... it was deemed inappropriate to attempt to reproduce all of the resulting manuscripts [in this report]. (Au)

## ZOBELL, C.E.

748

### Bacterial oxidization of mineral oils at sub-zero Celsius /

ZoBell, C.E. Agosti, J.M.

(Abstracts of the Annual Meeting of the American Society for Microbiology, 1972, p. 231)

Abstract only.

ASTIS document number 177130.

NSDB

Oil-oxidizing bacteria were demonstrated in 16 samples of soil and water collected in the vicinity of natural oil seeps from the North Alaska Slope above the Arctic Circle. Small portions (ca. 0.1 g) of the refrigerated samples were used to inoculate mineral salts medium enriched with clear mineral oil (0.5 ml/50 ml of medium). Duplicates were incubated at 4, 8, and 25 C. Microbial growth and oil oxidation occurred at all three temperatures. Growth was measured by turbidity and microscopic examinations. The emulsification of oil, its gradual disappearance, and O<sub>2</sub> uptake were used as criteria of oil oxidation. Up to 20 ml of O<sub>2</sub> was consumed during 28 days at 4 C. This much O<sub>2</sub> was consumed during 14 days at 8 C and during 5 days at 25 C. Subcultures, initially incubated at 4 C, oxidized appreciable amounts of oil in media kept cold enough to contain much ice at near -1 C. At this temperature, oil was oxidized and bacteria reproduced almost as rapidly as at 4 C. Solid surfaces provided by ice crystals appear to promote the growth of oil-oxidizing bacteria. About half of the carbon in the oil assimilated was converted into bacterial biomass, the efficiency of conversion being higher at -1 C than at 8 or 25 C. Mixed cultures attacked mineral oils much more rapidly than any of the pure cultures isolated therefrom. (Au)

## SUBJECT INDEX

*The numbers listed below are citation numbers, not page numbers.*

- Acclimatization 586  
 Acoustic radar 363  
 Aerial surveys 89, 90, 142, 576  
 Air pollution 16, 200, 378, 578, 637, 643  
 Air quality 200  
 Aircraft disturbance 399, 515  
 Airports 253  
 Albedo 74, 139, 454, 728, 729  
 Aleuts - Hunting, trapping and fishing 333  
 Algae 44, 56, 57, 67, 104, 105, 167, 181, 189, 190, 191, 208, 246, 282, 323, 324, 400, 402, 403, 518, 556, 559, 626, 643, 644, 645, 653, 672, 713  
 Amino acids 72  
 Amphipoda 52, 59, 87, 128, 129, 131, 157, 190, 191, 263, 296, 395, 400, 402, 403, 553, 555, 560, 561, 586, 618  
 Animal behaviour 14, 17, 25, 70, 71, 98, 128, 129, 131, 164, 180, 225, 226, 230, 239, 244, 255, 256, 260, 268, 269, 270, 271, 273, 274, 303, 306, 331, 347, 356, 357, 372, 400, 403, 424, 435, 436, 437, 438, 439, 440, 441, 517, 521, 522, 536, 537, 538, 539, 552, 553, 560, 561, 579, 581, 582, 589, 592, 623, 634, 649, 650, 654, 662, 665, 673, 674, 682, 731  
 Animal diseases 46, 87, 234, 269, 306, 312, 356, 435, 437, 438, 439, 440, 441, 458, 496, 539, 579  
 Animal distribution 44, 47, 48, 164, 189, 190, 191, 223, 272, 292, 400, 403, 432, 493, 494, 532, 546, 598, 608, 609, 668, 724, 737  
 Animal ecology 538, 539  
 Animal food and nutrition 14, 17, 24, 53, 70, 71, 98, 129, 164, 169, 260, 261, 269, 287, 291, 295, 303, 371, 375, 437, 438, 496, 519, 548, 555, 561, 601, 602, 623, 633, 649, 695, 733, 735, 736  
 Animal growth 15, 23, 87, 133, 134, 135, 274, 371, 372, 374, 376, 435, 436, 437, 438, 440, 457, 480, 488, 536, 544, 547, 548, 551, 579, 583, 584, 587, 623, 648, 649, 650, 658, 659, 665, 731, 737  
 Animal integumentary systems 17, 347, 473, 551  
 Animal metabolism 4, 24, 64, 180, 201, 229, 230, 234, 255, 268, 273, 287, 290, 291, 330, 332, 338, 356, 357, 367, 431, 437, 438, 439, 536, 548, 552, 555, 579, 585, 618, 657, 659, 683, 707, 722  
 Animal migration 17, 164, 272, 306, 589, 592, 633, 724  
 Animal mortality 81, 82, 114, 115, 128, 129, 131, 134, 135, 164, 239, 261, 263, 264, 310, 329, 347, 352, 376, 394, 395, 396, 403, 473, 517, 534, 537, 538, 539, 546, 551, 583, 593, 648, 649, 650, 658, 659, 665, 668, 673, 674, 695, 736, 737  
 Animal nervous systems 17, 269, 271, 306, 441, 657  
 Animal physiology 25, 53, 72, 73, 86, 98, 106, 138, 180, 202, 226, 229, 234, 235, 237, 244, 256, 269, 270, 273, 274, 306, 331, 368, 371, 376, 433, 435, 436, 437, 438, 441, 457, 472, 480, 496, 544, 545, 547, 580, 581, 584, 618, 633, 634, 655, 660, 662, 665, 683  
 Animal population 43, 47, 48, 50, 53, 55, 57, 64, 68, 89, 90, 122, 123, 144, 164, 189, 190, 191, 223, 261, 295, 315, 316, 317, 318, 319, 320, 384, 400, 455, 456, 493, 494, 532, 538, 539, 546, 557, 603, 609, 672, 699, 707, 736, 737  
 Animal reproduction 14, 15, 239, 261, 272, 306, 441, 536, 538, 539, 546, 695, 735, 736  
 Animal respiration 17, 56, 68, 131, 226, 230, 255, 256, 287, 291, 292, 293, 295, 472, 552, 555, 581, 582, 650, 657, 665, 682  
 Animal taxonomy 45, 46, 53, 55, 319, 456  
 Annelida 24, 591  
 Arctic char 489  
 Arctic fox 253  
 Arctic grayling 489  
 Arctic Petroleum Operators' Association. Industry/Public Interface Program. Beaufort Sea Project 311  
 Argo Merchant (Ship) 165, 384, 504  
 Arrow (Ship) 75, 165, 466, 504, 718  
 Arthropoda 591, 632  
 Artificial islands 342  
 Artificial islands - Environmental aspects 16  
 Atlases 197  
 Atmospheric temperature 253, 468, 502  
 Avalanches 570  
 Bacteria 13, 45, 46, 47, 48, 52, 53, 56, 57, 58, 64, 65, 85, 122, 175, 187, 221, 232, 249, 251, 287, 288, 289, 290, 291, 292, 293, 294, 295, 298, 312, 315, 316, 317, 320, 348, 355, 360, 491, 495, 511, 513, 514, 556, 597, 608, 609, 631, 632, 672, 733, 748  
 Bacteria, Heterotrophic 49, 59, 60, 68, 123, 124, 125, 126, 144, 145, 146, 220, 222, 223, 490, 598, 607, 629  
 Bacteria, Psychrophilic 124, 194, 490  
 Bacteria, Psychrotrophic 319  
 Barrier islands 304  
 Bathymetry 36, 44, 212, 253  
 Beach erosion 530  
 Beaches 76, 86, 94, 104, 105, 106, 107, 148, 206, 221, 222, 224, 262, 272, 281, 282, 283, 296, 308, 309, 310, 462, 463, 466, 479, 491, 511, 526, 527, 528, 530, 531, 532, 631, 632, 634, 662, 672, 733, 742, 743  
 Beaufort Sea Project (Canada) 725  
 Bedford Institute of Oceanography 716  
 Benthos 24, 44, 48, 59, 60, 66, 94, 96, 98, 106, 108, 130, 168, 174, 188, 189, 190, 191, 206, 220, 224, 225,

- 230, 232, 246, 272, 284, 289, 313, 314, 392, 400, 496,  
550, 552, 560, 561, 584, 586, 591, 599, 602, 603, 616,  
618, 624, 628, 636, 639, 642, 662
- Bibliographies** 9, 35, 154, 218, 245, 246, 430, 474, 614,  
663, 705
- Bioassay** 266, 395, 396
- Biochemistry** 360, 431, 436, 496, 722
- Biodegradation of petroleum** 13, 24, 32, 35, 43, 45, 46,  
47, 48, 49, 50, 51, 55, 58, 59, 60, 61, 63, 64, 65, 68, 94,  
96, 109, 122, 124, 125, 126, 127, 145, 146, 160, 161,  
167, 174, 175, 187, 193, 194, 220, 221, 222, 223, 224,  
226, 228, 232, 233, 249, 250, 251, 259, 276, 288, 289,  
290, 293, 294, 295, 298, 299, 301, 313, 314, 315, 316,  
317, 318, 319, 320, 348, 354, 360, 413, 417, 439, 457,  
490, 491, 497, 511, 513, 514, 518, 528, 541, 542, 543,  
556, 597, 598, 599, 607, 608, 609, 629, 630, 631, 634,  
650, 661, 662, 672, 707, 711, 713, 733, 734, 743, 748
- Biological productivity** 146, 208, 219, 323, 410, 611
- Biology** 97, 215, 218
- Bird eggs and nests** 14, 15, 537, 539, 545, 546, 695,  
724
- Birds** 182, 392, 405, 662
- Black Guillemots** 544
- Blood** 201, 237, 271, 375, 547, 548, 588
- Blood - Analysis** 231, 235
- Bottom sediments** 23, 24, 25, 45, 46, 47, 48, 49, 50,  
53, 60, 68, 70, 71, 72, 73, 84, 86, 96, 98, 103, 104, 105,  
106, 107, 108, 109, 123, 128, 130, 144, 167, 172, 173,  
194, 206, 221, 222, 223, 224, 245, 248, 251, 281, 282,  
283, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296,  
299, 300, 301, 306, 307, 308, 317, 328, 350, 353, 355,  
366, 378, 380, 383, 457, 462, 471, 490, 495, 511, 513,  
514, 522, 526, 527, 531, 550, 560, 563, 564, 575, 584,  
601, 602, 607, 608, 609, 610, 611, 617, 628, 631, 637,  
639, 641, 642, 643, 645, 646, 648, 651, 656, 666, 673,  
674, 705, 711, 715, 731, 742, 743
- Bottom sediments - Analysis** 54, 195, 723
- Bottom sediments - Carbon content** 146, 171, 346, 640
- Bottom sediments - Composition** 708, 741
- Bottom sediments - Nitrogen content** 733
- Bottom sediments - Phosphorus content** 733
- Bowhead whale** 17, 195
- Bryozoans** 641
- Canada. Arctic Marine Oilspill Program** 140, 460, 606,  
686
- Canada. Baffin Island Oil Spill Project** 94, 95, 96, 97,  
98, 106, 107, 108, 109, 226, 420, 634, 635, 636, 671,  
685, 687
- Canadian Marine Drilling Limited** 91
- Canadian Wildlife Service** 546
- Capelins** 438
- Carbon** 145, 471
- Carbon cycling** 53, 293
- Carbon dioxide** 200, 289, 355
- Carbon monoxide** 200
- Cartography** 333
- Cassin's Auklets** 14, 15
- Chemical oceanography** 143, 313, 708, 741
- Chemistry** 97, 662
- Chlorophyll** 143, 281, 282, 402, 520
- Cities and towns** 253
- Clams** 23, 24, 25, 72, 86, 96, 98, 103, 104, 105, 107,  
109, 169, 189, 190, 191, 224, 225, 226, 230, 274, 281,  
282, 328, 332, 400, 424, 493, 494, 496, 517, 519, 601,  
602, 628, 634, 641, 642, 645, 646, 648, 649, 650, 651,  
665, 673, 674, 715, 735
- Climatic changes** 485, 572, 728, 729
- Climatology** 74, 139, 211, 212, 253, 370, 388, 454,  
578, 626, 627, 679
- Coast changes** 253, 530
- Coasts** 211, 272, 297, 304, 305, 307, 308, 315, 320,  
333, 340, 345, 460, 462, 463, 529, 611, 637, 705, 717,  
724, 747
- Cod** 157, 202, 586
- Cold adaptation** 618
- Collembola** 632, 672
- Continental shelf** 45, 46, 300, 326, 410, 504, 608, 616,  
624, 642, 705, 706, 738
- Copepoda** 263, 273, 395, 402, 495
- Crabs** 46, 64, 87, 110, 133, 134, 135, 164, 347, 472,  
473, 581, 584, 642, 657
- Crustacea** 168, 189, 438, 590
- Data buoys** 38
- Decomposition** 54
- Diatoms** 57, 160, 325, 459, 713
- Diseases** 539
- Dome Petroleum Limited** 119
- Dredging** 228
- Dredging - Environmental aspects** 16, 240
- Drilling muds - Environmental aspects** 16, 302, 388,  
566, 585, 703
- Drilling muds - Toxicity** 399
- Drillships** 342, 401
- Ducks** 82, 367, 368
- Dunlins** 633
- Earthquakes** 302
- Echinoderms** 86, 96, 98, 103, 104, 105, 107, 109, 168,  
189, 190, 191, 224, 225, 226, 236, 282, 328, 400, 424,  
437, 441, 591, 628, 634, 641, 645
- Ecology** 102, 211, 215, 625, 709, 744
- Economic conditions** 700
- Effects monitoring** 181, 215, 397, 410, 494, 617
- Eiders** 82, 195
- Electronic data processing** 746
- Endangered species** 182
- Energy budget** 219, 623
- Environmental impact statements** 195, 311, 611
- Environmental protection** 102, 198, 337, 342, 512
- Enzymes** 230, 288, 306, 371, 431, 435, 439
- Erosion** 107
- Estuaries** 245, 256, 354, 540, 559



- Estuarine ecology 51  
 Euphausiacea 521  
 Fast ice 20, 140, 178, 179, 207, 361, 362, 680  
 Fast ice - Break-up 696  
 Fast ice - Physical properties 363  
 Fast ice - Thickness 78, 79, 363  
 Fat metabolism 488  
 Fertilizers and manures 63, 221, 317, 318, 511, 629  
 Fish eggs 87, 439, 440, 441, 489, 579, 583, 658, 659  
 Fish larvae 87, 138, 433, 434, 439, 440, 441, 487, 489, 520, 587, 588, 593, 623, 638, 659, 682  
 Fisheries 77, 333, 337, 617, 688, 692, 700, 701, 704, 747  
 Fishes 27, 77, 189, 232, 233, 239, 264, 272, 302, 312, 341, 353, 392, 396, 405, 434, 435, 440, 455, 520, 521, 529, 536, 579, 585, 591, 594, 616, 624, 639, 642, 643, 662, 704, 706, 741  
 Fishes, Fresh-water 405, 489  
 Flatfishes 164, 202, 306, 433, 434, 436, 437, 438, 439, 440, 441, 457, 458, 735  
 Florida (Ship) 165  
 Fluorometry 258, 284, 383  
 Fracture mechanics 426  
 Fresh-water ecology 51, 55, 63, 192, 233, 266  
 Fresh-water flora 192  
 Fresh-water invertebrates 603  
 Friction 163, 183, 185, 426, 619, 669, 670, 746  
 Fungi 56, 193, 222, 312, 348, 733  
 Fur-bearing animals 331  
 Gas chromatography 108, 177, 383  
 Gas hydrates 5, 691  
 Gas wells 253  
 Gasoline spills 335  
 Gasoline spills - Environmental aspects 59, 75, 317, 668  
 Gastropoda 181, 645, 668  
 General M.C. Meigs (Ship) 165  
 Geochemistry 723, 743  
 Geology 197, 705  
 Geomorphology 297, 307, 308, 309, 340, 388, 461, 462, 479, 610, 611  
 Glaciers 462  
 Glucose 287, 291, 294  
 Glutamate 287, 291, 294  
 Golden Robin (Ship) 718  
 Grand Zenith (Ship) 384  
 Grasses 206  
 Gravel mines and mining - Environmental aspects 16  
 Gray whale 702  
 Grease ice 447, 449, 451, 452, 453, 621  
 Ground water 99  
 Guillemots 261  
 Gulls 14, 371, 375, 480, 537, 538, 539, 544, 547, 548  
 Heat budget 277, 728, 729  
 Heat transmission 268, 285, 357, 358  
 Heavy metals 24, 303  
 Herring 138, 581, 658, 659  
 Historic sites 333  
 Human ecology 233  
 Hunting 16, 399  
 Hydrocarbons 25, 43, 45, 46, 48, 49, 50, 51, 55, 58, 59, 60, 64, 68, 73, 77, 94, 96, 98, 100, 101, 103, 104, 105, 109, 161, 166, 167, 168, 169, 170, 171, 172, 173, 175, 193, 194, 210, 224, 226, 230, 232, 236, 237, 239, 247, 251, 252, 258, 273, 274, 281, 282, 283, 285, 293, 300, 313, 314, 316, 319, 346, 349, 350, 353, 354, 355, 360, 382, 383, 409, 410, 424, 429, 431, 434, 457, 471, 491, 511, 519, 528, 540, 557, 563, 596, 597, 598, 601, 602, 607, 608, 609, 634, 637, 639, 640, 641, 642, 643, 644, 645, 646, 651, 656, 662, 692, 707, 722, 723, 735, 741, 743  
 Hydrocarbons - Environmental aspects 54, 86, 209, 211, 628, 708  
 Hydrocarbons - Toxicity 24, 26, 70, 71, 72, 87, 128, 133, 134, 135, 157, 174, 195, 201, 202, 219, 229, 255, 264, 303, 306, 359, 372, 373, 374, 394, 396, 433, 437, 438, 439, 440, 472, 473, 480, 487, 488, 489, 496, 521, 522, 536, 547, 551, 579, 580, 581, 582, 584, 585, 586, 587, 588, 593, 594, 623, 648, 650, 658, 659, 666, 673, 682, 731, 747  
 Hydrodynamics 196, 619, 620  
 Ice 31  
 Ice - Ablation 729  
 Ice - Formation 116, 351, 626, 627  
 Ice - Surface properties 163, 415  
 Ice - Temperature 351  
 Ice cores 176  
 Ice floes 113, 278, 719  
 Ice leads 17, 74, 139, 423, 454  
 Ice-breakers - Environmental aspects 228, 239, 397  
 Ice-breaking - Environmental aspects 240, 401  
 Icebergs 253, 370, 475  
 Icebergs - Detection 36  
 Industrial wastes - Environmental aspects 102, 213, 314  
 Instruments 745  
 Intertidal zone 23, 70, 71, 76, 96, 97, 98, 105, 107, 140, 146, 164, 174, 189, 221, 247, 262, 272, 274, 281, 296, 462, 471, 493, 494, 495, 511, 514, 522, 526, 527, 531, 541, 588, 591, 594, 608, 616, 633, 634, 641, 643, 644, 645, 648, 651, 662, 668, 692, 715, 733, 743  
 Inuit - Hunting, trapping and fishing 401, 405  
 Invertebrate eggs 373, 579  
 Invertebrate larvae 110, 134, 135, 372, 373, 374, 433, 436, 439, 473, 487, 581, 585, 588, 590, 593  
 Invertebrates 63, 106, 219, 226, 233, 264, 312, 353, 394, 396, 436, 437, 455, 550, 552, 553, 554, 556, 559, 579, 585, 588, 594, 732  
 Irish Stardust (Ship) 165  
 Isopoda 87, 128, 244, 256, 551, 560, 561, 618

- Kelp** 195  
**Kittiwakes** 261, 539, 737  
**Kurdistan (Ship)** 114, 115, 199, 217, 254, 262, 369, 385, 476, 503, 504, 520, 534, 574, 575, 576, 577, 693, 694, 716, 717, 718, 719, 720, 721  
**Lagoons** 164, 304  
**Lakes** 319  
**Land use** 304  
**Lichens** 56, 57, 67  
**Light** 12, 402, 471, 596, 653  
**Lipid metabolism** 360  
**Lobsters** 731  
**Mackenzie Valley Pipeline - Environmental aspects** 208  
**Mammals** 272, 529  
**Maps** 253, 272, 462, 463  
**Marine biology** 2, 27, 106, 145, 337, 484, 512, 535, 564, 624, 700, 704, 705, 706, 738  
**Marine ecology** 27, 51, 55, 77, 130, 143, 165, 181, 212, 232, 233, 240, 248, 250, 264, 297, 327, 341, 394, 396, 398, 512, 535, 539, 557, 558, 559, 578, 585, 616, 633, 662, 688, 700, 703, 704, 705, 733, 735, 744  
**Marine fauna** 6, 96, 127, 140, 147, 151, 152, 153, 165, 166, 167, 186, 212, 228, 238, 240, 246, 296, 297, 393, 397, 398, 404, 430, 431, 432, 497, 554, 557, 564, 580, 617, 662, 663, 688, 692, 699, 701, 703, 704, 721, 722, 725  
**Marine flora** 127, 140, 166, 188, 212, 228, 238, 240, 241, 398, 404, 430, 557, 617, 663, 688, 692, 699, 703  
**Marine LNG transportation** 625  
**Marine LNG transportation - Environmental aspects** 391  
**Marine mammals** 83, 136, 142, 182, 198, 232, 233, 240, 241, 253, 270, 302, 341, 392, 399, 405, 455, 624, 643, 662, 706, 747  
**Marine oil spills** 8, 11, 12, 18, 20, 28, 29, 35, 41, 59, 78, 93, 106, 108, 118, 119, 121, 132, 141, 147, 149, 150, 151, 152, 153, 154, 155, 158, 184, 199, 203, 204, 207, 216, 245, 258, 265, 275, 279, 284, 305, 336, 337, 343, 344, 370, 386, 387, 394, 395, 396, 401, 406, 407, 419, 425, 428, 444, 448, 461, 464, 474, 475, 476, 477, 478, 481, 482, 485, 492, 499, 501, 505, 506, 507, 508, 509, 510, 516, 525, 533, 562, 573, 577, 595, 600, 604, 606, 612, 613, 614, 615, 622, 625, 664, 671, 675, 676, 678, 679, 681, 696, 700, 701, 712, 727, 728, 730, 738, 741, 742  
**Marine oil spills - Economic aspects** 21, 297, 333  
**Marine oil spills - Environmental aspects** 1, 2, 3, 4, 6, 7, 8, 10, 12, 14, 15, 16, 17, 21, 23, 24, 27, 32, 33, 35, 36, 38, 39, 41, 44, 47, 48, 49, 53, 55, 57, 58, 59, 60, 65, 66, 69, 73, 74, 75, 76, 77, 79, 80, 81, 82, 83, 86, 88, 89, 90, 91, 93, 94, 95, 96, 97, 98, 103, 104, 105, 107, 109, 111, 113, 114, 115, 117, 119, 120, 121, 122, 130, 131, 133, 136, 139, 140, 141, 144, 145, 146, 148, 149, 150, 154, 155, 158, 159, 162, 163, 164, 165, 166, 167, 169, 170, 172, 175, 176, 177, 178, 179, 180, 182, 183, 185, 186, 187, 188, 190, 191, 195, 196, 198, 206, 217, 218, 220, 221, 223, 224, 225, 226, 227, 229, 230, 231, 232, 233, 235, 236, 238, 239, 240, 241, 242, 243, 244, 246, 254, 255, 256, 257, 261, 262, 264, 267, 269, 270, 271, 272, 273, 274, 276, 277, 278, 280, 281, 282, 283, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 296, 299, 301, 302, 303, 304, 307, 308, 309, 310, 312, 315, 317, 321, 322, 323, 326, 328, 329, 331, 333, 335, 336, 338, 339, 340, 341, 342, 343, 345, 347, 348, 350, 351, 352, 354, 356, 361, 362, 365, 368, 369, 370, 371, 375, 376, 377, 379, 380, 381, 384, 385, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 402, 403, 405, 408, 411, 412, 413, 414, 417, 418, 419, 420, 421, 422, 423, 424, 427, 430, 432, 434, 435, 436, 438, 439, 440, 441, 442, 443, 444, 446, 449, 451, 452, 453, 454, 455, 456, 459, 460, 462, 463, 465, 466, 467, 468, 469, 470, 476, 479, 484, 485, 491, 495, 496, 497, 500, 503, 504, 508, 511, 512, 513, 515, 516, 520, 523, 524, 526, 527, 528, 529, 530, 531, 532, 534, 535, 536, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 552, 553, 554, 556, 557, 559, 562, 564, 565, 566, 567, 569, 570, 571, 572, 574, 575, 576, 578, 584, 585, 586, 587, 588, 592, 596, 598, 599, 602, 605, 606, 610, 611, 614, 616, 617, 618, 619, 620, 621, 628, 631, 632, 634, 636, 638, 641, 644, 647, 648, 649, 652, 654, 655, 658, 659, 660, 661, 662, 663, 665, 667, 668, 669, 670, 672, 674, 676, 680, 682, 684, 685, 686, 687, 688, 691, 692, 693, 694, 697, 699, 702, 703, 705, 709, 710, 711, 713, 714, 716, 717, 718, 719, 720, 721, 722, 725, 728, 730, 731, 732, 733, 734, 736, 737, 743, 746, 747  
**Marine oil spills - Social aspects** 304  
**Marine oil spills - Thermal properties** 502  
**Marine petroleum transportation** 253, 432, 572, 625  
**Marine petroleum transportation - Environmental aspects** 41, 76, 83, 87, 111, 174, 175, 212, 214, 228, 238, 313, 401, 432, 494, 529, 633, 653, 703, 721  
**Marine pollution** 22, 64, 99, 101, 168, 181, 198, 240, 264, 275, 303, 313, 334, 349, 378, 380, 382, 393, 394, 395, 396, 409, 429, 492, 521, 535, 563, 578, 593, 625, 637, 647, 740, 741  
**Marine resources** 337, 342  
**Marine transportation - Environmental aspects** 22, 212, 397, 399, 515  
**Marshes, Tide** 206, 616  
**Mass spectrometry** 108, 383  
**Mathematical models** 33, 34, 37, 38, 39, 40, 41, 42, 92, 137, 155, 163, 196, 241, 261, 267, 277, 278, 334, 351, 377, 398, 406, 417, 443, 445, 469, 470, 502, 506, 507, 540, 541, 542, 543, 605, 612, 613, 615, 667, 689, 737, 746  
**Metals** 25, 77, 84, 200, 252, 306, 495  
**Metals - Toxicity** 433, 436, 437, 438, 439, 440  
**Meteorological stations** 253  
**Meteorology** 41, 197, 253, 286, 337, 627, 705, 706, 729  
**Metula (Ship)** 165  
**Micro-organisms** 13, 43, 45, 46, 47, 48, 49, 50, 51, 53, 55, 56, 57, 59, 60, 61, 63, 64, 65, 68, 84, 96, 143, 144, 194, 233, 287, 288, 291, 292, 293, 294, 295, 299, 300, 301, 315, 317, 318, 320, 348, 511, 513, 514, 598, 607, 608, 636, 662, 707, 734  
**Microbial ecology** 51, 54, 143, 250, 733  
**Microclimatology** 611  
**Model ice** 163, 351, 365, 416, 423, 745  
**Mollusks** 87, 164, 168, 247, 591, 641

- Murres 1, 338  
 Mussels 195, 487, 641, 645, 646  
 Mysidacea 157, 618  
 National parks and reserves 401  
 Native peoples - Employment 392  
 Native peoples - Hunting, trapping and fishing 16, 392  
 Natural gas 29, 56, 101, 173, 207, 218, 416, 426, 568, 686, 689, 746  
 Nematoda 402, 495, 632, 672  
 Nemertea 591  
 Nitrification 47, 49, 55, 289, 292, 300  
 Nitrogen 60, 249, 315, 491  
 Nitrogen-fixation 47, 53, 55, 56, 289, 290, 292, 293, 294, 295, 300, 355  
 Noise - Environmental aspects 16, 182, 198, 213, 240, 399, 401, 702  
 Northern Gulf (Ship) 165  
 Ocean bottom 225  
 Ocean currents 5, 33, 34, 38, 137, 183, 185, 196, 253, 267, 313, 369, 408, 426, 443, 455, 462, 503, 505, 507, 572, 609, 611, 670, 688, 691, 693, 697, 698, 746  
 Ocean currents - Measurement 41  
 Ocean temperature 58, 112, 125, 126, 157, 161, 162, 193, 194, 243, 356, 359, 365, 450, 466, 467, 471, 491, 520, 563, 579, 585, 586, 588, 590, 594, 668, 682  
 Ocean waves 96, 112, 262, 411, 447, 453, 504, 526, 528, 530, 531, 532, 541, 691  
 Ocean-atmosphere interaction 170, 173, 350, 578  
 Oceanography 2, 5, 36, 44, 147, 151, 152, 153, 174, 175, 197, 211, 246, 253, 275, 314, 327, 337, 340, 370, 388, 392, 409, 442, 486, 512, 542, 543, 578, 624, 679, 703, 705, 706, 721, 725, 747  
 Offshore gas fields 366, 625  
 Offshore gas fields - Environmental aspects 195, 401  
 Offshore oil fields 432, 484, 625  
 Offshore oil fields - Economic aspects 498  
 Offshore oil fields - Environmental aspects 195, 399, 498  
 Offshore oil well blowouts 5, 29, 30, 35, 37, 40, 42, 92, 118, 156, 207, 370, 419, 445, 512, 677, 690, 712, 726  
 Offshore oil well blowouts - Environmental aspects 32, 42, 91, 140, 142, 155, 159, 167, 177, 178, 179, 185, 214, 240, 271, 286, 361, 362, 363, 364, 370, 377, 389, 391, 401, 416, 419, 426, 483, 486, 512, 515, 565, 566, 568, 617, 619, 620, 689, 691, 697, 725, 730  
 Offshore oil well drilling 342, 484  
 Offshore oil well drilling - Economic aspects 512, 700, 701  
 Offshore oil well drilling - Environmental aspects 2, 6, 16, 22, 64, 83, 88, 89, 90, 91, 93, 159, 182, 213, 228, 238, 239, 240, 302, 337, 342, 392, 397, 401, 481, 483, 485, 512, 515, 564, 624, 625, 688, 700, 701, 703, 706, 726, 728, 730, 741  
 Offshore oil well drilling - Equipment and supplies 92  
 Offshore oil well drilling - Social aspects 512, 700, 701  
 Offshore oil wells 197  
 Offshore seismic exploration 399, 702  
 Offshore seismic exploration - Environmental aspects 198  
 Offshore structures 82, 239, 397  
 Oil and gas leases 688, 700, 701, 702  
 Oil seeps 13, 47, 48, 57, 85, 99, 100, 101, 171, 172, 173, 194, 258, 273, 378, 380, 381, 382, 383, 386, 387, 407, 492, 587, 643, 740, 748  
 Oil spill burning 30, 117, 118, 119, 120, 121, 155, 156, 162, 200, 207, 216, 277, 278, 285, 408, 422, 469, 510, 525, 526, 652, 676  
 Oil spill cleanup 13, 19, 20, 30, 35, 75, 76, 88, 95, 112, 118, 119, 121, 140, 147, 148, 149, 150, 151, 152, 153, 155, 156, 162, 184, 197, 214, 217, 242, 257, 275, 278, 286, 309, 336, 340, 351, 370, 377, 401, 412, 414, 419, 421, 446, 462, 463, 466, 468, 469, 470, 479, 499, 501, 504, 508, 510, 512, 529, 532, 565, 566, 569, 570, 572, 573, 606, 611, 622, 629, 631, 635, 662, 671, 675, 676, 677, 680, 684, 687, 701, 714, 717, 721, 725, 744  
 Oil spill cleanup - Environmental aspects 304, 497, 515  
 Oil spill cleanup - Equipment and supplies 117, 297, 408, 499, 600  
 Oil spill cleanup - Equipment and supplies - Testing 18  
 Oil spill cleanup - Testing 94, 96, 97, 204, 207, 216, 285, 328, 461, 500, 525, 526, 527, 528, 634, 742, 743  
 Oil spill detection 20, 35, 147, 149, 151, 152, 153, 155, 199, 279, 336, 387, 443, 474, 475, 476, 492, 503, 533, 576, 577, 664, 744, 745  
 Oil spill dispersants 20, 105, 106, 108, 123, 140, 147, 151, 152, 153, 187, 204, 259, 284, 293, 332, 422, 497, 511, 528, 541, 631, 662, 710, 712, 718, 743  
 Oil spill dispersants - Environmental aspects 23, 26, 86, 94, 96, 97, 103, 104, 107, 122, 146, 223, 226, 230, 244, 256, 274, 283, 292, 294, 324, 328, 367, 402, 403, 424, 496, 545, 547, 548, 628, 634, 636, 655, 661, 709, 731, 734  
 Oil spill dispersants - Testing 112, 132, 526, 527, 685  
 Oil spill dispersants - Toxicity 225, 263, 264, 368, 393, 394, 395, 396, 546, 555, 709  
 Oil spill dispersants - Toxicity - Testing 266  
 Oil spill movement 11, 20, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 69, 74, 106, 108, 113, 119, 120, 137, 139, 155, 162, 163, 166, 172, 176, 178, 179, 183, 185, 196, 199, 233, 241, 245, 257, 265, 267, 276, 277, 278, 285, 286, 321, 322, 326, 336, 339, 344, 351, 363, 365, 369, 388, 392, 398, 406, 414, 415, 416, 417, 421, 422, 423, 427, 428, 442, 443, 445, 450, 452, 453, 454, 455, 464, 468, 469, 470, 477, 481, 500, 501, 503, 505, 506, 507, 509, 566, 567, 572, 573, 574, 575, 604, 605, 612, 613, 619, 620, 621, 622, 626, 627, 663, 670, 675, 677, 680, 681, 688, 692, 693, 696, 697, 698, 711, 714, 716, 721, 725, 727, 736, 739  
 Oil spill prevention 155, 214, 484  
 Oil spills 9, 214  
 Oil spills - Environmental aspects 9, 51, 62, 102, 214, 215, 744  
 Oil spills on lakes 59, 351, 446  
 Oil spills on lakes - Environmental aspects 317, 626, 627

- Oil spills on land 111
- Oil spills on land - Environmental aspects 13, 67, 165, 377, 413, 540
- Oil spills on rivers 19, 446
- Oil spills on rivers - Environmental aspects 165
- Oil well blowouts 680
- Oil well drilling - Environmental aspects 213
- Oil wells 99, 253
- Old Squaws 195, 724
- Oligochaeta 672
- Optical properties 12
- Oysters 372, 373, 374
- Pack ice 74, 111, 139, 140, 178, 179, 326, 370, 385, 408, 449, 450, 451, 454, 575, 576, 680, 691, 717, 719
- Pack ice - Movement 179, 478, 567, 573
- Pancake ice 447, 449, 451, 453, 621
- Parasites 487
- Passive microwave remote sensing 474, 533
- Pelage 4, 164, 180, 234, 268, 303, 330, 331, 357, 358, 524, 654, 655
- Permafrost 102, 413, 569
- Petrels 544, 695
- Petroleum 22, 25, 29, 46, 56, 57, 64, 75, 84, 109, 113, 116, 120, 169, 173, 177, 183, 185, 208, 236, 237, 243, 248, 256, 260, 268, 271, 288, 293, 300, 314, 318, 325, 330, 339, 351, 355, 357, 358, 367, 384, 385, 404, 416, 418, 422, 431, 447, 457, 458, 490, 514, 518, 519, 520, 524, 531, 538, 544, 557, 558, 560, 561, 568, 601, 602, 609, 618, 626, 638, 647, 651, 656, 665, 667, 670, 674, 686, 691, 715, 722, 725, 729, 735, 739
- Petroleum - Analysis 412
- Petroleum - Chemical properties 500
- Petroleum - Composition 101, 200, 316, 411, 596
- Petroleum - Density 345
- Petroleum - Physical properties 32, 415, 421, 427, 466, 468, 500, 541, 575, 689, 712, 746
- Petroleum - Thermal properties 500, 502
- Petroleum - Toxicity 4, 15, 17, 23, 26, 52, 60, 63, 70, 71, 110, 128, 129, 131, 134, 135, 138, 150, 157, 161, 186, 201, 202, 206, 225, 229, 230, 231, 234, 235, 242, 244, 255, 263, 264, 269, 289, 303, 306, 313, 324, 332, 347, 352, 359, 368, 371, 372, 373, 374, 375, 376, 393, 395, 433, 434, 435, 438, 439, 440, 441, 472, 473, 480, 487, 488, 489, 494, 496, 517, 522, 523, 536, 537, 545, 546, 547, 548, 550, 551, 552, 553, 555, 556, 559, 579, 580, 581, 582, 583, 584, 585, 589, 590, 591, 592, 594, 597, 603, 623, 648, 649, 650, 652, 653, 657, 658, 663, 668, 673, 682, 683, 695
- Petroleum - Toxicity - Testing 266
- Petroleum - Viscosity 20, 500, 622, 710
- Petroleum geology 484
- Petroleum industry 215
- Petroleum industry - Economic aspects 215, 498, 703
- Petroleum industry - Environmental aspects 45, 46, 93, 102, 111, 136, 164, 173, 198, 215, 228, 239, 240, 311, 392, 397, 498, 535, 557, 617, 633, 692, 699, 703, 705, 737, 738, 747
- Petroleum industry - Plant facilities - Environmental aspects 213, 401, 405
- Petroleum industry - Regulatory agencies 215, 498, 702
- Petroleum industry - Social aspects 215, 392, 498, 703
- Petroleum law 21
- Petroleum pipelines - Design and construction 213
- Petroleum pipelines - Environmental aspects 83, 111, 213
- Petroleum pipelines - Maintenance and repair 213
- Petroleum transportation 166
- Petroleum transportation - Environmental aspects 165, 213, 646, 647
- Phosphorus 60, 249, 315, 491
- Photosynthesis 56, 471, 549, 653
- Physical geography 211
- Phytoplankton 12, 85, 143, 174, 208, 253, 323, 324, 325, 431, 518, 556, 559, 626, 653, 662, 713
- Pinnipedia 142, 227, 303, 358
- Plankton 232, 246, 253, 313, 392, 616, 624, 643, 704, 706, 709, 741
- Plant distribution 298, 598, 608
- Plant ecology 192
- Plant growth 325, 518, 632
- Plant nutrition 295, 733
- Plant respiration 287, 291, 292, 295, 653
- Plant-soil relationships 102
- Plants and natural gas 67
- Plants and sulphur dioxide 67
- Plastics 647
- Plumage 114, 338, 367, 376, 384
- Polar bears 4, 89, 90, 227, 231, 234, 239, 253, 303, 329, 330, 331, 515, 523
- Politics and government 159
- Pollution 213
- Polychaeta 24, 25, 70, 71, 73, 87, 98, 103, 128, 236, 400, 402, 522, 646, 715
- Polynyas 5, 557
- Potomac (Ship) 456
- Precipitation (Meteorology) 253
- Pressure ridges 727
- Primary production (Biology) 12, 55, 85, 208, 253, 313, 314, 323, 324, 398, 402, 403, 459, 549, 709
- Proteins 201
- Puddles 408
- Puffins 375, 737
- Radar 361, 362, 364, 474, 533
- Recreation areas 333
- Regional planning 700
- Remote sensing 254, 279, 364, 745
- Research 5, 94, 97, 140, 175, 203, 215, 238, 280, 420, 427, 430, 467, 468, 590, 636, 661, 662, 667, 685, 686, 687, 705, 718

- Research stations 36  
 Right whale 702  
 River discharges 54, 137, 245, 313, 327  
 Rivers 245  
 Salinity 450, 471, 588, 598, 618  
 Salmon 87, 219, 255, 260, 306, 359, 433, 437, 438, 439, 440, 441, 487, 488, 489, 581, 582, 583, 586, 587, 588, 589, 592, 593, 623, 682, 683  
 Salmon fisheries 195  
 Sand 631, 651  
 Sandpipers 633  
 SAR 475  
 Satellite communications 697  
 Satellite photography 199, 577  
 Scoters 724  
 Sculpins 104, 157, 201, 202, 282, 395, 489, 586  
 Sea anemones 128  
 Sea birds 1, 2, 3, 6, 14, 36, 80, 81, 83, 89, 90, 114, 115, 232, 233, 239, 240, 241, 253, 302, 310, 352, 376, 379, 384, 455, 480, 545, 546, 624, 643, 688, 701, 704, 706, 717, 724, 736, 737, 747  
 Sea grasses 471, 549  
 Sea ice 2, 6, 7, 8, 12, 18, 28, 29, 30, 32, 33, 35, 41, 42, 45, 47, 50, 59, 68, 75, 76, 78, 79, 82, 93, 113, 117, 118, 119, 120, 121, 147, 149, 150, 151, 152, 153, 155, 156, 158, 159, 162, 166, 167, 176, 177, 184, 197, 199, 200, 203, 207, 212, 214, 216, 217, 218, 232, 241, 246, 253, 254, 262, 265, 277, 278, 279, 285, 286, 292, 299, 302, 317, 321, 322, 335, 337, 341, 343, 370, 377, 388, 389, 390, 392, 406, 414, 419, 421, 422, 423, 425, 428, 442, 445, 446, 447, 448, 466, 469, 470, 474, 475, 476, 477, 478, 481, 482, 484, 485, 486, 492, 497, 499, 501, 503, 508, 509, 510, 532, 533, 550, 557, 559, 565, 566, 567, 568, 569, 570, 577, 578, 595, 599, 604, 606, 607, 608, 611, 620, 622, 663, 664, 676, 677, 678, 679, 680, 681, 686, 689, 691, 694, 696, 705, 706, 711, 713, 716, 718, 721, 725, 726, 728, 729, 730, 744, 747  
 Sea ice - Break-up 94, 203, 205  
 Sea ice - Composition 209, 210  
 Sea ice - Deformation 426  
 Sea ice - Distribution 41  
 Sea ice - Drainage 453  
 Sea ice - Environmental aspects 462  
 Sea ice - Formation 20, 94, 203, 452, 500, 595, 621, 739  
 Sea ice - Identification 679  
 Sea ice - Measurement 727  
 Sea ice - Melting 20, 74, 139, 454  
 Sea ice - Movement 97, 203, 257, 450, 572, 574, 693, 697  
 Sea ice - Permeability 621  
 Sea ice - Physical properties 426, 428, 746  
 Sea ice - Salt content 482  
 Sea ice - Surface properties 11, 34, 183, 185, 364, 426, 427, 468, 605, 619, 669, 670, 714, 720, 727, 746  
 Sea ice - Temperature 482, 500, 739  
 Sea ice - Thickness 361, 364  
 Sea ice and climate 572, 728  
 Sea ice ecology 402, 459  
 Sea lions 268, 310, 357, 655  
 Sea otters 164, 180, 227, 268, 303, 310, 352, 356, 357, 358, 654  
 Sea water 25, 43, 45, 46, 50, 63, 68, 103, 104, 105, 120, 123, 125, 161, 167, 172, 173, 210, 221, 222, 223, 224, 263, 281, 282, 283, 287, 292, 293, 294, 295, 299, 319, 327, 328, 339, 346, 349, 350, 353, 380, 383, 385, 410, 418, 429, 434, 490, 491, 541, 596, 597, 598, 607, 608, 609, 617, 636, 637, 641, 642, 646, 650, 667, 689, 694, 711, 716, 719, 735  
 Sea water - Carbon content 171, 640  
 Sea water - Density 344, 345  
 Sea water - Nitrogen content 126  
 Sea water - Phosphorus content 126  
 Sea water - Physical properties 143  
 Seals (Animals) 1, 89, 90, 229, 234, 235, 237, 239, 268, 269, 270, 271, 310, 352, 357, 524, 534, 556, 655, 660  
 Sediment transport 86, 137, 171, 224, 252, 307, 308, 313, 346, 460, 464, 465, 528, 530, 566, 610, 640  
 Sedimentation and deposition 54, 460, 465, 723  
 Sediments (Geology) 314  
 Seismic exploration - Environmental aspects 182  
 Serials 5, 141  
 Sewage disposal 64  
 Sewage disposal - Environmental aspects 240  
 Shear zone 179, 449, 450, 451  
 Shipwrecks 217, 504  
 Shore ice - Melting 719, 720  
 Shore-lines 16, 32, 86, 94, 96, 97, 98, 104, 109, 140, 147, 148, 151, 152, 153, 188, 205, 217, 220, 262, 282, 283, 304, 309, 326, 328, 333, 388, 414, 442, 460, 462, 463, 476, 479, 497, 525, 528, 530, 531, 532, 575, 600, 622, 628, 629, 630, 631, 632, 634, 636, 716, 719, 721  
 Shrimps 26, 110, 306, 359, 433, 473, 581, 593, 642  
 Silt 513, 514, 598  
 Sipunculoidea 72  
 Slopes (Physical geography) 462  
 Slush 363  
 Smelts 434, 437, 438, 440  
 Snails 715  
 Snow 19, 162, 335, 468, 469, 470, 663  
 Snow - Impurities 209  
 Snow - Thickness 78, 79  
 Snow cover 361, 362, 363  
 Soils 19, 194, 564  
 Solar radiation 12, 411  
 Stamukhi 680  
 Sticklebacks 489  
 Storage tanks 19, 570  
 Storms 326  
 Submarine geology 327, 337, 706

- Submarine topography 679
- Subsea containment 5
- Sulphides 513
- Sulphur 514
- Sulphur dioxide 56, 200
- Suspended solids 170, 171, 245, 252, 292, 346, 429,  
442, 541, 566, 640, 641, 642, 643, 707
- Tank vessels 117, 175
- Telemetry 697
- Thermoregulation 4, 17, 202, 234, 330, 331, 338, 356,  
358, 368, 523, 655
- Tides 137, 350, 450, 513, 611, 688, 715
- Time-lapse photography 203, 205
- Torrey Canyon (Ship) 165
- Trace elements 25, 77, 84, 174, 306, 433, 436, 437,  
438, 439, 440
- Trans-Alaska Pipeline System - Environmental aspects  
314, 593, 646, 744
- Trapping 405
- Trout 219, 306, 436, 440, 441, 581
- Tundra ecology 51, 55, 233
- Ultrasound remote sensing 279
- Ultraviolet radiation 434
- Underwater acoustics 182, 399
- United States Coast Guard 468
- United States: Outer Continental Shelf Environmental  
Assessment Program 64
- University of Toronto 667
- Volcanism 302
- Walrus 357
- Water 596, 638
- Water - Temperature 116
- Water masses 36, 212, 409
- Water pollution 99, 101, 334, 625
- Water-birds 272
- Weathering of petroleum 7, 20, 24, 28, 32, 47, 49, 58,  
69, 86, 103, 105, 107, 108, 109, 130, 161, 162, 166,  
167, 176, 177, 187, 196, 200, 206, 224, 233, 262, 276,  
277, 278, 285, 293, 301, 316, 321, 322, 339, 343, 345,  
348, 354, 377, 411, 412, 413, 414, 418, 434, 442, 443,  
468, 469, 470, 500, 501, 528, 530, 531, 540, 541, 542,  
543, 562, 596, 599, 622, 626, 627, 651, 662, 667, 672,  
675, 678, 711, 720, 742, 743
- Whales 1, 182, 227, 234, 239, 303, 352, 392
- Whaling 563
- Wildlife conservation 102, 198, 272, 333, 700
- Wildlife management 198
- Winds 38, 41, 137, 196, 253, 326, 369, 443, 450, 455,  
462, 468, 470, 502, 503, 524, 569, 688, 693, 698, 714
- Yeasts 193, 348, 733
- Zoology 111, 744
- Zooplankton 27, 219, 253, 455, 456, 585, 593, 626,  
662, 732

## GEOGRAPHIC INDEX

*The numbers listed below are citation numbers, not page numbers.*

- Afognak Island, Alaska 3
- Alaska 18, 62, 67, 193, 297, 489, 498
- Alaska, Gulf of 22, 46, 64, 99, 100, 101, 133, 172, 173, 267, 300, 303, 349, 429, 430, 490, 538, 588, 591, 608, 610, 624, 642, 647, 648, 668, 669, 698, 699, 701, 705, 708, 723
- Alaska, Gulf of, region 192
- Alaska, Northern 111, 304, 697, 748
- Alaska, Southeastern 192, 591
- Alaska, Southwestern 688
- Alaska Peninsula 310, 688
- Alaska Peninsula waters 310
- Alaskan waters 238, 297, 305, 399, 446, 458, 580, 622, 704, 738
- Alert Bay, British Columbia 165, 718
- Aleutian Islands, Alaska 700
- Aleutian Islands waters, Alaska 688
- Amak Island, Alaska 442
- Amalga Harbour, Alaska 673, 674
- Amchitka Island, Alaska 352
- Amundsen Gulf, N.W.T. 5, 41, 211, 405
- Antarctic regions 9
- Antarctic waters 521, 563, 599
- Arctic Basin 572
- Arctic Bay (Hamlet), N.W.T. 401
- Arctic Ocean 43, 74, 139, 165, 182, 209, 258, 315, 334, 452, 454, 557, 578, 598, 707
- Arctic regions 6, 9, 35, 51, 55, 59, 60, 61, 147, 150, 151, 152, 153, 193, 197, 227, 228, 232, 233, 234, 243, 319, 335, 343, 404, 428, 432, 558, 744
- Arctic waters 8, 21, 35, 59, 60, 155, 157, 167, 197, 228, 232, 246, 319, 335, 336, 341, 376, 419, 421, 430, 432, 446, 474, 475, 497, 499, 532, 599, 680, 730, 732
- Atkasook, Alaska 392
- Auke Bay, Alaska 110, 157, 581, 589, 590, 594, 682
- Auke Bay (Village), Alaska 134, 359, 473, 579, 582, 584, 585, 586, 590, 683
- Auke Creek, Alaska 359, 581, 587, 592
- Auke Lake, Alaska 487
- Baffin Bay-Davis Strait 36, 37, 38, 39, 41, 93, 140, 143, 212, 214, 215, 273, 378, 380, 445, 505, 575, 677
- Baffin Island, N.W.T. 142, 462
- Baffin Island waters, N.W.T. 27, 188, 203, 230, 381, 382, 460, 461, 462, 465, 635, 671, 742
- Balaena Bay, N.W.T. 12, 206, 422, 448, 508
- Baltic Sea 7, 578
- Barrow, Alaska 317, 392
- Barrow, Point, Alaska 707
- Barrow, Point, region, Alaska 52
- Barrow, Point, waters, Alaska 320, 392, 490, 618, 712
- Barrow region, Alaska 63
- Barrow waters, Alaska 58, 68, 130, 278, 315, 598, 724
- Beaufort Sea 2, 17, 20, 30, 32, 33, 39, 40, 41, 45, 47, 48, 49, 50, 53, 64, 68, 77, 81, 82, 91, 92, 111, 118, 119, 124, 125, 126, 127, 140, 156, 159, 179, 195, 200, 211, 213, 214, 215, 239, 240, 241, 245, 271, 275, 279, 286, 292, 293, 294, 295, 300, 301, 303, 311, 317, 320, 321, 323, 324, 325, 326, 327, 329, 355, 389, 397, 398, 399, 408, 410, 412, 413, 417, 448, 449, 451, 481, 483, 485, 486, 498, 508, 509, 516, 530, 535, 556, 567, 588, 607, 608, 615, 620, 622, 637, 641, 642, 643, 660, 666, 669, 690, 697, 705, 706, 723, 724, 725, 726, 727, 728, 734, 740, 741, 748
- Beaufort Sea region 32, 211, 326, 530, 622
- Becharof Lake region, Alaska 99
- Bechevin Bay, Alaska 164
- Beekman Peninsula, N.W.T. 142
- Bering River, Alaska 101
- Bering Sea 16, 22, 39, 41, 46, 47, 48, 54, 84, 164, 172, 173, 178, 179, 182, 201, 202, 257, 268, 288, 299, 300, 302, 303, 337, 349, 352, 357, 366, 399, 406, 442, 443, 447, 449, 450, 451, 468, 470, 588, 642, 643, 647, 666, 669, 700, 702, 705, 713, 723
- Bering Sea region 700
- Bering Strait 567
- Blossom, Cape, Channel, Alaska 455
- Borden Peninsula, N.W.T. 462
- Bristol Bay, Alaska 172, 442, 688
- British Columbian waters 344
- Brockton Point waters, British Columbia 668
- Browns Harbour, N.W.T. 235, 237, 269, 271
- Buchan Gulf, N.W.T. 273, 382, 383
- Buzzards Bay, Massachusetts 165, 698
- Bylot Island, N.W.T. 462
- Cabot Strait, Gulf of St. Lawrence 115, 199, 217, 254, 503, 504, 574, 693, 694, 716, 717, 719, 721
- Calgary, Alberta 423, 426
- California waters 15, 58, 668, 735
- Canada 148, 370
- Canadian Arctic 83, 102, 141, 154, 253, 331, 379, 614, 711
- Canadian Arctic Islands waters 5, 39, 41, 214, 420, 666, 687
- Canadian Arctic waters 83, 117, 141, 149, 154, 155,

- 198, 218, 253, 336, 340, 342, 344, 345, 391, 393, 414, 444, 486, 529, 554, 606, 612, 613, 614, 655, 676, 734
- Canadian waters 243, 345, 414, 529, 662, 734
- Cape Breton Island, Nova Scotia 115, 262, 534, 719
- Cape Breton Island waters, Nova Scotia 115, 262, 385, 576, 693, 694, 719, 720
- Caribou Bar Creek, Y.T. 603
- Cartwright region, Labrador 44
- Casco Bay, Maine 165
- Chaleur Bay, New Brunswick 718
- Chambers Creek, Washington 439
- Chedabucto Bay, Nova Scotia 75, 165, 194, 352, 466, 467, 476, 491, 569, 718, 719
- Chiniak Bay, Alaska 46
- Chukchi Sea 39, 41, 43, 68, 173, 178, 179, 211, 257, 276, 277, 278, 300, 303, 304, 315, 317, 320, 349, 388, 392, 449, 451, 569, 620, 666, 669, 705, 706
- Churchill, Manitoba 231, 523
- Churchill region, Manitoba 4, 330
- Clarence, Port, Bay, Alaska 162, 469, 470
- Clyde River (Hamlet), N.W.T. 401
- Coal Bay (59 33 N, 151 28 W), Alaska 291, 645
- Coal Point (59 36 N, 151 24 W), Alaska 645
- Colville River, Alaska 455
- Constantine Harbor (146 38 N, 60 22 W), Alaska 180
- Cook Inlet, Alaska 47, 49, 50, 54, 64, 136, 170, 171, 173, 196, 252, 292, 293, 294, 295, 300, 307, 309, 346, 349, 350, 354, 479, 541, 598, 608, 609, 625, 640, 641, 642, 643, 644, 692, 701, 705, 723
- Cook Inlet region, Alaska 540
- Copper River (60 18 N, 145 03 W) region, Alaska 538
- Copper River Delta, Alaska 611, 633
- Copper Sands (Bar), Alaska 539
- District of Mackenzie 213, 215, 741
- Deception Bay, Quebec 75, 165, 569, 570, 571
- Denali region, Alaska 455
- Devon Island, N.W.T. 462
- Devon Island waters, N.W.T. 462
- Dikson, Ostrov, U.S.S.R. 360
- Douglas Point, Ontario 285
- Drift River Channel, Alaska 455
- Dry Bay (59 08 N, 138 25 W), Alaska 538, 539
- Eclipse Sound, N.W.T. 203, 220, 222, 465
- Egg Island (60 23 N, 145 46 W), Alaska 537, 538, 539
- Ellamar Cove, Alaska 658, 659
- Ellef Ringnes Island, N.W.T. 564
- Ellef Ringnes Island waters, N.W.T. 90, 564, 565
- Elson Lagoon, Alaska 45, 49, 50, 128, 129, 131, 287, 291, 293, 294, 317, 320, 618
- Eskimo Lakes, N.W.T. 126, 324, 355, 552, 553, 555, 560, 561
- Fanshawe, Cape, waters, N.W.T. 36
- Farallon Islands, California 14
- Flattery, Cape, Washington 165
- Frantsa-Iosifa, Zemlya, U.S.S.R. 258
- Frobisher Bay, N.W.T. 27, 264, 395, 396
- Georges Bank, North Atlantic Ocean 698
- Glacier Bay, Alaska 293
- Gluudneset, Svalbard 629, 632
- Graham, Port, Alaska 455
- Grand Banks, North Atlantic Ocean 617
- Grassy, Cape, waters, N.W.T. 89
- Great Island, Newfoundland 375
- Great Lakes, Canada/U.S. 340
- Haenke Island, Alaska 538, 539
- Halten Bank, Norwegian Sea 69, 339
- Harrison Bay, Alaska 326, 566, 679
- Hatt, Cape, N.W.T. 94, 95, 96, 97, 108, 146, 188, 205, 460, 461, 511, 525, 528, 630, 634, 671, 684, 685, 743
- Hatt, Cape, waters, N.W.T. 86, 94, 96, 97, 98, 103, 104, 105, 106, 107, 108, 109, 122, 123, 144, 145, 146, 188, 189, 190, 191, 203, 204, 205, 220, 221, 222, 223, 224, 225, 226, 236, 274, 281, 282, 283, 284, 328, 400, 402, 403, 424, 461, 496, 511, 526, 527, 528, 531, 628, 631, 634, 636, 685, 743
- Hay, Cape, (73 44 N, 79 58 W) waters, N.W.T. 36
- Hecla and Griper Bay, N.W.T. 28, 113, 176, 177
- Herschel Island, Y.T. 724
- Herschel Island waters, Y.T. 551
- Homer, Alaska 701
- Hope, Point, (68 20 N, 166 50 W) waters, Alaska 392
- Hudson Bay 344
- Hudson Strait region, Quebec 570, 571
- Iniskin Peninsula, Alaska 99, 100
- Inuvik region, N.W.T. 208
- Issaquah, Washington 440
- Izembek Lagoon, Alaska 84, 471
- Jackson Bay, N.W.T. 88, 90, 564, 565
- Jones Sound, N.W.T. 380
- Juan de Fuca Strait 251, 715
- Kachemak Bay, Alaska 50, 160, 541, 645, 692, 713
- Kamishak Bay, Alaska 455
- Karskoye More 210, 298
- Kasitsna Bay, Alaska 110, 287, 289, 290, 291, 293, 473, 540, 541, 542, 543, 581
- Katalla region, Alaska 100
- Katalla River, Alaska 101
- Kenai, Alaska 701
- Kenai Peninsula, Alaska 310
- Kenai Peninsula waters, Alaska 310
- Kennedy Entrance, Alaska 50
- King Edward Cove, South Georgia, Antarctic regions 168
- Kodiak, Alaska 701
- Kodiak Island, Alaska 3, 310, 333, 737
- Kodiak Island waters, Alaska 3, 64, 310, 333, 439, 723,



- 736, 737
- Kongsfjorden, Svalbard 672
- Kotzebue Sound, Alaska 308, 449, 451
- Kugmallit Bay, N.W.T. 560, 561
- Kvichak Bay, Alaska 455
- La Jolla, California 541, 542, 543
- Labrador 463
- Labrador Sea 22, 27, 39, 93, 140, 370, 506, 507, 573, 575, 691
- Labrador waters 44, 97, 464, 617
- Lancaster Sound, N.W.T. 36, 37, 38, 42, 212, 273, 380, 398, 401, 445, 462, 484, 512, 515
- Lancaster Sound region, N.W.T. 401, 462, 512
- Laptevkh, More 298
- Liard River, Y.T. 603
- Little Port Walter, Alaska 579
- Louise, Lake, (62 20 N, 146 32 W) region, Alaska 538
- Mackenzie Bay, N.W.T./Y.T. 508, 740
- Mackenzie Delta, N.W.T. 213, 214, 498
- Mackenzie Estuary, N.W.T./Y.T. 245, 344
- Mackenzie River, N.W.T. 245, 603
- Magdalen Islands waters, Quebec 269, 271
- Magellan, Strait of 165
- Maine 480
- Maine waters 544, 695
- Makkovik region, Labrador 44
- McKinley Bay (69 56 N, 131 10 W), N.W.T. 120, 121, 207, 216, 459
- Mediterranean Sea 417
- Melville Bugt, Greenland 456, 562
- Melville Island waters, N.W.T. 89
- Mexico, Gulf of 22
- Moller, Port, Alaska 455
- Montague Island, Alaska 310
- Montague Island waters, Alaska 310
- Monterey waters, California 356
- Mukilteo, Washington 434, 437, 438
- Nantucket Island waters, Massachusetts 165
- Newfoundland waters 691
- Niagara Falls (City), Ontario 11, 664
- Nome, Alaska 19, 455, 703
- Nome waters, Alaska 579, 594
- Norman Wells, N.W.T. 413
- North Atlantic Ocean 22, 166, 193, 340, 345, 352, 384, 430, 476, 661, 698, 699
- North Marble Island (58 39 N, 136 03 W), Alaska 538, 539
- North Pacific Ocean 22, 165, 340, 345, 352, 430, 661
- Northwest Passage 212, 213, 215, 398
- Norton Sound, Alaska 16, 47, 48, 54, 171, 173, 272, 293, 346, 449, 451, 703, 723, 747
- Norton Sound region, Alaska 272
- Norwegian Sea 80, 280
- Nova Scotia 476, 534, 716, 717
- Nova Scotian waters 114, 476, 520, 534, 577, 716, 717
- Nuwuk Lake, Alaska 128, 131
- Oregon waters 134
- Ottawa region, Ontario 626, 627
- Parry, Cape, N.W.T. 229
- Parry, Cape, waters, N.W.T. 235
- Parry Channel, N.W.T. 5
- Parry Peninsula (69 45 N, 124 45 W), N.W.T. 405
- Parry Peninsula (69 45 N, 124 45 W) waters, N.W.T. 508
- Patricia Bay, British Columbia 187, 709
- Point Hope (Village), Alaska 392
- Point Lay (Village), Alaska 392
- Pond Inlet, N.W.T. 205
- Pond Inlet (Hamlet), N.W.T. 401
- Pond Inlet region, N.W.T. 635
- Port Clarence, Alaska 468
- Port Moller waters, Alaska 1
- Pribilof Islands, Alaska 261, 700, 702
- Pribilof Islands waters, Alaska 261
- Prince William Sound, Alaska 87, 138, 247, 310, 313, 347, 633, 654
- Prudhoe Bay, Alaska 45, 57, 63, 65, 66, 68, 78, 79, 137, 178, 179, 246, 250, 257, 361, 362, 363, 364, 368, 395, 412, 449, 455, 490, 500, 501, 567, 586, 595, 639, 652, 656, 678, 681, 696
- Puale Bay region, Alaska 100
- Puget Sound, Washington 272, 372, 373, 374, 434, 437, 440, 457
- Puget Sound region, Washington 272
- Ragged Channel, N.W.T. 86, 94, 96, 97, 98, 103, 104, 105, 107, 108, 109, 122, 123, 189, 190, 191, 204, 205, 220, 221, 222, 223, 236, 274, 282, 283, 284, 328, 402, 403, 424, 511, 526, 527, 531, 628, 631, 634, 636, 743
- Ragged Channel region, N.W.T. 108
- Resolute, N.W.T. 76, 263
- Resolute Bay, N.W.T. 75, 76, 165, 263, 394, 395, 482
- Resurrection Bay, Alaska 169, 650, 665
- Runde (62 24 N, 05 37 E) waters, Norway 338
- Rush Rock, Alaska 442
- Sable Island, Nova Scotia 534
- Sable Island waters, Nova Scotia 617
- Sadie Cove, Alaska 291
- San Diego, California 180
- San Francisco Bay, California 517, 519
- Sandy Hook Bay, New Jersey 522
- Sashin Creek, Alaska 583
- Scotian Shelf, North Atlantic Ocean 114, 217, 369, 520, 534, 575
- Scotland 498
- Scott Inlet, N.W.T. 273, 378, 382, 386, 387, 407, 492

- Seattle, Washington 434, 437, 438  
 Seniavin, Cape, Alaska 442  
 Sequim Bay, Washington 23, 25, 70, 71, 72, 73, 457, 601, 602  
 Seward, Alaska 701  
 Seward region, Alaska 648  
 Shelikof Strait, Alaska 171, 196, 272, 295, 349, 541, 701  
 Shelikof Strait region, Alaska 272  
 Shuyak Island, Alaska 3  
 Signy Island, Antarctic regions 168  
 Simpson, Cape, Alaska 57, 85, 194  
 Simpson Lagoon, Alaska 137, 157  
 Sitka, Alaska 701  
 Smith Sound, Greenland/N.W.T. 380  
 Snake River (64 30 N, 165 25 W), Alaska 19  
 Soldotna, Alaska 701  
 Spruce Island (57 55 N, 152 25 W), Alaska 3  
 Squamish Estuary, British Columbia 256  
 St. George Island, Alaska 268, 357, 702  
 St. John's, Newfoundland 426  
 St. Lawrence, Gulf of, Canada 344, 556, 575  
 St. Matthew Island, Alaska 455  
 Stefansson Sound, Alaska 618  
 Strawberry Reef, Alaska 539  
 Summer's Harbour, N.W.T. 405  
 Svalbard waters 258  
 Sveagruva, Svalbard 158  
 Sveagruva region, Svalbard 158  
 Tacoma, Washington 440  
 Tomales Bay, California 517  
 Toronto, Ontario 422, 667  
 Trail River (69 08 N, 138 22 W), Y.T. 603  
 Tuktoyaktuk Harbour, N.W.T. 77  
 Tuktoyaktuk Peninsula, N.W.T. 697  
 Tuktoyaktuk Peninsula waters, N.W.T. 740  
 Tuktoyaktuk region, N.W.T. 733  
 Tuktoyaktuk waters, N.W.T. 733  
 Tulalip, Washington 439  
 U.S. 446  
 Ugak Bay, Alaska 46  
 Umiat, Alaska 57  
 Umiat region, Alaska 13  
 Unimak Pass, Alaska 455  
 Valdez, Port, Alaska 43, 65, 87, 174, 175, 181, 248, 313, 314, 353, 409, 429, 455, 493, 494, 495, 513, 514, 593, 597, 598, 643, 646, 649, 651, 653, 674, 707  
 Valdez Narrows, Alaska 313  
 Valdez waters, Alaska 175, 409, 495, 593  
 Van Mijenfjorden, Svalbard 158, 296  
 Viscount Melville Sound, N.W.T. 212  
 Wainwright, Alaska 392  
 Warrender, Cape, waters, N.W.T. 36  
 Washington (State) waters 249  
 Wise Bay, N.W.T. 405  
 Y.T., Northern 724  
 Yakataga, Cape, Alaska 100, 101  
 Yakataga, Cape, waters, Alaska 594  
 Yakutat, Alaska 701  
 Yakutat Bay, Alaska 101  
 Yakutat region, Alaska 100  
 Yakutat waters, Alaska 455  
 Yellowknife, N.W.T. 510  
 Yenisei Bay, U.S.S.R. 298  
 Yukon Delta, Alaska 747  
 Yukon River, Alaska 455

## TITLE INDEX

*The numbers listed below are citation numbers, not page numbers.*

- ABSORB tests oil/ice interaction 595  
 Abundance and activity of heterotrophic marine bacteria in selected bays at Cape Hatt, N.W.T. : effects of oil spills, 1981 122  
 Abundance and activity of heterotrophic marine bacteria in selected bays at Cape Hatt, N.W.T. 1980 : first report to the Baffin Island Oil Spill (BIOS) project 123  
 Accelerated biodegradation of crude oil on arctic shorelines 629  
 Accumulation, fractionation and release of oil by the intertidal clam *Macoma balthica* 169  
 Acute and chronic toxicity of seawater extracts of Alaskan crude oil to zoeae of the Dungeness crab, *Cancer magister* Dana 133  
 Acute and chronic toxicity, uptake and depuration, and sublethal metabolic response of Alaskan marine organisms to petroleum hydrocarbons 579  
 Acute and chronic toxicity, uptake and depuration, and sublethal response of Alaska marine organisms to petroleum hydrocarbons 580  
 Acute effects : Pacific herring roe in the Gulf of Alaska 658  
 Acute lethal toxicity of Corexit 9527/Prudhoe Bay crude oil mixtures to selected Arctic invertebrates 393  
 Acute lethal toxicity of oil/dispersant mixtures to selected arctic species 263  
 Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 on four arctic marine invertebrates 394  
 Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 to arctic marine fish and invertebrates 395  
 Acute lethal toxicity of Prudhoe Bay crude oil and Corexit 9527 to arctic marine invertebrates and fish from Frobisher Bay, N.W.T. 264, 396  
 Acute toxic effects of petroleum on arctic and subarctic marine organisms 186  
 Acute toxicity and uptake-depuration studies with Cook Inlet crude oil, Prudhoe Bay crude oil, No. 2 fuel oil, and several subarctic marine organisms 581  
 Acute toxicity of the water-soluble fraction of Cook Inlet crude oil to the Manila clam 517  
 Aerial photographic surveys analyzed to deduce oil spill movement during the decay and breakup of fast ice, Prudhoe Bay, Alaska, final report 696  
 Alaska peninsula oil spill 1  
 Aliphatic and aromatic hydrocarbons in benthic invertebrates from two sites in Antarctica 168  
 Alterations in petroleum resulting from physico-chemical and microbiological factors 348  
 Analyses of Beaufort Sea and Prudhoe Bay crude oils 412  
 Analysis of aliphatic and aromatic hydrocarbons in antarctic marine sediment layers 563  
 Anticipated fisheries impact of offshore hydrocarbon development on the Canadian east coast 617  
 Anticipated oil dispersion rates in pack ice 573  
 Anticipated oil-ice interactions in the Bering Sea 447  
 Application of an oil spill vulnerability index to the shoreline of lower Cook Inlet, Alaska 479  
 Arctic atlas : background information for developing marine oilspill countermeasures 253  
 arctic coastal environment of Alaska, Vol. 2 : A compilation and review of scientific literature of the arctic marine environment 246  
 Arctic hydrocarbon biodegradation 43  
 Arctic marine ecosystems and oil pollution 550  
 Arctic Marine Oil Spill Program Technical Seminar preprints 336  
 Arctic Ocean : the hydrographic environment and the fate of pollutants 578  
 Arctic oil biodegradation 707  
 Arctic oil spills 413  
 Arctic shoreline countermeasures : initial results and implications from the BIOS experiment 525  
 Arctic winter oil spill test : United States Coast Guard 162  
 Arene and alkane hydrocarbons in nearshore Beaufort Sea sediments 637  
 Aromatic hydrocarbon oxidation by diatoms isolated from the Kachemak Bay region of Alaska 160  
 Aspects of oil-ice interaction subsequent to the Kurdistan spill 574  
 Assessment of available literature on effects of oil pollution on biota in arctic and subarctic waters 430  
 Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development of the outer continental shelf in the Beaufort Sea 45  
 Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf in the Gulf of Alaska 46  
 Assessment of potential interactions of microorganisms and pollutants resulting from petroleum development on the outer continental shelf of Alaska 47, 48, 49, 50  
 Assessment of tanker and slick drift following break-up of the tanker "Kurdistan" 503  
 assessment of the biodegradation of petroleum in the Arctic 51  
 Assessment of the ecological effects of an oil spill in an offshore subarctic environment 93  
 Assessment of the effects of oil on arctic marine fish and marine mammals 341

- Background levels of petroleum residues in Baffin Bay and the eastern Canadian Arctic : role of natural seepage 378
- Bacterial oxidization of mineral oils at sub-zero Celsius 748
- Bacterial populations associated with the Arctic amphipod *Boeckosimus affinis* 52
- Bacterial populations of the Beaufort Sea 53
- Baffin Island Oil Spill (BIOS) Project : a summary 634
- Baffin Island Oil Spill experiment : chemistry component : final report on baseline year activities, volume 1 : field work, environmental chemistry, hydrocarbon infrared data 281, 282
- Baffin Island Oil Spill Project 94
- Baffin Island Oil Spill Project : Cape Hatt ice conditions 203
- Baffin Island Oil Spill Project : chemistry component - 2 : analytical biogeochemistry : report on 1983 field experiments 86
- Baffin Island Oil Spill Project : chemistry component : final report on the 1983 oil spill experiments : volume 1, summary of field work and shoreline hydrocarbon analysis 628
- Baffin Island Oil Spill Project : chemistry component : report on the 1981 oil spill experiments, volume 1 : summary of field work 283
- Baffin Island Oil Spill Project : chemistry component : report on the 1982 oil spill experiments, volume 1 : summary of field work and shoreline hydrocarbon analysis 328
- Baffin Island Oil Spill Project : chemistry component : report on 1981 oil spill experiment, vol. 2 : summary of analytical biogeochemistry 103
- Baffin Island Oil Spill Project : chemistry component : volume 2 104
- Baffin Island Oil Spill Project : chemistry component : volume 2 : final report 105
- Baffin Island Oil Spill Project : chemistry component 2, analytical biogeochemistry : report on 1982 field experiments 224
- Baffin Island Oil Spill Project : microbial degradation of oil - measurements in Ragged Channel, Z-lagoon and Eclipse Sound, Cape Hatt 1980, a baseline assessment 220
- Baffin Island Oil Spill Project : microbial degradation of oil : measurements in Ragged Channel test bays and enhanced biodegradation experiments in Z-Lagoon : a postspill survey 221
- Baffin Island Oil Spill Project : microbial degradation of oil : measurements in Ragged Channel, Z-Lagoon and Eclipse Sound, Cape Hatt 1980 : a baseline assessment 222
- Baffin Island Oil Spill Project : 1981 shoreline component 526
- Baffin Island Oil Spill Project : 1982 shoreline component 527
- Baffin Island Oil Spill Project : 1983 shoreline component : final report 743
- Baffin Island Oil Spill Project oil discharge systems 204
- Baffin Island Oil Spill Project status report 635
- Baffin Island Oilspill Project Cape Hatt ice conditions 205
- Baseline hydrocarbon concentrations 353
- Baseline study of microbial activity in the Beaufort Sea and Gulf of Alaska, and analysis of crude oil degradation by psychrophilic bacteria 490
- Beaufort Environmental Monitoring Project, 1983-1984 397
- Beaufort Environmental Monitoring Project, 1984-85 final report 239
- Beaufort Sea monitoring program : proceedings of a workshop (September 1983) and sampling design recommendations 195
- Beaufort Sea synthesis report : environmental impacts of OCS development in northern Alaska : proceedings 2
- Behavior and pathophysiology of seals exposed to crude oil 269
- behavior of oil spilled in a cold water environment 466
- Behavior of oil spilled under floating ice 351
- Behaviour of and response to a major oil spill from a tanker in arctic waters 117
- behaviour of crude oil spilled under multi-year ice 28
- Behaviour of oil spills under sea ice, Prudhoe Bay 678
- Behaviour of oil under Canadian climatic conditions, Part 1 : Oil on water under ice-forming conditions 626
- Behaviour of subsurface discharges of oil, gas and dispersants 712
- Behavioural and physiological effects of hydrocarbon exposure on selected arctic invertebrates 424
- Behavioural characteristics and cleanup techniques of North Slope crude oil in an arctic environment 468
- Behavioural responses of benthic invertebrates exposed to dispersed crude oil 225
- Benthos : nearshore studies in the Makkovik Bay and Cartwright region 44
- BIO spill response 716
- Bioavailability of crude oil from experimentally oiled sediments to English sole (*Parophrys vetulus*), and pathological consequences 457
- Bioavailability of naphthalenes from marine sediments artificially contaminated with Prudhoe Bay crude oil 601
- Biodegradation of a chemically dispersed crude oil 187
- Biodegradation of aromatic compounds by high-latitude phytoplankters 713
- Biodegradation of crude petroleum by the indigenous microbial flora of the Beaufort Sea 124, 125
- Biodegradation of petroleum hydrocarbons in continental shelf regions of the Bering Sea 299
- biogeochemical assessment of the BIOS experimental spills : transport pathways and fates of petroleum in benthic animals 106
- Biological consequences of oil-spills in arctic waters 497
- Biological effects of chemically dispersed crude oils in marine sediments : preliminary results from behaviour experiments with a post-larval crustacean in the laboratory 731

- biological effects of hydrocarbon exploration and production related activities, disturbances and wastes on marine flora and fauna of the Beaufort Sea region 240
- Biological impacts of three oil spill scenarios in the Beaufort Sea 241
- Biological productivity of the southern Beaufort Sea : phytoplankton and seaweed studies 323
- biologist looks at oil in the sea 444
- BIOS Project - 1980 review 95
- BIOS Project : an experimental oil spill 636
- BIOS Project : an update 96
- BIOS Project : frontier oil spill countermeasures research 97
- BIOS Project : preliminary results 98
- BIOS shoreline experiments : results from 1980-1982 field studies 528
- Biotransformation of petroleum hydrocarbons in marine organisms indigenous to the Arctic and Subarctic 431
- Bird deaths mount in Alaska 3
- Canola oil as a substitute for crude oil in cold water spill tests 18
- carcinogenic load of the environment : benzo(a)pyrene in sediments of arctic waters 666
- Case study : oil recovery beneath ice 19
- Changes in the volatile hydrocarbon content of Prudhoe Bay crude oil treated under different simulated weathering conditions 596
- Characterization of organic matter in sediments from Cook Inlet and Norton Sound 346
- Characterization of the microbial component of an intertidal silt sediment ecosystem at Valdez, Alaska, and its failure to degrade added crude oil 513
- Chemical and size fractionation of aqueous petroleum dispersions 638
- Coastal environments of Canada : the impact and cleanup of oil spills 340
- Coastal morphology and sedimentation, Lower Cook Inlet, Alaska, with emphasis on potential oil spill impacts 307
- coastal morphology and sedimentology of Cape Hatt : implications for the Baffin Island Oil Spill Project (BIOS) 460, 461
- coastal morphology and sedimentology of eastern Lancaster Sound and northeast Baffin Island : a study of shoreline sensitivity to a potential oil spill 462
- coastal morphology and sedimentology of Labrador : a study of shoreline sensitivity to a potential oil spill 463
- Coastal morphology, oil spill vulnerability and sedimentation of the northern Gulf of Alaska 610
- Coastal oil spills and their impact on land 529
- coastal sediments of Labrador and their use to predict the movement of an oil spill in the coastal zone 464
- Coastal sensitivity analysis of the northern Chukchi Sea coast of Alaska 304
- old regions spill response 446
- Commentary : what impact will the oil industry have on seabirds in the Canadian Arctic? 379
- Comparative fate of chemically dispersed and untreated oil in the Arctic : Baffin Island Oil Spill studies 1980-1983 107
- comparative fate of chemically dispersed and untreated oils in an arctic nearshore environment 108
- Comparison of ecological impacts of postulated oil spills at selected Alaskan locations 455
- computation of a pollutant budget for the Arctic Ocean 334
- Concentration of petroleum residues in the waters and sediments of Baffin Bay and the eastern Canadian Arctic - 1977 380
- Conceptual oil dispersion modeling, lower Cook Inlet-Shelikof Strait 196
- Consequences of oil fouling on marine mammals 270
- containment of oil spilled under rough ice 183
- Content of the NOAA/BLM Alaskan OCS research effort 238
- Continuous open flow-through system as a model for oil degradation in the Arctic Ocean 315
- Control of arctic oil spills 714
- Control of oil spills under ice 499
- Countermeasures for oil spills in Canadian Arctic waters : the Arctic Marine Oilspill Program 606
- Crude oil behavior on Arctic winter ice 469
- Crude oil degradation in the arctic : changes in bacterial populations and oil composition during one-year exposure in a model system 316
- Crude oil in cold water : the Beaufort Sea and the search for oil 481
- Crude oil phytotoxicity studies 653
- Data report no. 5 : Nearshore studies of the physical oceanography of Cape Warrender, Cape Fanshawe and Cape Hay, 1979 36
- Deep sea dispersion analyses 505
- Deep-water blowout trajectory models for the Lancaster Sound region 37, 445
- Degradation of oil by yeast and filamentous fungi in arctic environments 193
- Degradation of petroleum by a psychrotolerant marine flora from the Eskimo Lakes, N.W.T. 126
- Denitrification and nitrogen fixation in Alaskan continental shelf sediments 300
- Detection and monitoring of oil pollution in the ice environment through microwave techniques 533
- Detection of oil under ice - a laboratory program 664
- Detection of oil under ice, a joint ESSO/EPS project 279
- Determination of acute and chronic effects of treated ballast water on selected aquatic biota from Port Valdez, Alaska 87
- Determination of probabilities of oil blowouts in the Beaufort Sea 92
- Direct and indirect effects of oil on ringed seals (*Phoca hispida*) of the Beaufort Sea 271
- discussion of factors influencing dispersion of pollutants in the

- Beaufort Sea 275
- discussion of the future oil spill problem in the arctic 276
- Dispersant effectiveness in cold water 112
- disposition of gas/oil mixtures trapped under ice 689
- Distribution and abundance of low molecular weight hydrocarbons and suspended hydrocarbons in Cook Inlet, Alaska 170
- Distribution and abundance of low molecular weight hydrocarbons and suspended hydrocarbons in Cook Inlet, Shelikof Strait, and Norton Sound, Alaska 171
- Distribution and ecological characteristics of *Zannichellia palustris* L. along the Alaska Pacific coast 192
- Distribution and transport of hydrocarbons in surface sediments of the Alaskan Outer Continental Shelf 723
- Distribution of aromatic hydrocarbons in Port Valdez, Alaska 409
- Distribution of hydrocarbon-utilizing microorganisms and hydrocarbon biodegradation potentials in Alaskan continental shelf areas 608
- Distribution of hydrocarbons and microbial populations related to sedimentation processes in Lower Cook Inlet and Norton Sound, Alaska 54
- Distribution of light hydrocarbons, C1-C4, in the northeast Gulf of Alaska and the southeastern Bering Shelf 172
- Distribution of low-molecular-weight hydrocarbons in southern Beaufort Sea 410
- Distribution of oil, chlorophyll, and larval fish on the Scotian Shelf during April and May 1979 following the Kurdistan spill 520
- Distribution of tar and particulate pollutants along the Beaufort Sea coast 740
- Dome Petroleum experimental oil spill at McKinley Bay, N.W.T. : examination of ice biota 459
- Dome Petroleum Ltd. environmental impact statement oil spill scenario 4 : tanker collision in Lancaster Sound 398
- Dome Petroleum's oil and gas undersea ice study 118, 119
- Dome's Petroleum [sic] study of oil and gas under sea ice 207
- Draft environmental impact statement, April 1985 : proposed St. George Basin (sale 89) 700
- ecological impact of northern petroleum development 102
- effect of Alaskan crude oil and selected hydrocarbon compounds on embryonic development of the Pacific oyster, *Crassostrea gigas* 372
- Effect of an oil spill in Spitzbergen in 1978 296
- effect of contact and ingestion of crude oil on ringed seals of the Beaufort Sea 660
- Effect of crude oil on polar bears 523
- Effect of crude oil on zoobenthos colonization of artificial substrates in subarctic ecosystems 603
- Effect of environmental parameters on bacterial degradation of Bunker C oil, crude oils, and hydrocarbons 491
- effect of exposure temperatures on oxygen consumption and opercular breathing rates of pink salmon fry exposed to toluene, naphthalene, and water-soluble fractions of Cook Inlet crude oil and no. 2 fuel oil 682
- Effect of low temperature and varying energy input on the droplet size distribution of oils treated with dispersants 132
- effect of naphthalene on synthesis of peptide antifreeze in the Bering Sea sculpin *Myoxocephalus verrucosus* 201
- Effect of oil and oil dispersant mixtures on the basal metabolic rate of ducks 367
- effect of oil pollution on marine mammals 352
- effect of oil-contaminated prey on the energetics of pink salmon fry 623
- Effect of petroleum hydrocarbons on breathing and coughing rates, and hydrocarbon uptake-depuration in pink salmon fry 582
- Effect of petroleum products on the snow-ice cover of the Arctic 335
- effect of Prudhoe Bay crude oil on a tidal-flat ecosystem in Port Valdez, Alaska 495
- effect of Prudhoe Bay crude oil on survival and growth of eggs, alevins, and fry of pink salmon, *Oncorhynchus gorbuscha* 583
- Effect of the dispersant Corexit 9527 on the microbial degradation of Prudhoe Bay oil 259
- Effect of water soluble fraction of Prudhoe Bay crude oil on embryonic development of Pacific herring 659
- effectiveness of chemical dispersants at low temperatures and in the presence of ice 710
- effects and fate of chemically dispersed crude oil in a marine ecosystem enclosure : data report and methods 709
- Effects of a seawater-soluble fraction of Alaskan crude oil and its major aromatic components on larval stages of the Dungeness crab, *Cancer magister* Dana 134
- Effects of a seawater-soluble fraction of Cook Inlet crude oil and its major aromatic components on larval stages of the Dungeness crab, *Cancer magister* Dana 135
- Effects of acute and long-term exposure to dispersed oil in benthic invertebrates 226
- effects of Alaskan crude oil on flatfish and the prevalence of fish pathology in Alaskan marine waters 458
- effects of chronic (episodic) oil spills resulting from normal petroleum development activities on birds 81
- Effects of chronic exposure to petroleum upon the growth and molting of juveniles of the arctic marine isopod crustacean *Mesidotea entomon* 551
- Effects of chronic/episodic oil spills resulting from normal petroleum hydrocarbon development activities within and adjacent to the marine environment on polar bears 329
- Effects of Cook Inlet crude oil, benzene, and naphthalene on heart rates of the Alaskan king crab (*Paralithodes camtschatica*) 472
- Effects of crude oil and naphthalene on growth, caloric content, and fat content of pink salmon juveniles in seawater 488
- Effects of crude oil on arctic marine invertebrates 552
- Effects of crude oil on polar bears : summary report 4

- Effects of crude oil on the locomotory activity of arctic marine invertebrates 553
- Effects of crude oils and the oil dispersant Corexit on primary production of arctic marine phytoplankton and seaweed 324
- Effects of crude oils on Arctic marine invertebrates 554
- Effects of crude oils on the growth of arctic marine phytoplankton 325
- Effects of dispersed crude oil upon the respiratory metabolism of an arctic marine amphipod, *Onisimus* (*Boekisimus*) [sic] *affinis* 555
- Effects of hydrocarbons and heavy metals on fish harvest 77
- Effects of hydrocarbons on microorganisms and petroleum biodegradation in arctic ecosystems 55
- effects of hydrocarbons on selected hydrobionts in the coastal zone of the Antarctic waters 521
- Effects of ingestion of Hibernia and Prudhoe Bay crude oils on hepatic and renal mixed function oxidase in nestling herring gulls (*Larus argentatus*) 371
- effects of Kurdistan oil on seabirds 114
- Effects of offshore petroleum operations on cold water marine mammals, a literature review 399
- Effects of oil and chemically dispersed oil in sediments on clams 23
- Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island: I. Results of 1980 pre-spill studies 188, 189
- Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. II. Results of 1980 and 1981 pre- and post-spill studies 190
- Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. III. Results of 1980, 1981 and 1982 pre- and post-spill studies 191
- Effects of oil and dispersed oil on nearshore macrobenthos at Cape Hatt, northern Baffin Island. IV. Results of 1980, 1981, 1982 and 1983 pre- and post-spill studies 400
- Effects of oil contamination in the sea otter, *Enhydra lutris* 180
- Effects of oil exposure on the ultrastructure of king crab gill, antenna, and hepatopancreas 657
- Effects of oil in open water areas around offshore structures during periods of ice cover on eiders and diving ducks 82
- Effects of oil on arctic invertebrates 732
- Effects of oil on arctic marine organisms: a review of studies conducted by the Arctic Biological Station 556
- effects of oil on marine mammals 655
- Effects of oil on microbial component of an intertidal silt-sediment ecosystem 514
- Effects of oil spills in arctic and subarctic environments 165
- Effects of oil under sea ice 739
- Effects of oiled sediment on juvenile king crab 584
- Effects of oiling on temperature regulation in sea otters 356
- Effects of petroleum and related pollutants on arctic microorganisms 56
- Effects of petroleum exposure on hatching success of Alaskan glaucous-winged gulls (*Larus glaucescens*) on Egg Island, Copper River Delta 537
- Effects of petroleum exposure on predatory behavior of coho salmon (*Oncorhynchus kisutch*) 260
- Effects of petroleum exposure on the breeding ecology of the Gulf of Alaska herring gull group (*Larus argentatus* x *Larus glaucescens*) and reproductive ecology of large gulls in the northeast Gulf of Alaska 538
- Effects of petroleum hydrocarbons on Alaskan aquatic organisms: a comprehensive review of all oil-effects research on Alaskan fish and invertebrates conducted by the Auke Bay Laboratory, 1970-81 585
- Effects of petroleum in polar marine environments 557
- effects of petroleum on aquatic organisms: a multidisciplinary approach 306
- Effects of petroleum on arctic and subarctic marine environments and organisms 432
- Effects of petroleum on ecosystems 616
- Effects of petroleum on marine mammals 227
- Effects of petroleum pollutants on arctic microbial populations 57
- Effects of Prudhoe Bay crude oil contamination on sediment working rates of *Abarenicola pacifica* 70
- Effects of Prudhoe Bay crude oil in sediment on *Abarenicola pacifica* in laboratory and field experiments 71
- Effects of Prudhoe Bay crude oil on molting tanner crabs, *Chionoecetes bairdi* 347
- Effects of Prudhoe Bay crude oil-contaminated sediments on *Protothaca staminea* (Mollusca: Pelecypoda): hydrocarbon content, condition index, free amino acid level 72
- effects of Prudhoe crude oil fractions on the arctic amphipods *Boeckosimus affinis* and *Gammarus zaddachi* 128
- Effects of temperature and crude oil composition on petroleum biodegradation 58
- Effects of temperature on the median tolerance limit of pink salmon and shrimp exposed to toluene, naphthalene and Cook Inlet crude oil 359
- Effects of the water-soluble fraction of Cook Inlet crude oil on the marine alga, *Dunaliella tertiolecta* 518
- Effects on polar environments 558
- Emissions from in situ burning of crude oil in the Arctic 200
- Endocrine dysfunction in seabirds caused by ingested oil 544
- Enhanced oil biodegradation on an arctic shoreline 630
- Environmental assessment of the Alaskan continental shelf: Final reports of principal investigators 704
- Environmental assessment of the Alaskan continental shelf: Interim environmental synthesis of the Northeast Gulf of Alaska 624
- Environmental assessment of the Alaskan continental shelf: interim synthesis report - Beaufort/Chukchi 706
- Environmental assessment of the Alaskan continental shelf: Lower Cook Inlet interim synthesis report 625
- Environmental assessment of the northeastern Gulf of Alaska:

- chemical oceanography (hydrocarbons) 708
- Environmental impact assessment and oilspill contingency plan in support of an application for a drilling authority to Panarctic - Jackson Bay G-16 88
- Environmental impact statement for exploratory drilling in the Lancaster Sound region 512
- Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 3A : Beaufort Sea - Delta setting 211
- Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 3B : Northwest Passage setting 212
- Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 4 : Biological & physical effects 213
- Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 6 : Accidental spills 214
- Environmental impact statement for hydrocarbon development in the Beaufort Sea - Mackenzie Delta region. Volume 7 : Research and monitoring 215
- Environmental influences of oil and gas development in the Arctic Slope and Beaufort Sea 111
- Environmental issues and impacts associated with exploratory drilling in Lancaster Sound 401
- Environmental issues in the Arctic 228
- environmental research program for drilling in the Canadian Beaufort Sea 311
- Environmental studies of Port Valdez 313
- Environmental studies of Port Valdez, Alaska 174
- Evolution, pathobiology, and breeding ecology of large gulls (Larus) in the northeast Gulf of Alaska, and, Effects of petroleum exposure on the breeding ecology of gulls and kittiwakes 539
- Experimental oil spill : oil in arctic coastal environments 684
- experimental oil spill on Haltenbanken, 1982 69
- Experimental oil spills : the Baffin Island Oil Spill in particular 685
- Experimental oilspills general plan 140
- Experiments on the response of sea otters *Enhydra lutris* to oil contamination 654
- Experiments with *Littorina* species to determine the relevancy of oil spill data from southern California to the Gulf of Alaska 668
- exploratory study of the behaviour of crude oil spills under ice 285
- Exposure of *Abarenicola pacifica* to oiled sediment : effects on glycogen content and alterations in sediment-bound hydrocarbons 73
- Factors affecting the persistence of stranded oil on low energy coasts 530
- Fast ice thickness and snow depth relationships related to oil entrapment potential, Prudhoe Bay, Alaska 78
- Fast-ice thickness and snow depth in relation to oil entrapment potential, Prudhoe Bay, Alaska 79
- fate and behaviour of oil in cold climates 711
- Fate and behaviour of oil spills 414
- Fate and behaviour of water-in-oil emulsions in ice 216
- Fate and effect of bunker C oil spilled by the USNS Potomac in Melville Bay - Greenland - 1977 562
- Fate and effects of oil pollutants in extremely cold marine environments 59, 60
- Fate and weathering of petroleum spills in the marine environment : a literature review and synopsis 343
- Fate of crude oil spilled in a simulated arctic environment 411
- Fate of petroleum hydrocarbons in nearshore arctic aquatic ecosystems 317
- Feeding, respiration and excretion of the copepod *Calanus hyperboreus* from Baffin Bay, including waters contaminated by oil seeps 273
- field guide for arctic oil spill behavior 32
- Field observations on the acute effect of crude oil on glucose and glutamate uptake in samples collected from arctic and subarctic waters 287
- field study of brine drainage and oil entrainment in first-year sea ice 448
- field study on the permeability of multiyear ice to sea water with implications on its permeability to oil 482
- Final administrative report, the BIOSIS (sic) project, Canada, 1980-1982 631
- Final environmental impact statement, Volume 1 : Proposed Gulf of Alaska/Cook Inlet lease sale 88 701
- Final report : Baffin Island Oil Spill Project shoreline component 742
- Final supplemental environmental impact statement : supplement to Final environmental impact statement St. George Basin 702
- Freezing of water in w/o emulsions 116
- Frozen sea research 5
- Further chemical evidence for natural seepage on the Baffin Island shelf 381
- Halten Bank experiment : observations and model studies on drift and fate of oil in marine environment 339
- Harrison Bay sea ice conditions relating to oil spills 679
- hazard assessment of chemically dispersed oil spills and seabirds : a novel approach 545
- hazards and risks of offshore drilling 6
- Heat budget of oil contaminated sea ice 729
- Heinz-body hemolytic anemia from the ingestion of crude oil : a primary toxic effect in marine birds 375
- Hydrocarbon biodegradation 597
- Hydrocarbon biodegradation in Alaskan waters 598
- Hydrocarbon biodegradation in Cook Inlet, Alaska 609
- Hydrocarbon gas in sediment from the shelf, slope, and basin of the Bering Sea 366
- Hydrocarbon levels in the marine environment of the southern Beaufort Sea 741
- Hydrocarbon metabolism and cortisol balance in oil-exposed ringed seals, *Phoca hispida* 229
- Hydrocarbon studies in the benthic environment at Prudhoe Bay 639



- Hydrocarbons : natural distribution and dynamics on the Alaskan outer continental shelf 640, 641, 642, 643
- Hydrocarbons in Alaskan marine intertidal algae 644
- Hydrocarbons in the intertidal environment of Kachemak Bay, Alaska 645
- Hydrocarbons in the marine environment of Port Valdez, Alaska 646
- Hydrodynamics of an oilwell blowout 690
- Ice conditions hinder oil weathering in Baltic Sea spill 7
- Identification of major processes in biotransformations of petroleum hydrocarbons and trace metals 433
- Identification of natural and anthropogenic petroleum sources in the Alaskan Shelf areas utilizing low molecular weight hydrocarbons 173
- Impact and cleanup of oil spills on Canadian shorelines : a summary 148
- Impact of oil on the Kachemak Bay environment 692
- Impact on sea birds : preliminary comments 115
- Importance of measuring microbial enzymatic functions while assessing and predicting long-term anthropogenic perturbations 288
- In situ microbial degradation of Prudhoe Bay crude oil in Beaufort Sea sediments 301
- In situ studies of effects of oil and chemically treated oil on primary productivity of ice algae and on under-ice meiofaunal and macrofaunal communities 402
- In situ studies of effects of oil and dispersed oil on primary productivity of ice algae and on under-ice amphipod communities 403
- Increased opercular rate of pink salmon (*Oncorhynchus gorbuscha*) fry after exposure to the water-soluble fraction of Prudhoe Bay crude oil 683
- Influence of petroleum on egg formation and embryonic development in seabirds 14
- Information needs and priorities for assessing the sensitivity of marine birds to oil spills 736
- Inputs, transport mechanisms, and observed concentrations of petroleum in the marine environment 166
- Insulation in marine mammals : the effect of crude oil on ringed seal pelts 524
- Interaction of crude oil and natural gas with first-year sea ice 568
- Interaction of crude oil and natural gas with laboratory-grown saline ice 29
- Interaction of crude oil with Arctic sea ice 508
- Interaction of oil and arctic sea ice 680
- Interaction of oil with sea ice in an offshore environment 691
- Interaction of oil with sea ice in the Arctic Ocean 449, 450, 451, 452
- Interactions of crude oil and Arctic microbial populations in open chemostats 318
- Interactions of microorganisms and petroleum pollutants in the Arctic 61
- Interfacial behaviour of oil under ice 415
- Interfacial tension and contact angle of crude oil under ice 425
- Introduction to the Workshop on Ecological Effects of Hydrocarbon Spills in Alaska 62
- Investigation of the behaviour of crude oil spilled under multi-year ice at Griper Bay, N.W.T. 176
- Investigation of the use of microwave systems in detecting and monitoring oil slicks over ice and ice-infested waters - Phase I report 474
- Investigation of the use of microwave systems in detecting and monitoring oil slicks over ice and ice-infested waters - Phase II and III report 475
- Investigation of the weathering of a selected crude oil in a cold environment 627
- Jackson Bay, Ellef Ringnes Island, N.W.T. : baseline, environmental and resource data on flora, fauna, sediments and soils 564
- Jackson Bay, Ellef Ringnes Island, N.W.T. : oil and ice interaction 565
- Kinetics of dissipation and biodegradation of crude oil in Alaska's Cook Inlet 354
- Kodiak Island coastal sensitivity study : balancing human use with oil residence and biological sensitivity 333
- Kodiak Islands oil pollution 310
- Kurdistan : an unusual spill successfully handled 217
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team 717
- Kurdistan spill movement 693
- Laboratory studies of oil spill behavior in broken ice fields 265
- Laboratory study of the behaviour of oil and gas under ice 416
- Laboratory study of the dispersion of crude oil within sea ice grown in a wave field 453
- Lethal and sublethal effects on selected Alaskan marine species after acute and long-term exposure to oil and oil components 586, 587, 588
- Light intensity and primary productivity under sea ice containing oil 12
- Likely effects of oil in the Canadian Arctic 83
- Lipid composition of a carbohydrate-oxidizing mycobacterium isolated from arctic waters 360
- Long-term effects of crude oil on microbial processes in subarctic marine sediments 289
- Long-term effects of crude oil on microbial processes in subarctic marine sediments : studies on sediments amended with organic nutrients 290
- Long-term effects of crude oil on uptake and respiration of glucose and glutamate in arctic and subarctic marine sediments 291
- Long-term effects of the water soluble fraction of Prudhoe Bay crude oil on survival, movement and food search success of the arctic amphipod *Boeckosimus* (= *Onisimus*) *affinis* 129
- Long-term fate of crude oil in the arctic nearshore environment : the BIOS experiments 109
- Low molecular weight hydrocarbon concentrations (C1 - C4), Alaskan continental shelf, 1975-1979 349

Mapping the distribution of protected and valuable, oil-sensitive coastal fish and wildlife	272	473	
Marine biological effects of OCS petroleum development	738	Motion of oil in leads	423
Marine biological impacts	535	Movement of oil and gas spills under sea ice	426
Marine fish and invertebrate diseases, host disease resistance, and pathological effects of petroleum	312	Movement of oil slicks in northwestern Baffin Bay, SLIKTRAK simulations	38
Marine mammal studies in southeastern Baffin Island	142	movement of oil under sea ice	604
Marine mammals of lower Cook Inlet and the potential for impact from outer continental shelf oil and gas exploration, development, and transport	136	Movement of satellite-tracked buoys in the Beaufort Sea (1979-1981)	697
Marine terminus of the trans-Alaska pipeline	314	Multivariate analysis of petroleum hydrocarbon weathering in the subarctic marine environment	540
mathematical model of evaporation and dissolution from oil spills on ice, land, water and under ice	377	Multivariate analysis of petroleum weathering in the marine environment : sub arctic	541
mechanics of oil containment beneath rough ice	184	Multivariate analysis of petroleum weathering in the marine environment : sub arctic. Volume I : technical results	542
Metabolic and temperature responses of polar bears to crude oil	330	Multivariate analysis of petroleum weathering in the marine environment : sub arctic. Volume II : appendices	543
Metabolic effects and hydrocarbon fate in arctic bivalves exposed to dispersed petroleum	230	mutagenicity of Prudhoe Bay crude oil and its burn residues	652
Metabolism of petroleum hydrocarbons : accumulation and biotransformation in marine organisms	722	Natural hydrocarbon seepage at Scott Inlet and Buchan Gulf, Baffin Island shelf : 1980 update	382
Microbial degradation of aromatics and saturates in Prudhoe Bay crude oil as determined by glass capillary gas chromatography	249	Natural oil seeps at Cape Simpson, Alaska : aquatic effects	85
Microbial degradation of CANMAR oils by northern marine microorganisms	733	Natural seepage of petroleum at Buchan Gulf, Baffin Island	383
Microbial degradation of oil : measurements in Ragged Channel test bays and Bay 102, Cape Hatt 1981	223	Natural variability in distribution of an intertidal population of <i>Macoma balthica</i> subject to potential oil pollution at Port Valdez, Alaska	493
Microbial degradation of organic sulfur compounds in Prudhoe Bay oil	250	nature and biological effects of weathered petroleum	434
Microbial degradation of petroleum at low temperature	194	Navarin Basin environment and possible consequences of planned offshore oil and gas development	337
Microbial degradation of petroleum in the Arctic	63	Nearshore marine fisheries investigations in coastal areas of southeast Baffin Island	27
Microbial release of soluble trace metals from oil impacted sediments	84	Need for real world assessment of the environmental effects of oil spills in ice-infested marine environments	599
Microbial studies as part of Alaska's Outer Continental Shelf Environmental Assessment Program for offshore petroleum development	64	Nitrogen fixation in arctic marine sediments : effects of oil and hydrocarbon fractions	355
Microbiological observations in south Davis Strait	143	North Aleutian shelf sea otters and their vulnerability to oil	164
Microbiology 1 : Effects of oil on bacterial activity : 1982 study results	144	Novel countermeasures for an Arctic offshore well blowout	30
Microbiology 1 : Effects of oil on bacterial activity, 1980 study results	145	Numerical taxonomic studies on bacteria selected for ability to utilize hydrocarbons from arctic aquatic ecosystems exposed to crude or refined oil	319
Microbiology 1 : Effects of petroleum releases on the microheterotrophic flora of arctic sediments : effects after two years	146	Observations of scope for growth, aspartate aminotransferase activity and glucose-6-phosphate dehydrogenase activity in <i>Mya truncata</i> and <i>Serripes groenlandicus</i> exposed to various concentrations of chemically dispersed crude oil in the DIAND/BIOS 1983 tank study	274
Microorganisms and the degradation of oil under northern marine conditions	734	Occurrence and impact of petroleum on arctic environments	167
Modeling the association of petroleum hydrocarbons and sub-arctic sediments	429	Occurrences of oil and gas seeps : Alaska Peninsula, Alaska : western Gulf of Alaska	99
Modelling the sensitivity of colonially breeding marine birds to oil spills : guillemot and kittiwake populations on the Pribilof Islands, Bering Sea	261	Occurrences of oil and gas seeps along the Gulf of Alaska	100
Molting and survival of king crab ( <i>Paralithodes camtschatica</i> ) and coon-stripe shrimp ( <i>Pandalus hypsinotus</i> ) larvae exposed to Cook Inlet crude oil water-soluble fraction		Offshore drilling for oil in the Beaufort Sea : a preliminary	

- environmental assessment 483
- Offshore drilling for oil in the Beaufort Sea, a preliminary environmental assessment 91
- Offshore drilling in Lancaster Sound : possible environmental hazards 484
- Oil & gas under sea ice study 121
- Oil and arctic marine birds : an assessment of risk 376
- Oil and arctic marine invertebrates 559
- Oil and dispersants in Canadian seas : recommendations from a research appraisal 661
- Oil and dispersants in Canadian seas : research appraisal and recommendations 662
- Oil and gas 218
- Oil and gas seeps in Alaska : north-central Gulf of Alaska 101
- Oil and gas under ice laboratory study 11
- Oil and ice 365
- Oil and ice in the Arctic Ocean : possible large-scale interactions 139
- Oil and ice in the Beaufort Sea 725
- Oil and ice in the Beaufort Sea : the physical effects of a hypothetical blowout 726
- Oil behaviour under multi-year ice at Griper Bay, N.W.T. 177
- Oil biodegradation in arctic coastal waters 320
- Oil degradation and heterotrophic capability of marine organisms in the Beaufort Sea 127
- Oil drilling in the Beaufort Sea : leaving it to luck and technology 159
- Oil in ice computer simulation model 746
- Oil in moving pack ice - laboratory study 477
- Oil in pack ice : the Kurdistan spill 575
- Oil in pack ice coldroom tests 478
- Oil in sea ice 389, 390
- Oil in the Arctic 321
- Oil in the Beaufort and Mediterranean seas 417
- Oil migration and modification processes in solid sea ice 500
- Oil movement under ice 31
- Oil polluted seaweeds in the Arctic : short term effects on decomposers and fate of the oil 672
- Oil pollution and seabirds : Atlantic Canada 1976-77, and some implications for northern environments 384
- Oil pollution in ice-covered arctic waters 730
- Oil pollution in ice-infested waters 569
- Oil pollution in polar bears : exposure and clinical effects 231
- Oil pollution in the Arctic 322
- Oil pooling under sea ice 361, 362
- Oil released in arctic environments : oil and ice/snow interactions 8
- Oil seep in the Arctic 492
- oil sinking ability of Mackenzie River borne suspended sediments in the Beaufort Sea : a literature review 245
- oil slick occurrence off Baffin Island 407
- Oil spill at Deception Bay, Hudson Strait 570, 571
- Oil spill behavior in a winter arctic environment 470
- Oil spill cleanup in the Beaufort Sea : another viewpoint 408
- Oil spill countermeasures in landfast sea ice 20
- oil spill Environmental Sensitivity Index applied to the Alaskan coast 297
- Oil spill on the shore of an ice-covered fjord in Spitsbergen 158
- Oil spill processes : evaporation, emulsification, dissolution and sinking 418
- Oil spill protection and cleanup countermeasures on arctic shorelines : are they biologically necessary? 606
- Oil spill related research in the public domain at the Arctic Institute of North America : citations and abstracts 35
- Oil spill scenario for the Labrador Sea 370
- Oil spill simulations in the southeastern Beaufort Sea and along the proposed eastern tanker route 39
- Oil spill simulations in the southeastern Beaufort Sea, 1969 - 1978 40
- oil spill trajectory data bases for Beaufort Sea and tanker route simulations 41
- Oil spill trajectory studies for Atlantic coast and Gulf of Alaska 698
- Oil spill vulnerability index, Copper River delta 611
- Oil spill vulnerability, coastal morphology, and sedimentation of Kotzebue Sound 308
- Oil spilled with ice : some qualitative aspects 75
- Oil spills : what have we learned? 718
- Oil spills and oil pollution in the Arctic and Antarctic, 1970 - May 1983 : citations from the Pollution Abstracts database 9
- Oil spills in the Alaskan coastal zone - the statistical picture 305
- Oil spills in the Arctic Ocean : extent of spreading and possibility of large-scale thermal effects 74
- Oil spills in the Arctic Ocean : extent of spreading, and possibility of large-scale thermal effects [reply] 454
- Oil spreading in broken ice 621
- Oil threat to aquatic birds along the Yukon coast 724
- Oil under multi-year ice 113
- Oil weathering under arctic conditions 675
- Oil well blowout simulations for the Dundas drill site, Lancaster Sound, N.W.T. 42
- Oil-ice interaction 686
- Oil-in-cold-water research at Nova Scotia Technical College 467
- Oil-in-ice and oil-stranding observations 719
- Oil-in-ice studies : progress report 605
- Oil, ice and climate change : the Beaufort Sea and the search for oil 485
- Oil, ice and climate in the Beaufort Sea 728
- Oil, ice and gas : proceedings of a workshop held in Toronto,

Canada, October 10 and 11, 1979	419	Physiological responses of arctic epibenthic invertebrates to winter stresses and exposure to Prudhoe Bay crude oil dispersions	618
oiled arctic shore	76	Polar bear thermoregulation : effect of oil on the insulative properties of fur	331
oilspill in pack ice	476	Pollutant behavior, trajectories, and issues analyses	566
oilspill risk analysis for the Beaufort Sea, Alaska (proposed sale 71) Outer Continental Shelf lease area	615	Pooling of oil under sea ice	363
Oilspill workshop	676	Port Valdez environmental studies, 1976-1978	175
On experimental oil spills	420	Possible environmental effects on polar bears of offshore drilling in Lancaster Sound	515
On experimental oil spills - a response	687	Possible fate of oil in the Arctic Basin	572
On experimental spills : a reply	280	Potential biological effects of hypothetical oil discharges in the Atlantic coast and Gulf of Alaska	699
Onshore enhanced biodegradation experiments in Z-lagoon and assessment of biodegradation of oil in Bay 11 : postspill surveys	511	potential effects of oil spills and other chemical pollutants on marine mammals occurring in Alaskan waters	303
Outer Continental Shelf Environmental Assessment Program : comprehensive bibliography March 1984	705	Potential long-term effects of Prudhoe Bay crude oil in Arctic sediments on indigenous benthic invertebrate communities	130
overview of a field guide for arctic oil spill behavior	622	Prediction of the motion of oil spills in northern Canadian waters	612, 613
overview of the Canadian Arctic in relation to oil spill countermeasures	197	predictive oil spill surface drift model for the Labrador Sea	507
oxidation of certain Prudhoe Bay hydrocarbons by microorganisms indigenous to a natural oil seep at Umiat, Alaska	13	preliminary assessment of the effects of Alaskan North Slope crude oil on developing larvae of the Pacific oyster, <i>Crassostrea gigas</i>	373
Pelagic tar and plastic in the Gulf of Alaska and Bering Sea : 1975	647	Preliminary notes on changes in algal primary productivity following exposure to crude oil in the Canadian Arctic	208
Perceptions of biological impact	232	Preliminary observations on oil/ice interaction from CSS Hudson	694
perspective on oilspill modelling offshore Labrador	506	Preliminary observations on the effect of Bunker C fuel oil on seals on the Scotian Shelf	534
Petroleum and marine fishes : a review of uptake, disposition, and effects	435	Preliminary report : laboratory responses to Dome Nektoralik oil	266
Petroleum biodegradation in the Arctic	65	Preliminary results of remote sensing overflights during the Kurdistan operation	254
Petroleum effects in the arctic environment	233	Preliminary study of the fate of oil from a subsea blowout on the east coast	677
Petroleum effects on marine mammals	234	Probable behaviour and fate of a winter oil spill in the Beaufort Sea	509
Petroleum hydrocarbons in arctic ringed seals, <i>Phoca hispida</i> , following experimental oil exposure	235	probable nature and behaviour of oil spills in the Beaufort Sea, and the feasibility of cleanup	286
Petroleum hydrocarbons in the Arctic Ocean surface water	258	Problems in ecological monitoring in Port Valdez, Alaska	181
Petroleum hydrocarbons in two benthic invertebrates, the urchin <i>Strongylocentrotus droebachiensis</i> and the polychaete <i>Pectinaria granulosa</i>	236	Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978	342
Petroleum in benthic sediments in Prudhoe Bay, Alaska	656	Proceedings of a synthesis meeting : the Barrow Arch environment and possible consequences of planned offshore oil and gas development, Girdwood, Alaska, 30 October-1 November, 1983	392
Petroleum ingestion reduces reproduction in Cassin's Auklets	15	Proceedings of a Synthesis Meeting : the North Aleutian Shelf environment and possible consequences of offshore oil and gas development, Anchorage Alaska, 9-11 March, 1982	688
Petroleum residue concentrations in Scotian Shelf waters following the Kurdistan spill : preliminary results	385	Proceedings of a synthesis meeting : the Norton Sound Environment and Possible Consequences of Planned Oil and Gas Development, Anchorage, Alaska, October 28-30, 1980	747
Petroleum-oxidizing microflora of arctic seas of the USSR	298	Proceedings of a synthesis meeting : the St. George Basin	
physical and chemical fate of spilled oil	421		
physical environment of the Beaufort Sea related to oil, ice and water interactions	486		
physical interaction and cleanup of crude oil with slush and solid first year sea ice	501		
Physical weathering of Kurdistan oil : droplet formation and effect on shore-ice melting	720		
physiological effect of acute and chronic exposure to hydrocarbons of petroleum on the near-shore fishes of the Bering Sea	202		
Physiological impact of oil on pinnipeds	268, 357		

- Environment and Possible Consequences of Planned Offshore Oil and Gas Development, Anchorage, Alaska, April 28-30, 1981 302
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar 147
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta 149
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, 2d, Edmonton, Alberta, March 7-9, 1979 155
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta 150
- proceedings of the Conference on Assessment of Ecological Impact of Oil Spills, 14-17 June, 1978, Keystone, Colorado 21
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta 151
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta 152
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta 153
- Processes affecting the distribution of low-molecular-weight aliphatic hydrocarbons in Cook Inlet, Alaska 350
- program for the detection of oil under ice 745
- Proposed Norton Basin Lease Sale 100 : final environmental impact statement 703
- Proposed research program (technical proposal) on Baffin Island experimental oil spill and dispersant studies : hydrocarbon bioaccumulation and histopathological and biochemical responses in two species of marine bivalve molluscs 496
- proposed study of oil and gas under ice 156
- prospectus on the biological effects of oil spills in marine environments 242
- Prudhoe Bay oil spill scenarios 681
- Prudhoe Bay oil toxicity and avoidance behavior in pink salmon fry 589
- Prudhoe crude oil in arctic marine ice, water, and sediment ecosystems : degradation and interactions with microbial and benthic communities 66
- Quantitative monitoring of an intertidal population of *Macoma inconspicua* for detection of the effects of oil pollution : within-season population variation, 1971 494
- Raspredelenie urlevodorodov v svezhevyvavshem snege i vo l'du na stantsii "Severnaya polius-22" (po nabliudeniym 1977-1978 gg.) = [The distribution of hydrocarbons in a fresh-fallen snow and in ice at the "North Pole-22" station from observations during 1977-1978] 209
- Recent University of Toronto studies on the fate and effects of oil in the marine environment 667
- Recommendations for minimizing the impacts of hydrocarbon development on the fish, wildlife, and aquatic plant resources of the northern Bering Sea and Norton Sound 16
- Recovery potential of oiled marine northern environments 10
- Reduced survival of chicks of oil-dosed adult Leach's Storm-petrels 695
- relative importance of evaporation and biodegradation, and the effect of lower temperature on the loss of some mononuclear and dinuclear aromatic hydrocarbons from seawater 161
- Report - Canada. EPS. Arctic Marine Oilspill Program 141
- Report of a workshop on Arctic marine mammals 198
- Research in oil, gas and ice at the University of Toronto 422
- Research to determine the accumulation of organic constituents and heavy metals from petroleum-impacted sediments by marine detritivores of the Alaskan outer continental shelf 24, 25
- Research to investigate effects from Prudhoe Bay crude oil on intertidal infauna of the Strait of Juan de Fuca 715
- Response of the clam, *Macoma balthica* (Linnaeus), exposed to Prudhoe Bay crude oil as unmixed oil, water-soluble fraction, and oil-contaminated sediment in the laboratory 673
- Response of the clam, *Macoma balthica* (Linnaeus), exposed to Prudhoe Bay crude oil as unmixed oil, water-soluble fraction, and sediment-adsorbed fraction in the laboratory 674
- Responses of arctic marine benthic crustaceans to sediments contaminated with crude oil 560
- Responses of arctic marine crustaceans to crude oil and oil-tainted food 561
- Responses of the clam *Macoma balthica* to Prudhoe Bay crude oil 648
- Responses of the lichens *Peltigera aphthosa* and *Cetraria nivalis* and the alga *Nostoc commune* to sulfur dioxide, natural gas, and crude oil in Arctic Alaska 67
- results of a survey of the amounts of aliphatic hydrocarbons in selected intertidal bivalve mollusks from Prince William Sound, Alaska 247
- Results of the Coast Guard's tarball sampling program 22
- Return to Balaena Bay : long term effects of a large scale crude oil spill under arctic sea ice 1975 to 1981 206
- review of oil toxicity studies conducted at the Auke Bay laboratory 590
- review of the biological fate and effects of oil in cold marine environments 243
- Review of the effects of oil on marine flora and fauna with special reference to arctic regions 404
- review of the wildlife and marine resources of the Cape Parry region in relation to a fuel staging area for sea vessels near Cape Parry, N.W.T. 405
- Satellite data on the Kurdistan spill 199
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography 721
- Scott Inlet slick : an arctic oil seep? 386
- Scottish and Alaskan offshore oil and gas experience and the

- Canadian Beaufort Sea 498
- Sea ice thickness profiling and under-ice oil entrapment 364
- Sea ice topography in the Beaufort Sea and its effect on oil containment 727
- sediment environment of Port Valdez, Alaska : the effect of oil on this ecosystem 248
- selected bibliography on the fate and effects of oil pollution relevant to the Canadian marine environment 154, 614
- Selective degradation of biphenyl and methylbiphenyls in crude oil by two strains of marine bacteria 251
- Sensitivity of Alaskan freshwater and anadromous fishes to Prudhoe Bay crude oil and benzene 489
- Sensitivity of arctic marine amphipods and fish to petroleum hydrocarbons 157
- Sensitivity of larval and adult Alaskan shrimp and crabs to acute exposures of the water-soluble fraction of Cook Inlet crude oil 110
- Sensitivity of parasitized coho salmon fry to crude oil, toluene, and naphthalene 487
- Sensitivity of 39 Alaskan marine species to Cook Inlet crude oil and no. 2 fuel oil 591
- Shorebirds and oil development in the Copper River Delta area, Alaska 633
- Shoreline experiments and the persistence of oil on arctic beaches 531
- simple oilspill trajectory model for the Scotian Shelf, using single and multi-point wind fields 369
- Simulation modeling of marine bird population energetics, food consumption, and sensitivity to perturbation 737
- Sinking of oil : water density considerations 344, 345
- Small oil spill kills 10-20,000 seabirds in north Norway 80
- Some aspects of weathering and burning of crude oil in a water-and-ice environment 510
- Some effects of oil on Alaskan marine animals 649
- Some effects of petroleum on nearshore Alaskan marine organisms 650
- Some possible effects of arctic industrial developments on the marine environment 391
- Some thoughts regarding the possible effects of oil contamination on bowhead whales, *Balaena mysticetus* 17
- Spill impacts and shoreline cleanup operations on arctic and sub-arctic coasts 532
- Spilled oil retention potential - Beaufort Sea coast of Alaska 516
- Spilling oil in Arctic to study cleaning up 671
- Spreading of crude oil on an ice surface 163
- Storm-related oil spill movement on the Beaufort Sea shelf 326
- Studies of oil spill behaviour under ice 427
- Studies of the behavior of oil in ice, conducted by the Outer Continental Shelf Environmental Assessment Program 669
- Studies of the behaviour of oil in ice 670
- Studies on a seven years old seashore crude oil spill on Spitsbergen 632
- Studies on petroleum biodegradation in the Arctic 68
- Study and investigation on the knowledge to date of the effects of oil spills on the arctic environment 744
- Study of microbial activity and crude oil-microbial interactions in the waters and sediments of Cook Inlet and the Beaufort Sea 292, 293, 294, 295
- study of the behavior of oil spills in the Arctic 277, 278
- Subject classified literature references on effects of oil pollution in arctic and subarctic waters 663
- sublethal and lethal effects of the water-soluble fraction of Prudhoe Bay crude oil on juvenile coho salmon (*Oncorhynchus kisutch*) 255
- Sublethal biological effects of petroleum hydrocarbon exposures : fish 536
- Sublethal effects : effects on sea grass 549
- Sublethal effects as reflected by morphological, chemical, physiological and behavioral indices 436
- Sublethal effects of a water-soluble fraction and chemically dispersed form of crude oil on energy partitioning in two arctic bivalves 332
- Sublethal effects of chronic oil exposure on the intertidal clam *Macoma balthica* 665
- sublethal effects of dispersed crude oil on an estuarine isopod 256
- sublethal effects of dispersed oil on an estuarine isopod 244
- sublethal effects of hydrocarbons on the bioenergetics and productivity of selected marine fauna 219
- sublethal effects of oil and dispersants on seabirds 546
- Sublethal effects of oiled sediment on the sand worm, *Nereis (Neanthes) virens* : induced changes in burrowing and emergence 522
- Sublethal effects of petroleum hydrocarbons and trace metals including biotransformations, as reflected by morphological, chemical, physiological, and behavioral indices 437
- Sublethal effects of petroleum hydrocarbons and trace metals including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices 438, 439
- Sublethal effects of petroleum hydrocarbons and trace metals, including biotransformations, as reflected by morphological, chemical, physiological, pathological, and behavioral indices 440, 441
- Sublethal effects on seagrass photosynthesis 471
- Thermal conductance of immersed pinniped and sea otter pelts before and after oiling with Prudhoe Bay Crude 358
- Thermoregulation in a naturally oil-contaminated Black-billed Murre *Uria aalge* 338
- Thermoregulatory metabolism in mallard ducks exposed to crude oil and dispersant 368
- Toxicity and avoidance tests with Prudhoe Bay oil and pink salmon fry 592
- Toxicity of Alaskan north slope crude oil and selected hydrocarbons 374

- Toxicity of ballast-water treatment effluent to marine organisms at Port Valdez, Alaska 593
- Toxicity of chemically dispersed oil to shrimp exposed to constant and decreasing concentrations in a flowing system 26
- Toxicity of Cook Inlet crude oil and No. 2 fuel oil to several Alaskan marine fishes and invertebrates 594
- Toxicity of oil slicks to arctic amphipods 131
- Toxicity of Prudhoe Bay crude oil and its aromatic fractions to nestling herring gulls 547
- Transport and behavior of a Prudhoe Bay oil spill 567
- transport and behavior of oil spilled in and under sea ice 33, 178, 179, 257
- transport and behavior of oil spilled in and under sea ice : phase II of physical processes 619
- transport and behavior of oil spilled in and under sea ice : task 1 620
- transport and behaviour of spilled oil under ice 185
- Transport and deposition of oil and gas spills under sea ice 428
- Transport and fate of spilled oil 388, 442
- Transport mechanisms and hydrocarbon adsorption properties of suspended matter in Lower Cook Inlet 252
- Transport of oil under smooth ice 34
- Transport of pollutants in the vicinity of Prudhoe Bay, Alaska 137
- Transport, retention and effects of the water-soluble fraction of Cook Inlet crude oil in experimental food chains 735
- Trends in sediment distributions : a method to predict oil spill movement in the coastal zone 465
- Types of potential effects of offshore oil and gas development on marine mammals and endangered species of the northern Bering Sea and Arctic Ocean 182
- Uglevodorody v snezhno-ledianom pokrove i vode v severnoi Karskogo moria = [Hydrocarbons in the snow-ice cover and water of the North Kara Sea] 210
- Ultrastructural effects of crude oil on early life stages of Pacific herring 138
- Uptake and clearance of petroleum hydrocarbons in the ringed seal, *Phoca hispida* 237
- Uptake and depuration of petroleum hydrocarbons in the Manila clam, *Tapes semidecussata* Reeve 519
- Uptake and release of petroleum by intertidal sediments at Port Valdez, Alaska 651
- Uptake of hydrocarbons from marine sediments contaminated with Prudhoe Bay crude oil : influence of feeding type of test species and availability of polycyclic aromatic hydrocarbons. 602
- use of a diagnostic circulation model for oil trajectory analysis 267
- use of computer modelling to predict the effects of an oil spill 443
- use of flow-through fluorometry for tracking dispersed oil 284
- use of satellite imagery for tracking the Kurdistan oil spill 577
- Use of <sup>14</sup>C radiolabelled hydrocarbon spiked crude oil to assess oil biodegradation potential in the Beaufort Sea 607
- Vertical temperature profiles within equilibrium thickness crude oil spills on water 502
- Visual and chemical evidence for a natural seep at Scott Inlet, Baffin Island, District of Franklin 387
- visual identification of Bunker-C oil in dynamic pack ice 576
- Visual observations on the behaviour and fate of oil on shorelines in the Cape Breton area, Nova Scotia, contaminated after the Kurdistan oil spill 262
- Vulnerability of coastal environments of lower Cook Inlet, Alaska to oil spill impact 309
- Wave climate over the continental shelf and its impact on the oil spills of the Arrow, Argo Merchant, and Kurdistan 504
- WEBSEC 71-72 : an ecological survey in the Beaufort Sea, August-September, 1971-1972 327
- Weight loss of herring gulls exposed to oil and oil emulsion 548
- Which components of crude oil are toxic to young seabirds? 480
- Wildlife surveys - Cape Grassy : a pre-operational study of the distribution and abundance of wildlife in the Cape Grassy area 89
- Wildlife surveys - Jackson Bay : a pre-operational study of the distribution and abundance of wildlife in the Jackson Bay area 90
- Zooplankton in the vicinity of the USNS Potomac oil spill (Baffin Bay, August 5, 1977) 456
- 3-D oil spill model with and without ice cover 406

## SERIAL INDEX

*The numbers listed below are citation numbers, not page numbers.*

- Abstracts of the Annual Meeting of the American Society for Microbiology, 1972, p. 231 748
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1974, p. 64 61
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1975, p. 208 56
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1976, p. Q23 513
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1976, p. 194 318
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1977, p. 275 607
- Abstracts of the Annual Meeting of the American Society for Microbiology, 1978, p. 208 319
- AIDJEX bulletin, no. 33, Sept. 1976, p. 1-52, ill., tables, charts 727
- Alaska construction & oil, v. 21, no. 5, May 1980, p. 18-20, ill. 595
- Alaskan Beaufort Sea : ecosystems and environments / Edited by P. W. Barnes, D.M. Schell and E. Reimnitz - Orlando, Okla. ; Toronto, Ont. : Academic Press, 1984, p. 327-345, maps 53
- Alaskan Beaufort Sea : ecosystems and environments / Edited by P.W. Barnes, D.M. Schell and E. Reimnitz. - Orlando, Okla. ; Toronto, Ont. : Academic Press, 1984, p. 441-460 680
- Ambio, v. 14, no. 2, 1985, p. 108-110, ill. (some col.) 548
- American Institute of Chemical Engineers, 64th Annual Meeting, November 28-December 2, 1971, San Francisco Hilton Hotel. - [S.L.] : [s.n.], 1971, p. 40 322
- Annual report - Smithsonian Institution. Center for Short Lived Phenomena, 1970, p. 150-153, ill. 310
- Annual report - Smithsonian Institution. Center for Short Lived Phenomena, 1970, p. 154-157, ill. 1
- Annual report - United States. Office of Naval Research, no. 5 59
- Annual review of activities 1982 - Canada. Institute of Ocean Sciences, Patricia Bay, p. 32-35, ill., map 5
- APOA project no. 37 : Arctic environmental research, tundra and ecological studies on the Mackenzie Delta and Devon Island. Report 102
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 5 660
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 10 124
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 11 554
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 12c 323
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 13 740
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 27 508
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 28 604
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 29 12
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 33 690
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 35 728
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 36 727
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 38 741
- APOA project no. 72 : Beaufort Sea Environmental Program. Report, no. 39 483
- APOA project no. 107 : Some aspects of weathering and burning of crude oil in water and ice environment. Report 510
- APOA project no. 138 : Environmental investigations and analysis in Davis Strait - second half 1977. Report, no. 15 677
- APOA project no. 146 : Biological environmental investigations and analyses in Davis Strait 1978. Report, no. 6 27
- APOA project no. 149 : Oilspill and iceberg studies conducted for preparation of an environmental impact statement for Davis Strait. Report, no. 2 478
- APOA project no. 149 : Oilspill and iceberg studies conducted for preparation of an environmental impact statement for Davis Strait. Report, no. 3 505
- APOA project no. 161 : Microbial degradation of CANMAR oils by northern marine organisms, Report, no. 1 733
- Applied and environmental microbiology, v. 28, no. 6, Dec. 1974, p. 915-922, ill. 491
- Applied and environmental microbiology, v. 30, no. 3, Sept. 1975, p. 396-403, ill. 58



Applied and environmental microbiology, v. 33, no. 3, Mar. 1977, p. 647-653, ill.	315
Applied and environmental microbiology, v. 35, no. 5, May 1978, p. 897-905, ill., maps	608
Applied and environmental microbiology, v. 41, no. 2, Feb. 1981, p. 412-421, maps	300
Applied and environmental microbiology, v. 41, no. 6, June 1981, p. 1400-1406, ill., maps	287
Applied and environmental microbiology, v. 42, no. 5, Nov. 1981, p. 792-801, ill., maps	291
Aquatic toxicology, v. 4, no. 3, 1983, p. 199-217	234
Arctic circular, v. 21, no. 1, 1971, p. 22-27	570
Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 1- 1- 1- 11, ill., map	197
Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 10- 1- 10- 10, ill.	263
Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 12- 1- 12- 2	568
Arctic Marine Oil Spill Program Technical Seminar preprints / James F. MacLaren Ltd. - Edmonton : James F. MacLaren Ltd., [1978], 26- 1- 26- 26, ill., maps	613
Arctic Marine Oilspill Program report, EPS-9-ED-78- 1	253
Arctic Ocean : the hydrographic environment and the fate of pollutants / Edited by L. Rey and B. Stonehouse. - London : Macmillan, 1982, p. 275- 293	497
Arctic Ocean : the hydrographic environment and the fate of pollutants / Edited by L. Rey and B. Stonehouse. - London : Macmillan, 1982, p. 295- 341, ill., map	167
Arctic project bulletin, no. 15, 1977	2
Arctic seas bulletin, v. 2, no. 7, July 1980	606
Arctic, v. 24, no. 3, Sept. 1971, p. 229, ill.	76
Arctic, v. 30, no. 2, June 1977, p. 85-92, ill.	131
Arctic, v. 30, no. 2, June 1977, p. 93-100	417
Arctic, v. 31, no. 3, Sept. 1978, p. 155-157, figure	62
Arctic, v. 33, no. 4, Dec. 1980, p. 807-814, figures, tables	666
Arctic, v. 36, no. 1, Mar. 1983, p. 1-4	379
Arctic, v. 36, no. 3, Sept. 1983, p. 251-261, figures, tables	54
Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 95-117, ill., maps	314
Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 305-327, ill.	514
Assessment of the arctic marine environment : selected topics / Edited by D.W. Hood and D.C. Burrell. - Fairbanks, Alaska : Institute of Marine Science, University of Alaska, 1976. Occasional publication - Institute of Marine Science, no. 4, p. 425-431, ill., map	639
Astarte, v. 8, no. 2, 1975, p. 53-60, charts, table	67
Beaufort E.I.S. reference work, no. RWB18	733
Beaufort E.I.S. reference work, no. RWC09	459
Beaufort E.I.S. reference work, no. RWC17	11
Beaufort E.I.S. reference work, no. RWE01	405
Beaufort E.I.S. reference work, no. RWE08	245
Beaufort E.I.S. reference work, no. RWZ08	266
Beaufort E.I.S. support document, no. BEISSD01	240
Beaufort E.I.S. support document, no. BEISSD12	241
Beaufort E.I.S. support document, no. BEISSD13	242
Beaufort E.I.S. support document, no. BEISSD14	40
Beaufort E.I.S. support document, no. BEISSD15	398
Beaufort E.I.S. support document, no. BEISSD16	41
Beaufort E.I.S. support document, no. BEISSD17	39
Beaufort E.I.S. support document, no. BEISSD25	412
Beaufort E.I.S. technical specialist report	535

- Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. -  
Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental  
Protection and Renewable Resources Branch, no. 34, p. 178-190 77
- Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. -  
Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental  
Protection and Renewable Resources Branch, no. 34, p. 154-162 81
- Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. -  
Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental  
Protection and Renewable Resources Branch, no. 34, p. 166-174 82
- Beaufort Environmental Monitoring Project, 1983-1984 / LGL Limited, ESL Environmental Sciences Ltd., and ESSA Ltd. -  
Ottawa : Northern Environmental Protection Branch, 1985. Environmental studies - Canada. Northern Environmental  
Protection and Renewable Resources Branch, no. 34, p. 144-153 329
- Biological conservation, v. 23, no. 4, Aug. 1982, p. 261-272, ill., map 654
- Biological conservation, v. 28, no. 1, 1984, p. 21-49, ill. 736
- Biological cruises of the R/V Acona in Prince William Sound, Alaska (1970-1973) / H.M. Feder and A.J. Paul. - Fairbanks :  
Institute of Marine Science, University of Alaska, 1977. Institute of Marine Science report, R77- 4, p. 70-76 247
- Bulletin of environmental contamination and toxicology, v. 21, no. 4/5, Mar. 1979, p. 521-525 359
- Bulletin of environmental contamination and toxicology, v. 21, no. 6, Apr. 1979, p. 719-726, ill. 519
- Bulletin of environmental contamination and toxicology, v. 21, no. 6, Apr. 1979, p. 727-732, ill. 518
- Bulletin of environmental contamination and toxicology, v. 27, 1981, p. 458-462, ill. 260
- Bulletin of environmental contamination and toxicology, v. 29, 1982, p. 520-524 367
- Bulletin of environmental contamination and toxicology, v. 35, no. 1, July 1985, p. 9-14, ill. 338
- Bulletin of the Torrey Botanical Club, v.106, no. 4, Oct./Dec. 1979, p. 346-349, ill. 192
- Bureau of Mines report of investigations, 8122 99
- Bureau of Mines report of investigations, 8136 101
- C-CORE publication. Technical report 370
- C-CORE publication, no. 78- 2 370
- C-CORE publication, no. 78- 12 533
- C-CORE publication, no. 78- 18 474
- C-CORE publication, no. 79- 4 475
- C-CORE publication, no. 80- 2 476
- C-CORE publication, no. 80- 20 573
- Canadian data report of hydrography and ocean sciences, no. 29 709
- Canadian field naturalist, v. 85, no. 3, July-Sept. 1971, p. 249-251 208
- Canadian geographic, v.101, no. 6, Dec. 1981/Jan. 1982, p. 24-29, col. photos. 671
- Canadian journal of chemical engineering, v. 52, Feb. 1974, p. 71-74, ill. 163
- Canadian journal of chemical engineering, v. 54, Feb./Apr. 1976, p. 72-74, ill. 415
- Canadian journal of chemical engineering, v. 55, Dec. 1977, p. 696-700, ill. 285
- Canadian journal of microbiology, v. 27, no. 4, Apr. 1981, p. 432-443, ill. 249
- Canadian journal of microbiology, v. 28, no. 1, Jan. 1982, p. 92-99, figures tables 52
- Canadian journal of microbiology, v. 28, no. 1, Jan. 1982, p. 117-122, figures, table 259
- Canadian journal of microbiology, v. 29, no. 3, Mar. 1983, p. 291-296, figures, table 250
- Canadian journal of microbiology, v. 29, no. 5, May 1983, p. 497-503, ill. 251
- Canadian manuscript report of fisheries and aquatic sciences, no. 1515 143
- Canadian manuscript report of fisheries and aquatic sciences, no. 1552 142
- Canadian manuscript report of fisheries and aquatic sciences, no. 1611 145
- Canadian manuscript report of fisheries and aquatic sciences, no. 1708 122
- Canadian meteorological research reports, CMRR [79] 1/79 612
- Canadian shipping and marine engineering, v. 51, no. 8, May 1980, p. 23-35, map, ill. 726
- Canadian technical report of fisheries and aquatic sciences, no. 1005 198
- Canadian technical report of fisheries and aquatic sciences, no. 1200 341
- Canadian technical report of hydrography and ocean sciences, no. 35 717
- Chem 13 news, v. 70, 1975, p. 3-5, ill. 413

- Circumpolar Conference on Northern Ecology : proceedings, Ottawa, 1975. - Ottawa : National Research Council of Canada, [1975], p. II- 87-II 98, ill. 550
- Coastal zone '78 : proceedings of the Symposium on Technical, Environmental, Socioeconomic and Regulatory Aspects of Coastal Zone Management, San Francisco, March 1978. - New York : American Society of Civil Engineers, 1978, v. 3, p.2204-2220, ill., maps 611
- Comparative biochemistry and physiology. Part C: Comparative pharmacology, v. 72, no. 1, 1982, p. 133-136 229
- Condor (Los Angeles), v. 86, no. 1, Feb. 1984, p. 83-85, ill. 695
- Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document, no. RMPSD09 401
- Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document, no. RMPSD13 35
- Consolidex Magnorth Oakwood Lancaster Sound Joint Venture. Resource Management Plan support document, no. RMPSD15 42
- Continuing Engineering Education Workshop on Ice Engineering, University of Alaska, June 4-5, 1981. - Fairbanks, Alaska : University of Alaska, School of Engineering, 1981, [8] leaves, figures 499
- Contract report - Memorial University of Newfoundland. Centre for Cold Ocean Resources Engineering 474, 475, 476
- Contribution - Los Angeles. University of California. Institute of Geophysics and Planetary Physics, no. 2303 54
- Contribution - U.S. NOAA. Environmental Research Laboratories. Pacific Marine Research Laboratory, no. 542 54
- Contribution - University of Washington. Dept. of Atmospheric Sciences, no. 522 448
- Contribution - University of Washington. Dept. of Oceanography, no. 1114 448
- COOSRA project report, no. CS04V1-2 121
- COOSRA project report, no. CS07 206
- COOSRA project report, no. CS11 216
- Current research - Geological Survey of Canada, Part B. Paper - Geological Survey of Canada, 78- 1B, p. 21-26, ill, map 387
- Current research - Geological Survey of Canada, Part B. Paper - Geological Survey of Canada, 79- 1B, p. 379-383 381
- Eastern Arctic Marine Environmental Studies 27, 36, 38, 142, 143, 394, 478, 505, 523, 677
- eastern Bering Sea Shelf : oceanography and resources, volume one / Edited by D.W. Hood and J.A. Calder. - [Washington : Office of Marine Pollution Assessment, National Oceanic and Atmospheric Administration ; Seattle : University of Washington Press [distributor], 1981], p. 223-243, ill. 447
- Economic and technical review report, EPS 3-EC-74- 4 370
- Economic and technical review report, EPS 3-EC-77- 13 340
- Economic and technical review report, EPS 3-EC-77- 14 30
- Economic and technical review report, EPS 3-EC-77- 23 154
- Economic and technical review report, EPS 3-EC-80- 5 614
- Economic and technical review report, EPS 3-EC-82- 2 662
- effect of contact and ingestion of crude oil on ringed seals of the Beaufort Sea / T.G. Smith and J.R. Geraci. Technical report - Beaufort Sea Project, no. 5, p. 48-66, ill. 524
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume I : Nature and fate of petroleum / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 91-223, ill., map 166
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume I : Nature and fate of petroleum / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 225-307 348
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 1-93 186
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 95-173, ill. 312
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 175-270, ill. 722
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 319-335 536
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 337-357 616
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 399-410, ill. 270
- Effects of petroleum on arctic and subarctic marine environments and organisms. Volume II : Biological effects / Edited by D.C. Malins. - New York : Academic Press, 1977, p. 411-491, ill., map 165

- Eighth Annual Offshore Technology Conference : 1976 proceedings. - Dallas, Tex. : Offshore Technology Conference, 1976, v. 1, p. 211-220, maps 100
- Environment Canada Lands Directorate, Folio 6, no. 18, 1983, p. 123-140, ill., maps 529
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1977. Vol. XII : Effects, p. 44-65 161
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1977. Vol. XII : Effects, p. 596-635, ill. 658
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VI : Receptors, Microbiology, p. 1-84, ill., maps 50
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VI : Receptors, Microbiology, p. 85-178, ill., maps 295
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 12-146, ill., maps 439
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 151-309, ill., maps 538
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VII : Effects, p. 350-403, ill. 25
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VIII : Contaminant baselines, p. 11-72, ill., maps 252
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VIII : Contaminant baselines, p. 73-198, ill., maps 173
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. VIII : Contaminant baselines, p. 495-588, ill. 643
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1978. Vol. XI : Hazards, p. 8-10 452
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 1-61, maps 49
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 62-142, maps 294
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 264-325, ill., maps 170
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. V : Receptors, microbiology, contaminant baselines, p. 547-596, ill. 641
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 1-26, ill., maps 356
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 27-59 588
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 60-171, ill. 441
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VI : Effects, p. 172-234, ill. 24
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VII : Transport, p. 115-170, ill., maps 308
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VII : Transport, p. 171-180 451
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 310-323, ill., map 362
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 354-569, ill., maps 179
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1979. Vol. VIII : Transport, p. 570-588, ill. 620
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. I : Receptors : birds, plankton, littoral benthos, p. 413-475, ill. 618
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. II : Receptors, Microbiology, Ecological processes, p. 1-223, ill., maps 47
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. II : Receptors, Microbiology, Ecological processes, p. 224-464, maps 292

- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 1-12 586
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 13-79, ill. 438
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 192-272, ill., maps 171
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 273-295 640
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. III : Effects, Contaminant baselines, p. 296-352, ill., maps 346
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VI : Transport, p. 1-8, ill. 449
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 333-339, map 361
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 341-347 178
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1980. Vol. VII : Transport, data management, p. 349-360, ill. 619
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. III : Effects of contaminants 541
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 1-60, maps 48
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 61-78 587
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 79-171, ill. 440
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 172-269, ill., maps 281
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 271-463, ill. 105
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 465-555, ill., map 189
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 557-621, ill., maps 123
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 623-660, ill., map 222
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 661-663 713
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. IV : Effects of contaminants, p. 665-677, ill. 160
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. V : Transport, p. 1-28, ill., map 450
- Environmental assessment of the Alaskan continental shelf : Annual reports of principal investigators for the year ending March 1981. Vol. VI : Transport, p. 1-328, figures 257
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 3 : Physical science studies, 1981, p. 427-597, ill. 33
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 10 : Biological studies, [1981], p. 65-107, ill., maps 180
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 10 : Biological studies, [1981], p. 417-784, ill., maps 293
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 13 : Biological studies, 1981, p. 315-356, ill., maps 14
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 18 : Biological studies, [1982], p. 1-352, ill., maps 539
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 20, December 1983, p. 171-263, maps 136
- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 21, February 1984 542

- Environmental assessment of the Alaskan continental shelf : Final reports of principal investigators. Vol. 22, February 1984  
543
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
10 : Chemistry and microbiology, p. 147-191, ill., maps 490
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
10 : Chemistry and microbiology, p. 193-366, ill., maps 642
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
10 : Chemistry and microbiology, p. 367-380 84
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
11 : Physical oceanography and meteorology, p. 427-755, ill., maps 137
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 1-14, ill. 202
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 15-23 268
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 25-47 579
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 52-87, ill. 674
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 89-118 582
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 119-138 436
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 139-153 433
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 155-324 430
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 345-375, ill. 133
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
8 : Effects of contaminants, p. 377-383 549
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
9 : Chemistry and microbiology, p. 1-286, maps 45
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
9 : Chemistry and microbiology, p. 287-344, ill., maps 46
- Environmental assessment of the Alaskan continental shelf : Principal investigators reports for the year ending March 1976. Vol.  
9 : Chemistry and microbiology, p. 443-550, ill., maps 172
- Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976.  
Vol. III, p. 3-26, ill. 357
- Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976.  
Vol. III, p. 149-152 537
- Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976.  
Vol. III, p. 157-168, ill. 134
- Environmental assessment of the Alaskan continental shelf : Quarterly reports of principal investigators October-December 1976.  
Vol. III, p. 169-173 471
- Environmental geology, v. 2, no. 2, 1978, p. 107-117, ill., map 479
- Environmental pollution, v. 10, no. 1, Jan. 1976, p. 35-43, ill. 57
- Environmental pollution, v. 10, no. 2, Feb. 1976, p. 155-162 561
- Environmental pollution, v. 13, no. 1, May 1977, p. 1-10 560
- Environmental pollution, v. 13, no. 2, June 1977, p. 133-149, ill., map 355
- Environmental pollution, v. 15, no. 3, Mar. 1978, p. 209-221, ill., map 324
- Environmental pollution, v. 15, no. 3, Mar. 1978, p. 223-229 601
- Environmental pollution, v. 17, no. 2, Oct. 1978, p. 93-107, ill. 325
- Environmental research, v. 24, no. 1, Feb. 1981, p. 6-14, ill. 544
- Environmental research, v. 27, no. 1, Feb. 1982, p. 206-215, ill. 547
- Environmental research, v. 36, no. 1, Feb. 1985, p. 248-255, ill. 371
- Environmental science and technology, v. 10, no. 13, Dec. 1976, p. 1241-1246, ill., map 410

- Environmental science and technology, v. 12, no. 10, Oct. 1978, p.1200-1205, map 646
- Environmental science and technology, v. 13, no. 10, Oct. 1979, p.1259-1263, ill. 638
- Environmental science and technology, v. 15, no. 11, Nov. 1981, p.1272-1280, ill. 435
- Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 24 523
- Environmental studies - Canada. Northern Environmental Protection and Renewable Resources Branch, no. 34 397
- Environmental studies of Kachemak Bay and lower Cook Inlet / Edited by L.L. Trasky, L.B. Flagg and D.C. Burbank. - Anchorage, Alaska : Alaska Dept. of Fish and Game, Marine/Coastal Habitat Management, 1977, v. 1 692
- Environmental studies of Port Valdez / Edited by D.W. Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska. Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 397-410, ill., map 353
- Environmental studies of Port Valdez / Edited by D.W. Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska. Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 449-479, ill., map 597
- Environmental studies of Port Valdez / Edited by D.W. Hood, W.E. Shiels and E.J. Kelly. - Fairbanks, Alaska : University of Alaska. Institute of Marine Science, 1973. Occasional publication - Institute of Marine Science, no. 3, p. 413-446, ill. 653
- Environmental toxicology and chemistry, v. 1, no. 1, 1982, p. 39-44, ill. 480
- Estuarine and coastal marine science, v. 5, no. 3, 1977, p. 429-436, ill. 651
- Estuarine and coastal marine science, v. 9, no. 4, 1979, p. 435-449, ill., map 637
- Estuarine, coastal and shelf science, v. 15, no. 2, 1982, p. 183-198, ill., maps 289
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 270-275, ill., map 43
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 261-269, map 68
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 210-220, ill. 135
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 1-7 305
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 151-157, ill. 358
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 47-59, ill. 431
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 221-228, ill. 473
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 192-200, ill. 555
- Fate and effects of petroleum hydrocarbons in marine ecosystems and organisms : proceedings of a symposium, November 10-12, 1976, Olympic Hotel, Seattle, Washington / Edited by D.A. Wolfe, J.W. Anderson, D.K. Button, D.C. Malins, T. Roubal and U. Varanasi. - Toronto : Pergamon Press, 1977, p. 229-237, ill. 673
- Fate and weathering of petroleum spills in the marine environment : a literature review and synopsis / by Randolph E. Jordan [and] James R. Payne. Ann Arbor : Ann Arbor Science, [1980], p. 108-114, ill. 8
- Florida scientist, v. 38, suppl. 1, 1975, p. 14 729
- Flow research report, no. 175, p. 61-187, figures 678
- Flow research report, no. 176, p. 189-273 681
- Flow research report, no. 189, p. 275-327, figures 679
- Geochimica et Cosmochimica Acta, v. 44, no. 8, Aug. 1980, p.1145-1150, figures, tables 366
- Geochimica et Cosmochimica Acta, v. 46, no. 11, Nov. 1982, p.2135-2149, figures, tables 723
- Geos (Ottawa), 1979 [1] Spring, p. 2-4, ill., col. photos., map 492
- Impact of the use of microorganisms on the aquatic environment : proceedings / Edited by A.W. Bourquin, D.G. Ahearn and S.P.

- Meyers. - Corvallis, Ore. : U.S. National Environmental Research Center, 1975. Ecological research series, EPA-660/3-75-001, p. 183-198, ill., maps 65
- Institute of Marine Science report, R76- 5 246
- International Council for the Exploration of the Sea. Fisheries Improvement Committee, C.M. 1977/E: 26 556
- International Symposium on Identification and Measurement of Environmental Pollutants, Ottawa, Ontario, Canada, 14, 15, 16, 17 June, 1971. - Ottawa : National Research Council of Canada, 1971, p. 271-276, ill., map 569
- Journal of applied ecology, v. 19, no. 1, 1982, p. 1-31, ill., maps 261
- Journal of dispersion science and technology, v. 3, no. 4, 1982, p. 395-417, ill. 116
- Journal of glaciology, v. 13, no. 69, 1974, p. 473-488, ill. 739
- Journal of glaciology, v. 22, no. 88, 1979, p. 473-502, ill., photos. 448
- Journal of the Environmental Engineering Division, Oct. 1980, p. 907-917, ill., maps 175
- Journal of the Fisheries Research Board of Canada, v. 32, no. 11, Nov. 1975, p.2221-2224 683
- Journal of the Fisheries Research Board of Canada, v. 33, no. 9, Sept. 1976, p.1976-1984, ill., map 271
- Journal of the Fisheries Research Board of Canada, v. 34, no. 8, Aug. 1977, p.1143-1147, ill. 237
- Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 499-795, ill., maps, tables, charts 10
- Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 650-656, ill. 551
- Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 657-664, ill. 457
- Journal of thermal biology, v. 7, no. 4, Dec. 1982, p. 201-208, figures, tables 331
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 115-122, ill. 115
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 33-38, ill., map 503
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 39-47, map 694
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 19-29, ill. 716
- Kurdistan oil spill of March 16-17, 1979 : activities and observations of the Bedford Institute of Oceanography response team / Edited by J.H. Vandermeulen and D.E. Buckley. - [Dartmouth, N.S. : Bedford Institute of Oceanography], 1985. Canadian technical report of hydrography and ocean sciences, no. 35, p. 49-61, ill. 719
- Laboratory report - Imperial Oil Limited, no. L- 12075 605
- Land and water issues related to energy development : proceedings of the Fourth Annual Meeting of the International Society of Petroleum Industry Biologists, Denver, Colorado, September 22-25, 1981 / Edited by P.J. Rand. - Ann Arbor, Mich. : Ann Arbor Science, 1982, p. 263-280, ill. 330
- Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado : NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 11-24 580
- Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado : NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 54-71 458
- Marine biological effects of OCS petroleum development / Edited by D.A. Wolfe. - Boulder, Colorado : NOAA, Environmental Research Lab., 1978. NOAA technical memorandum, ERL OCSEAP 1, p. 106-129, ill. 735
- Marine biology, v. 41, no. 4, 1977, p. 371-382, ill., map 493
- Marine biology, v. 57, no. 1, 1980, p. 41-50, ill. 169
- Marine biology, v. 57, no. 1, 1980, p. 51-60, ill. 665
- Marine chemistry, v. 10, 1981, p. 355-364, ill., maps 383
- Marine ecology : Mackenzie Delta and Tuktoyaktuk Peninsula. - [S.l.] : Environmental-Social Committee Northern Pipelines, 1974. Task Force on Northern Oil Development (Canada) report, no. 74- 22, p. 1-30, ill., map 126
- Marine ecology : Mackenzie Delta and Tuktoyaktuk Peninsula. - [S.l.] : Environmental-Social Committee Northern Pipelines, 1974. Task Force on Northern Oil Development (Canada) report, no. 74- 22, p. 31-99, ill. 552
- Marine environmental research, v. 1, no. 2, 1978, p. 135-163, ill., map 668
- Marine environmental research, v. 3, no. 4, 1980, p. 307-313, ill. 70
- Marine environmental research, v. 4, no. 2, 1980-1981, p. 109-119, ill. 596
- Marine environmental research, v. 4, no. 2, 1980-1981, p. 135-141 72
- Marine environmental research, v. 5, no. 3, 1981, p. 167-180 129



- Marine environmental research, v. 7, no. 2, 1982, p. 91-102, ill. 301
- Marine environmental research, v. 13, no. 2, 1984, p. 121-139, ill. 522
- Marine fisheries review, v. 36, no. 7, 1974, p. 31-37, ill. 347
- Marine pollution : functional responses : proceedings of the Symposium "Pollution and Physiology of Marine Organisms", held on November 14-17, 1977 at Hobcaw Barony, Georgetown, South Carolina / Edited by W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J. Vernberg. - New York : Academic, 1979, p. 53-67, ill. 201
- Marine pollution : functional responses : proceedings of the Symposium "Pollution and Physiology of Marine Organisms", held on November 14-17, 1977 at Hobcaw Barony, Georgetown, South Carolina / Edited by W.B. Vernberg, A. Calabrese, F.P. Thurberg, and F.J. Vernberg. - New York : Academic, 1979, p. 39-52, ill. 682
- Marine pollution bulletin, v. 1, no. 5, May 1970, p. 66 3
- Marine pollution bulletin, v. 1, no. 5, May 1970, p. 73-74, map 83
- Marine pollution bulletin, v. 4, no. 8, Aug. 1973, p. 125-127 194
- Marine pollution bulletin, v. 8, no. 2, Feb. 1977, p. 35-40, ill. 553
- Marine pollution bulletin, v. 9, no. 12, Dec. 1978, p. 324-331, ill. 517
- Marine pollution bulletin, v. 10, no. 9, Sept. 1979, p. 253-255, ill., map, tables 80
- Marine pollution bulletin, v. 11, no. 2, Feb. 1980, p. 51-56, ill., map 384
- Marine pollution bulletin, v. 11, no. 10, Oct. 1980, p. 297-300, ill. 645
- Marine pollution bulletin, v. 12, no. 1, Jan. 1981, p. 10-14, ill., map 168
- Marine pollution bulletin, v. 12, no. 2, Feb. 1981, p. 45-46 661
- Marine pollution bulletin, v. 12, no. 9, Sept. 1981, p. 314-317, ill. 15
- Marine pollution bulletin, v. 13, no. 3, Jan. 1982, p. 96-98, ill., map 296
- Marine pollution bulletin, v. 13, no. 6, June 1982, p. 211-213, ill., map 258
- Marine pollution bulletin, v. 13, no. 8, Aug. 1982, p. 273-278, maps 290
- Marine pollution bulletin, v. 14, no. 5, May 1983, p. 162-165, ill. 288
- Marine technology society journal, v. 18, no. 3, 1984, p. 51-61, ill., map 557
- Marine transportation and high arctic development : a bibliography : scientific and technical research relevant to the development of marine transportation in the Canadian north / M.J. Dunbar. - Ottawa : Canadian Arctic Resources Committee, 1980, p. 141-150 218
- Meddelelser - Trondheim. Norges Tekniske Hogskole. Vassdrags- og Havnelaboratoriet, nr. 19E, 1980, p. 43-58, ill., figures, photos. 158
- Meteorologia i gidrologia, 1981, no. 5, p. 65-69, ill. 209
- Meteorologia i gidrologia, 1983, no. 5, p. 87-91, figure, table 210
- microbial degradation of oil pollutants : workshop held at Georgia State University, Atlanta, December 1972 / Edited by D.G. Ahearn and S.P. Meyers. - Baton Rouge, La. : Louisiana State University, 1973. Center for Wetland Resources publication no. LSU-SG-73- 01, p. 171-184, ill., map 598
- Microbial ecology / edited by M.W. Loutit and J.A.R. Miles. New York : Springer-Verlag, 1978, p. 86-90, ill. 51
- Microbiology, v. 46, no. 6, Nov.-Dec. 1977, p. 864-867 360
- Microbiology, v. 47, no. 4, Jul.-Aug. 1978, p. 616-618, ill. 298
- Narragansett Laboratory reference, no. 78- 07 456
- Nature, v.280, no.5723, Aug. 16, 1979, p. 576-578, ill. 563
- Ninth Annual Offshore Technology Conference 1977, proceedings. - Dallas, Tex. : Offshore Technology Conference, 1977, v. 3, p. 547-554, ill. 364
- NOAA data report, ERL PMEL- 2 349
- NOAA technical memorandum, ERL MESA 45 715
- NOAA technical memorandum, ERL OCSEAP 1 738
- NOAA technical memorandum, ERL PMEL- 26 350
- NTIS AD-A-010 269 321
- NTIS AD-A-012 351 327
- NTIS AD-A-014 096 707
- NTIS AD-A-017 600 455
- NTIS AD-A-048 334 59
- NTIS AD-A-070 992 60
- NTIS AD-A-072 859, p. 331-343, ill. 562

NTIS AD-A-072 859, p. 613-628, ill.	235
NTIS AD-A-072 859, p. 835-855, ill.	93
NTIS AD-A-072 859, p. 856-874	130
NTIS AD-A-078 892	193
NTIS AD-A-079 584	22
NTIS AD-A-114 178	265
NTIS AD-A-126 395	696
NTIS AD-A-133 159	697
NTIS AD-A-151 064	32
NTIS AD-717 142	278
NTIS AD-748 157	75
NTIS AD-754 261	469
NTIS AD-760 716, p. 171-184, ill., map	598
NTIS PB-240 159, p. 183-189, ill., maps	65
NTIS PB-253 013	99
NTIS PB-259 325	101
NTIS PB-259 972	248
NTIS PB-261 407, p. 1-14, ill.	202
NTIS PB-261 407, p. 15-23	268
NTIS PB-261 407, p. 25-47	579
NTIS PB-261 407, p. 139-153	433
NTIS PB-261 407, p. 155-324	430
NTIS PB-261 408, p. 1-286, maps	45
NTIS PB-261 408, p. 287-344, ill., maps	46
NTIS PB-261 408, p. 443-550, ill., maps	172
NTIS PB-261 409, p. 147-191, ill., maps	490
NTIS PB-261 409, p. 367-380	84
NTIS PB-261 993	246
NTIS PB-277 060, p. 7-32, ill.	238
NTIS PB-277 060, p. 77-85, ill.	649
NTIS PB-277 060, p. 87-110	306
NTIS PB-277 060, p. 111-113	590
NTIS PB-288 935	738
NTIS PB-288 935, p. 11-24	580
NTIS PB-288 935, p. 54-71	458
NTIS PB-288 935, p. 106-129, ill.	735
NTIS PB-299 235	34
NTIS PB80-130057, p. 1-84, ill., maps	50
NTIS PB80-130057, p. 85-178, ill., maps	295
NTIS PB80-130065, p. 12-146, ill., maps	439
NTIS PB80-130065, p. 151-309, ill., maps	538
NTIS PB80-130065, p. 350-403, ill.	25
NTIS PB80-130073, p. 11-72, ill., maps	252
NTIS PB80-130073, p. 73-198, ill., maps	173
NTIS PB80-130073, p. 495-588, ill.	643
NTIS PB80-130107, p. 8-10	452
NTIS PB80-160955	715
NTIS PB80-186851, p. 1-61, maps	49
NTIS PB80-186851, p. 224-464, maps	292
NTIS PB80-186851, p. 264-325, ill., maps	170
NTIS PB80-186851, p. 547-596, ill.	641

- NTIS PB80-186877, p. 115-170, ill., maps 308
- NTIS PB80-186877, p. 171-180 451
- NTIS PB80-186885, p. 310-323, ill., map 362
- NTIS PB80-186885, p. 354-569, ill., maps 179
- NTIS PB80-186885, p. 570-588, ill. 620
- NTIS PB81-159147 650
- NTIS PB82-154121 349
- NTIS PB82-250663 350
- NTIS PB83-146142 182
- NTIS PB83-864397 9
- NTIS PB84-209428 688
- Occasional publication - Institute of Marine Science, no. 3 313
- Ocean industry, v. 6, no. 1, Jan. 1971, p. 14-17, ill. 714
- Oceanographic report - United States. Coast Guard, no. CG 373- 64 327
- OCS oil and gas : an environmental assessment : a report to the President, vol. 5 / United States. Council on Environmental Quality. - Washington, D.C. : U.S.G.P.O., 1974, [microfiches 1-5], ill., maps 699
- OCS oil and gas : an environmental assessment : a report to the President, vol. 5 / United States. Council on Environmental Quality. - Washington, D.C. : U.S.G.P.O., 1974, [microfiches 5-7], ill., maps 698
- OCS report MMS 85- 0031 303
- Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 7-32, ill. 238
- Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 87-110 306
- Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 111-113 590
- Oil and aquatic ecosystems, tanker safety, and oil pollution liability : proceedings of the Cordova Fisheries Institute held in Cordova, Alaska on April 1-3, 1977 / Edited by B. Melteff. - Fairbanks, Alaska : Alaska University, Alaska Sea Grant Program, 1977. Sea grant report (College), 77- 8, p. 77-85, ill. 649
- Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 7-28 414
- Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 29-46 718
- Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 47-54 734
- Oil and dispersants in Canadian seas : research appraisal and recommendations / Edited by J.B. Sprague, J.H. Vandermeulen and P.G. Wells. Economic and technical review report, EPS 3-EC-82- 2, p. 113-122 655
- Oil and petrochemical pollution, v. 1, no. 2, 1983, p. 85-96, ill., maps 299
- Oil and the Canadian environment : Proceedings of the Conference, 16 May, 1973, sponsored by the Institute of Environmental Sciences and Engineering, University of Toronto / Edited by D. Mackay and W. Harrison. - Toronto : Institute of Environmental Sciences and Engineering, 1973, p. 104-106 467
- Oil and the Canadian environment : Proceedings of the Conference, 16 May, 1973, sponsored by the Institute of Environmental Sciences and Engineering, University of Toronto / Edited by D. Mackay and W. Harrison. - Toronto : Institute of Environmental Sciences and Engineering, 1973, p. 71-74 559
- Oil spill chemical dispersants : research, experience, and recommendations : a symposium sponsored by ASTM Committee F-20 on Hazardous Substances and Oil Spill Response, West Palm Beach, Fla., 12-13 Oct. 1982 / Edited by T.E. Allen. ASTM special technical publication, no. 840, 1984, p. 338-360, ill. 108
- Oil spill intelligence report, v. 2, no. 20, 1979, p. 2 7
- Oil under the ice / D.H. Pimlott, D. Brown, K.P. Sam. - Ottawa : Canadian Arctic Resources Committee, 1976, p. 93-110 6
- Oil under the ice / D.H. Pimlott, D. Brown, K.P. Sam. - Ottawa : Canadian Arctic Resources Committee, 1976, p. 161-178 286
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 37-47, ill., map 156
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S.

- Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 27-31 422
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 47-54, ill. 427
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 103-109 567
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 75-86, ill., maps 574
- Oil, ice and gas : proceedings of a workshop held in Toronto, Canada, October 10 and 11, 1979 / Edited by D. Mackay and S. Paterson. - Toronto : University of Toronto Institute for Environmental Studies, [1979], p. 55-73, ill. 689
- OLABS program report 44
- Open-file report - U.S. Geological Survey, 79- 539 79
- Open-file report - U.S. Geological Survey, 82- 13 615
- OTC paper, 1522 466
- OTC paper, 1551 277
- OTC paper, 1747 470
- OTC paper, 2444 100
- Outer Continental Shelf EIS/EA, MMS 85- 0085 703
- Outer Continental Shelf EIS, MMS 84- 0017 700
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 27, December 1984, p. 389-469, ill., maps 196
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 1-229, ill. 437
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 231-285, ill. 434
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 287-310, ill. 584
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 29, January 1985, p. 311-427, ill. 585
- Outer Continental Shelf Environmental Assessment Program : Final reports of principal investigators. Vol. 30, April 1985, p. 599-644, ill., maps 737
- Pacific marine science report, 76- 12 390
- Pacific marine science report, 81- 4 275
- Paper - Geological Survey of Canada, 79- 28 463
- Paper - Geological Survey of Canada, 81- 1A, p. 401-403, figures 382
- Paper - Geological Survey of Canada, 81- 1B, p. 153-162, figures, tables 460
- Paper - Geological Survey of Canada, 83- 24 462
- petrole et le gaz arctiques : problemes et perspectives = Arctic oil and gas : problems and possibilities, rapports scientifiques / Fondation francaise d'etudes nordiques, congres international, 5e, Le Havre, France, 2-5 mai, 1973. Publies sous la direction de Jean Malaurie. Paris : [Mouton & Co., c1975]. Contribution - Paris. Universite. Ecole des hautes etudes en sciences sociales. Centre d'etudes arctiques, no. 12, v. 2, p. 505-537 102
- Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 37-62 421
- Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 63-100 55
- Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 101-156 732
- Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 183-216 376
- Petroleum effects in the arctic environment / Edited by F.R. Engelhardt. - London ; New York : Elsevier Applied Science Publishers, 1985, p. 217-244 227
- Petromar 80 : petroleum and the marine environment / EUROCEAN. - London : Graham & Trotman Ltd., 1981, p. 299-318, figures, tables 726
- Petromar 80 : petroleum and the marine environment / EUROCEAN. - London : Graham & Trotman Ltd., 1981, p. 345-362, figures 378
- Phytochemistry, v. 18, no. 12, Nov. 1979, p.2025-2027 644
- POAC 77 : proceedings / Edited by D.B. Muggeridge. - St. John's, Nfld. : Ocean Engineering Information Centre, Memorial

- University of Newfoundland, 1977, v. 2, p. 832-843 309
- POAC 77 : proceedings / Edited by D.B. Muggeridge. - St. John's, Nfld. : Ocean Engineering Information Centre, Memorial University of Newfoundland, 1977, v. 2, p. 872-884, maps 174
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 2, p.1205-1225, ill., map, photos. 78
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 2, p.1227-1242, ill., map, photos. 158
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 1, p. 369-392, ill., map, photo. 391
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 1, p. 771-778, photo. 425
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 3, p. 255-264, ill., photos. 477
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 3, p. 247-253, maps 516
- POAC 79 : the Fifth International Conference on Port and Ocean Engineering under Arctic Conditions, at the Norwegian Institute of Technology, August 13-18, 1979, proceedings. - [Trondheim, Norway : Norwegian Institute of Technology], 1979, v. 1, p. 393-406, ill. 730
- POAC 81 : the Sixth International Conference on Port and Ocean Engineering under Arctic Conditions, Quebec, Canada, July 27-31, 1981, proceedings. - Quebec City : Universite Laval, 1981, v. 2, p. 912-922, ill., maps 363
- POAC 81 : the Sixth International Conference on Port and Ocean Engineering under Arctic Conditions, Quebec, Canada, July 27-31, 1981, proceedings. - Quebec City : Universite Laval, 1981, v. 2, p. 923-936, ill. 426
- POAC 81 : the Sixth International Conference on Port and Ocean Engineering under Arctic Conditions, Quebec, Canada, July 27-31, 1981, proceedings. - Quebec City : Universite Laval, 1981, v. 2, p. 937-944, ill. 599
- POAC 85 : the Eighth International Conference on Port and Ocean Engineering under Arctic Conditions, Narssarsuaq, Greenland, September 7-14, 1985, proceedings. - [Copenhagen, Denmark] : Danish Hydraulic Institute, 1985, v. 1, p. 60-69 228
- Polar geography and geology, v. 5, no. 4, Oct.-Dec. 1981, p. 228-234 334
- Polar geography and geology, v. 5, no. 4, Oct.-Dec. 1981, p. 235-241, ill. 335
- Polar record, v. 18, no.114, Sept. 1976, p. 237-250, ill., map 725
- Polish polar research, v. 2, no. 1-2, 1981, p. 95-102, ill. 521
- proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 1, p. 331-343, ill. 562
- proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 613-628, ill. 235
- proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 835-855, ill. 93
- proceeding of the Conference on Assessment of Ecological Impacts of Oil Spills, 14-17 June, 1978, Keystone, Colorado. - [Arlington, Va.] : American Institute of Biological Sciences, 1978, v. 2, p. 856-874 130
- Proceedings - Arctic Environmental Workshop, 6th, Fairmont Hot Springs, B.C., April 17-20, 1977 / Edited by J.G. Gainer, W.J. Logan [and] D. Mackay. Ontario : Institute for Environmental Studies, [1977]. Publication - University of Toronto. Institute for Environmental Studies, EE 6, p. 43-53, maps 486
- Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978 / Edited by S. James [and] D. Mackay. Toronto : Institute for Environmental Studies of the University of Toronto, [1978]. Publication - University of Toronto. Institute for Environmental Studies, EE 8, p. 67-73 444
- Proceedings - Arctic Environmental Workshop, 7th, Fairmont Hot Springs, B.C., April 12-15, 1978 / Edited by S. James [and] D. Mackay. Toronto : Institute for Environmental Studies of the University of Toronto, [1978]. Publication - University of Toronto. Institute for Environmental Studies, EE 8, p. 103-117 676
- Proceedings - Conference on Arctic Systems, St. John's, Newfoundland, August 18-22, 1975 / Edited by P.J. Amaria, A.A. Bruneau, and P.A. Lapp. New York : Plenum Press, 1977. Nato conference series : II. Arctic systems : v. 2, p. 237-256, figures, tables 311
- Proceedings - Symposium on the Impact of Oil Resource Development in Northern Plant Communities, 23rd AAAS Alaska Science Conference, University of Alaska, Fairbanks, 1972, p. 80-85 13
- Proceedings - Workshop on Research in the Labrador Coastal and Offshore Region, Goose Bay, Labrador, September 4-6, 1980 /

- Newfoundland Institute for Cold Ocean Science. [St. John's] : Memorial University of Newfoundland, 1980, p. 244 464
- Proceedings - Workshop on Research in the Labrador Coastal and Offshore Region, Goose Bay, Labrador, September 4-6, 1980 / Newfoundland Institute for Cold Ocean Science. [St. John's] : Memorial University of Newfoundland, 1980, p. 21-32, figure, table 506
- Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 447-454, ill., maps 267
- Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 455-460, ill., maps 326
- Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 461-463, ill. 411
- Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 493-494 648
- Proceedings - 1977 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1977, New Orleans, Louisiana. - Washington, D.C. : American Petroleum Institute, 1977, p. 575-578 110
- Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 355-358, maps 446
- Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 549-554, ill. 591
- Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 621-623 429
- Proceedings - 1979 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : 1979, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1979, p. 713-717, ill., maps 181
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 37-43, ill. 187
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 47-53, maps 409
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 55-61 593
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 69-75 26
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 167-172, map 97
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 183-189, ill., maps 207
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 191-198, ill. 500
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 199-201, ill., maps 573
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 203-208 183
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 215-219, ill., maps 217
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 297-304, ill. 20
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 305-309, ill. 532
- Proceedings - 1981 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : March 2-5, 1981, Atlanta, Georgia. - Washington, D.C. : American Petroleum Institute, 1981, p. 325-329, ill., maps 272
- Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 261-268, ill. 531
- Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 423-434, ill. 540
- Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 443-449, ill. 73
- Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 451-455, maps 96
- Proceedings - 1983 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 28-March 3, 1983, San Antonio, Texas. - Washington, D.C. : American Petroleum Institute, 1983, p. 473-475, ill., maps 284

- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 211-217, ill., maps 164
- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 349-353, ill. 23
- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 359-365, ill., maps 530
- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 399-403, ill., maps 622
- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 561-569, ill., map 107
- Proceedings - 1985 Oil Spill Conference : Prevention, Behavior, Control, Cleanup : February 25-28, 1985, Los Angeles, California. - Washington, D.C. : American Petroleum Institute, 1985, p. 571-575, map 634
- Proceedings : First World Congress on Water Resources, Chicago, 24-28 September, 1973, p. 58-70, maps 572
- Proceedings : Offshore Goteborg 83, International Conference on Offshore and Marine Technology : Technology for the Arctic. - Goteborg, Sweden : Svenska Massan Stiftelse, 1983, [11] p. 232
- Proceedings of a synthesis meeting : Beaufort Sea, Sale 71 : synthesis report : Chena Hot Springs, Alaska, April 21-23, 1981 / Edited by D.W. Norton, W.M. Sackinger, J.G. Strauch, Jr. and E.A. Strauch. - Juneau, Alaska : Outer Continental Shelf Environmental Assessment Program, 1981, p. 137-154, maps 566
- Proceedings of a synthesis meeting : the Barrow Arch environment and possible consequences of planned offshore oil and gas development, Girdwood, Alaska, 30 October-1 November, 1983 / Edited by J.C. Truett. - Anchorage, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984, p. 7-29, ill., maps 388
- Proceedings of a synthesis meeting : the north Aleutian Shelf environment and possible consequences of planned offshore oil and gas development, Anchorage, Alaska, 9-11 March, 1982 / Edited by L.K. Thorsteinson. - Juneau, Alaska : Outer Continental Shelf Environmental Assessment Program, 1984, p. 11-34, ill., maps 442
- Proceedings of Joint Conference on Prevention and Control of Oil Spills, June 15-17, 1971, Sheraton Park Hotel, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1971, p. 133-137, ill. 75
- Proceedings of Joint Conference on Prevention and Control of Oil Spills, June 15-17, 1971, Sheraton Park Hotel, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1971, p. 479-484, ill. 276
- Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13-15, 1973, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1973, p. 263-276, ill., map 468
- Proceedings of Joint Conference on Prevention and Control of Oil Spills, March 13-15, 1973, Washington, D.C. - Washington, D.C. : American Petroleum Institute, 1973, p. 667-670, ill. 592
- Proceedings of Joint Conference on Prevention and Control of Oil Spills, 1969, New York, N.Y. - Washington, D.C. : American Petroleum Institute, 1969, p. 333-340, ill., maps 354
- Proceedings of Offshore Environment in the 80's, St. John's, Newfoundland, December 2-4, 1980. - [St. John's, Nfld.] : [s.n.], 1980, [22] p., map 636
- Proceedings of Offshore Environment in the 80's, St. John's, Newfoundland, December 2-4, 1980. - [St. John's, Nfld.] : [s.n.], 1980, [23] p., ill., maps 691
- Proceedings of the American Society for Environmental Education Georges Bank Hydrocarbon Symposium, Nantucket, Mass., April 27-30, 1982. - [S.I.] : [s.n.], 1982, p. 281-287 617
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 3-14, figures 265
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 15-24, table 675
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 37-59, figures, tables 501
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 311-323, figures, maps 297
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 325-330 600
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 331-340, figure, tables 630
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 349-362, tables 525
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 447-450, ill. 443
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar. - [Ottawa : EPS. Environmental Emergency Branch], 1982, p. 581-618, ill., map 106

- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 31-44 670
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 45-61, ill. 185
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 62-86, ill., map 176
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 158-181, ill. 255
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 182-189 546
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 317-327, ill. 710
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 402-416, ill. 629
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 455-478, ill., maps 199
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 479-484 745
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 486-494, maps 685
- Proceedings of the Arctic Marine Oil Spill Program Technical Seminar, June 3-5, 1980, Edmonton, Alberta. - Ottawa : Environmental Protection Service, 1980, p. 529-547, ill., maps 575
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 3-44, figures, tables 184
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 45-73, figures, tables 428
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 115-138, ill. 256
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 139-179, figures, tables 231
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 181-194, tables 368
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 195-213, figures, tables 652
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 587-605, figures, table 664
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 647-686, figures, tables 119
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, June 16-18, 1981, Edmonton, Alberta. - Ottawa : EPS, 1981, p. 705-741, map 94
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 37-65, ill., maps 445
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 72-82, ill. 264
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 83-86 219
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 101-109, ill. 416
- Proceedings of the Arctic Marine Oilspill Program Technical Seminar, March 7-9, 1979, Edmonton, Alberta. - [Ottawa] : Environmental Protection Service, 1979, p. 110-111 113
- Proceedings of the Conference on Prevention and Control of Oil Pollution, San Francisco, California, 1975, p. 497-501, ill 351
- Proceedings of the Conference on Prevention and Control of Oil Pollution, San Francisco, California, 1975, p. 503-507, ill 583
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 1-4, ill. 621
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. - [Ottawa : EPS], 1985, p. 5-13, ill. 502



- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 26-32, ill. 746
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 42-52, ill. 423
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 53-58, ill. 418
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 59-77, ill., map 672
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 78-90, ill. 545
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 245-259, ill. 112
- Proceedings of the Eighth Annual Arctic Marine Oilspill Program Technical Seminar, June 18-20, 1985, Edmonton, Alberta. -  
[Ottawa : EPS], 1985, p. 362-374, maps 333
- Proceedings of the National Shellfisheries Association, v. 64, 1973, p. 4 373
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. -  
[Ottawa : EPS, 1984], p. 18-36, ill., maps 339
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. -  
[Ottawa : EPS, 1984], p. 60-74, ill. 632
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. -  
[Ottawa : EPS, 1984], p. 208-228, ill. 132
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. -  
[Ottawa : EPS, 1984], p. 278-294 304
- Proceedings of the Seventh Annual Arctic Marine Oilspill Program Technical Seminar, June 12-14, 1984, Edmonton, Alberta. -  
[Ottawa : EPS, 1984], p. 367-392 226
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 9-13, ill., maps 345
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 14-19, ill., map 177
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 24-29 667
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 30-31 731
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 32-51, ill. 225
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 59-64, ill., maps 528
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 263-279, ill., maps 120
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 280-291, ill., maps 109
- Proceedings of the Sixth Annual Arctic Marine Oilspill Program Technical Seminar, June 14-16, 1983, Edmonton, Alberta. -  
[Ottawa : EPS, 1983], p. 292-295, map 98
- Proceedings of the Tenth Annual Aquatic Toxicity Workshop, November 7-10 1983, Halifax, Nova Scotia / Edited by P.G. Wells  
and R.F. Addison. Canadian technical report of fisheries and aquatic sciences, no. 1368, p. 11-26, ill. 157
- Proceedings of the Tenth Annual Aquatic Toxicity Workshop, November 7-10 1983, Halifax, Nova Scotia / Edited by P.G. Wells  
and R.F. Addison. Canadian technical report of fisheries and aquatic sciences, no. 1368, p. 437-438 623
- Proceedings of the Third International Biodegradation Symposium / Edited by J.M. Sharpley and A.M. Kaplan. - London :  
Applied Science Pub., 1976, p. 79-85, map 63
- Proceedings of the Thirty-fifth General Meeting of the Society for Industrial Microbiology held at Houston, Texas, August 14-18,  
1978 / Edited by L.A. Underkofler. Developments in industrial microbiology, v. 20, 1979, p. 497-502, maps 609
- Proceedings of the Thirty-fourth General Meeting of the Society for Industrial Microbiology held at East Lansing, Michigan,  
August 21-26, 1977 / Edited by L.A. Underkofler. Developments in industrial microbiology, v. 19, 1978, p. 517-522, ill. 316
- Programme and proceedings of the annual meeting - Canadian Federation of Biological Societies, v. 19, 1976, p. 47 127
- Publication - University of Toronto. Institute for Environmental Studies, EE 8 342
- Publication - University of Toronto. Institute for Environmental Studies, EE 14 419

Publikasjon - Institutt for Kontinentalsokkelundersokelser, nr.112	69
Rand paper series - Rand Corporation, P- 6620, 1981	406
Recovery potential of oiled marine northern environments. Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 585-590, tables, charts	66
Recovery potential of oiled marine northern environments. Journal of the Fisheries Research Board of Canada, v. 35, no. 5, May 1978, p. 608-614, tables	602
Report - American Petroleum Institute, no. 4370, Oct. 1983	399
Report - Battelle Memorial Institute. Pacific Northwest Laboratories, no. PNL-SA-8134	71
Report - United States. Coast Guard, CG-D-114- 75	707
Report - United States. Coast Guard, CG-D-155- 75	455
Report - United States. Coast Guard, CG-D-30-83	697
Report - United States. Coast Guard, CG-D-96-75	321
Report - United States. Coast Guard, CG-TR-79-02	22
Report - United States. Coast Guard, 734108	469
Report - United States. Environmental Protection Agency, EPA-600/3-76-086, p. 1-292	248
Report - United States. Environmental Protection Agency, EPA-600/3-79-041	34
Report - United States. Environmental Protection Agency, EPA-600/3-81-018	650
Report of activities, part A. Paper - Canada. Geological Survey, 77- 1A, p. 523-524, map	407
Report series - Bedford Institute of Oceanography, BI-R-79- 3	380
Report series - Bedford Institute of Oceanography, BI-R-80- 3	721
Report STF-21A82101	631
Research in fisheries, 1973, p. 57	374
Resource publication - U.S. Fish and Wildlife Service, no. 96	111
Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 122	85
Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 51-52	494
Science in Alaska 1972 : proceedings, Twenty-third Alaska Science Conference, Fairbanks, Alaska, August 15 to August 17, 1972. - College, Alaska : Alaska Division, American Association for the Advancement of Science, 1972, p. 51	589
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 172	100
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 184	472
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976 / Edited by G.C. West. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1976], vol. I, p. 173	656
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 112-120	64
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 357-365, ill., map	320
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 229-260, ill., map	389
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 261-287, ill.	453
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 208-295, ill., map	633
Science in Alaska 1976 : proceedings of the Twenty-seventh Alaska Science Conference, Fairbanks, Alaska, August 4-7, 1976. - Fairbanks, Alaska : Alaska Division, American Association for the Advancement of Science, [1978], vol. II, p. 366-376, ill.	657

- Science of the total environment, v. 8, no. 1, 1977, p. 13-20, ill. 647
- Science, v.181, July 6, 1973, p. 56-58, map 139
- Science, v.186, Nov. 29, 1974, p. 843-845 74
- Science, v.186, Nov. 29, 1974, p. 845-846 454
- Science, v.191, Mar. 5, 1976, p. 929-931, map 159
- Science, v.220, May 20, 1983, p. 871-873, ill. 375
- Scientific series - Inland Waters Directorate, no. 29 571
- Scientific series - Inland Waters Directorate, no. 50 626
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 203-211 114
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 58-73, maps 254
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 132-154, ill., maps 262
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 17-32, ill., maps 369
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 87-104, maps 385
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 10-16, maps 504
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 167-192, ill., maps 520
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 193-202, ill. 534
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 74-85, ill. 576
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 33-57, ill., maps 693
- Scientific studies during the "Kurdistan" tanker incident : proceedings of a workshop, June 26 and 27, 1979, Bedford Institute of Oceanography / Edited by J.H. Vandermeulen. - Dartmouth, N.S. : Bedford Institute of Oceanography, Marine Ecology Laboratory, 1980, p. 105-119, ill. 720
- Sea grant report, College, 76- 9 246
- Sea grant report, College, 77- 14, p. 70-76 247
- Sources, effects and sinks of hydrocarbons in the aquatic environment : proceedings of the symposium, American University, Washington, D.C. - Washington, D.C. : American Institute of Biological Sciences, 1976, p. 447-462, ill. 269
- Sources, effects and sinks of hydrocarbons in the aquatic environment : proceedings of the symposium, American University, Washington, D.C. - Washington, D.C. : American Institute of Biological Sciences, 1976, p. 395-406 594
- Spill technology newsletter, v. 2, no. 2, Mar.-Apr. 1977, p. 13-22, ill. 92
- Spill technology newsletter, v. 2, no. 3, May-June 1977, p. 33-52, ill., maps 408
- Spill technology newsletter, v. 2, no. 6, Nov.-Dec. 1977, p. 21-27, ill., map 386
- Spill technology newsletter, v. 3, no. 2, Mar.-Apr. 1978, p. 22-31, figures, table 507
- Spill technology newsletter, v. 3, no. 2, Mar.-Apr. 1978, p. 37-41, tables 393
- Spill technology newsletter, v. 4, no. 3, May-June 1979, p. 160-161 686
- Spill technology newsletter, v. 4, no. 5, Sept.-Oct. 1979, p. 304-313, ill., map 156
- Spill technology newsletter, v. 4, no. 6, Nov.-Dec. 1979, p. 325-328, map 684
- Spill technology newsletter, v. 5, no. 3, May-June 1980, p. 76-87, figures, tables 465

- Spill technology newsletter, v. 5, no. 5, Sept.-Oct. 1980, p. 131-136 420
- Spill technology newsletter, v. 5, no. 5, Sept.-Oct. 1980, p. 137-146, tables 687
- Spill technology newsletter, v. 6, no. 1, Jan.-Feb. 1981, p. 21-36, map, tables 95
- Spill technology newsletter, v. 6, no. 2, Mar.-Apr. 1981, p. 44-45 280
- Spill technology newsletter, v. 6, no. 3, May-June, 1981, p. 120-146, figures, tables 118
- Spill technology newsletter, v. 7, no. 6, Nov.-Dec. 1982, p. 150-158, figures, table 279
- Spill technology newsletter, v. 8, no. 1, Jan.-Feb. 1983, p. 4-10, ill. 18
- Spill technology newsletter, v. 8, no. 2, Mar.-Apr. 1983, p. 22-27, figures 344
- Spill technology newsletter, v. 8, no. 3, May-June 1983, p. 50-77, figures 117
- Spill technology newsletter, v. 8, no. 4, July-Aug., 1983, p. 92-94 635
- status report on polar bear studies in Lancaster Sound / R.E. Schweinsburg, I. Stirling, S. Oosenbrug, and H. Kiliaan. - [Yellowknife, N.W.T.] : Northwest Territories Fish and Wildlife Service, 1977, p. 1-27 [i.e., 59-90], maps 515
- Technical bulletin - Inland Waters Directorate, no. 68 162
- Technical paper - Oregon. State University, Corvallis. Agricultural Research Station, no. 6556 54
- Technical report - Beaufort Sea Project, no. 5 660
- Technical report - Beaufort Sea Project, no. 10 124
- Technical report - Beaufort Sea Project, no. 11 554
- Technical report - Beaufort Sea Project, no. 12c 323
- Technical report - Beaufort Sea Project, no. 13 740
- Technical report - Beaufort Sea Project, no. 27 508
- Technical report - Beaufort Sea Project, no. 28 604
- Technical report - Beaufort Sea Project, no. 29 12
- Technical report - Beaufort Sea Project, no. 33 690
- Technical report - Beaufort Sea Project, no. 35 728
- Technical report - Beaufort Sea Project, no. 36 727
- Technical report - Beaufort Sea Project, no. 38 741
- Technical report - Beaufort Sea Project, no. 39 483
- Technical report - Beaufort Sea Project, no. B5a 125
- Technical report - Coastal Research Division, Department of Geology, University of South Carolina, no. 12-CRD 307
- Technical report - Coastal Research Division, Department of Geology, University of South Carolina, no. 15-CRD 610
- Technology development report, EPS 4-EC-77- 5 509
- Technology development report, EPS 4-EC-77- 11 482
- Technology development report, EPS 4-EC-78- 9 29
- Technology development report, EPS 4-EC-81- 6 577
- Technology development report, EPS 4-EC-82- 1 244
- Technology development report, EPS 4-EC-82- 2 37
- Technology development report, EPS 4-EC-82- 3 395
- Technology development report, EPS 4-EC-82- 4 28
- Technology review, v. 75, no. 6, May 1973, p. 45-46 365
- Tenth Annual Offshore Technology Conference, 1978 : proceedings, volume 1. - Dallas, Tex. : Offshore Technology Conference, 1978, p. 97-104, maps 495
- Tenth Annual Offshore Technology Conference, 1978 : proceedings, volume 1. - Dallas, Tex. : Offshore Technology Conference, 1978, p. 261-266, ill., map 19
- Tissue, structural studies and other investigations on the biology of endangered whales in the Beaufort Sea / Edited by T.F. Albert. - Washington, D.C. : U.S. Bureau of Land Management, 1981, p. 945-953 17
- Training manual - Environmental Protection Service, EPS-6-EC-78 1 148
- Transactions of the American Fisheries Society, v.108, no. 1, Jan. 1979, p. 70-75 659
- Transactions of the American Fisheries Society, v.108, no. 4, July 1979, p. 408-414, ill. 489
- Transactions of the American Fisheries Society, v.109, no. 2, 1980, p. 224-228, ill. 138
- Transactions of the American Fisheries Society, v.109, no. 3, May 1980, p. 293-297, ill. 487
- Transactions of the American Fisheries Society, v.112, no. 2A, Mar. 1983, p. 205-211, ill. 488
- United States. Bureau of Land Management report no. BLM-YK-TE-81-006 182

- United States. Bureau of Land Management. Alaska Outer Continental Shelf Office technical paper, no. 9 182
- Verhandlungen - Internationale Vereinigung für Theoretische und angewandte Limnologie, v. 19, 1975, p.2172-2177 603
- Water pollution research in Canada, v. 10, 1975, p. 132-141, ill. 377
- Water Quality Parameters : a symposium cosponsored by the Canada Centre for Inland Waters and the Analytical Chemistry Division of the Chemical Institute of Canada, Burlington, Ontario, Canada, 19-21 November 1973. ASTM special technical publication, no. 573, p. 514-525, ill. 627
- Water, air and soil pollution, v. 11, no. 2, 1979, p. 139-152, ill. 200
- Wilson bulletin (Wilson Ornithological Society), v. 87, no. 4, Dec. 1975, p. 467-480, ill., map 724
- Working report - Baffin Island Oil Spill Project, 80- 1 282
- Working report - Baffin Island Oil Spill Project, 80- 2 104
- Working report - Baffin Island Oil Spill Project, 80- 3 188
- Working report - Baffin Island Oil Spill Project, 80- 4 742
- Working report - Baffin Island Oil Spill Project, 80- 5 145
- Working report - Baffin Island Oil Spill Project, 80- 6 220
- Working report - Baffin Island Oil Spill Project, 80- 7 461
- Working report - Baffin Island Oil Spill Project, 80- 8 205
- Working report - Baffin Island Oil Spill Project, 81- 1 283
- Working report - Baffin Island Oil Spill Project, 81- 2 103
- Working report - Baffin Island Oil Spill Project, 81- 3 190
- Working report - Baffin Island Oil Spill Project, 81- 4 526
- Working report - Baffin Island Oil Spill Project, 81- 5 122
- Working report - Baffin Island Oil Spill Project, 81- 6 223
- Working report - Baffin Island Oil Spill Project, 81- 8 203
- Working report - Baffin Island Oil Spill Project, 81- 9 204
- Working report - Baffin Island Oil Spill Project, 81- 10, p. 1-61 [i.e. 85-146], ill., map 403
- Working report - Baffin Island Oil Spill Project, 81- 10, p. 1-81, ill. 236
- Working report - Baffin Island Oil Spill Project, 82- 1 328
- Working report - Baffin Island Oil Spill Project, 82- 2 224
- Working report - Baffin Island Oil Spill Project, 82- 3 191
- Working report - Baffin Island Oil Spill Project, 82- 4 527
- Working report - Baffin Island Oil Spill Project, 82- 5 144
- Working report - Baffin Island Oil Spill Project, 82- 6 221
- Working report - Baffin Island Oil Spill Project, 82- 7, Part I 402
- Working report - Baffin Island Oil Spill Project, 82- 7, Part II 712
- Working report - Baffin Island Oil Spill Project, 82- 7, Part III 225
- Working report - Baffin Island Oil Spill Project, 83- 1 628
- Working report - Baffin Island Oil Spill Project, 83- 2 86
- Working report - Baffin Island Oil Spill Project, 83- 3 400
- Working report - Baffin Island Oil Spill Project, 83- 4 743
- Working report - Baffin Island Oil Spill Project, 83- 5 146
- Working report - Baffin Island Oil Spill Project, 83- 6 511
- Working report - Baffin Island Oil Spill Project, 83- 7, [Part I] 274
- Working report - Baffin Island Oil Spill Project, 83- 7, [Part II] 424
- 1972 Offshore Technology Conference, May 1-3 - Houston, Texas : preprints. - [Dallas, Tex.] : Offshore Technology Conference, 1972, v. 1, p.I- 129-I- 140, ill. 466
- 1972 Offshore Technology Conference, May 1-3 - Houston, Texas : preprints. - [Dallas, Tex.] : Offshore Technology Conference, 1972, v. 1, p.I- 390-I- 402, ill. 277
- 1973 Offshore Technology Conference, April 30-May 2 - Houston, Texas : preprints. - Dallas, Tex. : Offshore Technology Conference, 1973, v. 1, p.I- 233-I- 248, ill. 470