Proceedings
from the

WORKSHOP ON THE GREAT LAKES CONTMINATED SEDIMENTS CLEANUP PROGRAMS

May 6 & 7, 1991
BURLINGTON, ONTARIO

INTRODUCTION

The summary notes for Day 1 - Removal Technologies, and the Workshop Groups, were drawn up by an attendee working with the National Water Research Institute.

The enclosures in Day 2 - Treatment Technologies, were submitted by the respective organizations in response to a request for information relating to their presentations and participation in the workshop. The request was made through COSTTEP.

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LIST OF ABBREVIATIONS

AOC - Area of Concern

ARCS - Assessment and Removal of Contaminated Sediment

CDF - Confined Disposal Facility

COSTTEP - Contaminated Sediment Treatment Technology Program

ETWG - Engineering and Technology Work Group

NWRI - National Water Research Institute

ENVIRONMENT CANADA
GREAT LAKES CLEANUP FUND

WORKSHOP ON THE GREAT LAKES CONTAMINATED SEDIMENTS CLEANUP PROGRAMS

MAY 6 & 7, 1991
HOLIDAY INN, BURLINGTON, ONTARIO

DAY 1 (MAY 6): REMOVAL TECHNOLOGIES

AGENDA

0830	WELCOME - I. ORCHARD, ENVIRONMENTAL PROTECTION, ENVIRONMENT CANADA
0840	GREAT LAKES CLEANUP PROGRAMS OVERVIEW - D. STEWART, GREAT LAKES ENVIRONMENT OFFICE
0900	ENVIRONMENT CANADA CONTAMINATED SEDIMENT REMOVAL PROGRAM - I. ORCHARD
0920	OVERVIEW OF SEDIMENT CONTAMINATION IN CANADIAN AREAS OF CONCERN - G. KRANTZBERG, ONTARIO MINISTRY OF THE ENVIRONMENT
0940	U.S.A. SEDIMENT REMOVAL RESEARCH - RUSS TILLMAN, U.S. CORPS OF ENGINEERS
1000	QUESTION PERIOD
1015	COFFEE
1035	CURRENT CANADIAN PRACTICES AND PROGRAMS RELATING TO DREDGING AND DISPOSAL - A. KHAN, PUBLIC WORKS CANADA
1055	CASE STUDY - WELLAND RIVER DEMONSTRATION PROJECT - P. MILES, ACRES INTERNATIONAL
1120	CASE STUDY - COLLINGWOOD HARBOUR - G. KRANTZBERG, ONTARIO MINISTRY OF THE ENVIRONMENT
1145	CASE STUDY - PORT HOPE HARBOUR - S. WESTON, ENVIRONMENT CANADA AND D. MAIN, ATOMIC ENERGY OF CANADA LTD.
1210	INSTRUCTIONS FOR AFTERNOON SESSIONS - I.ORCHARD
1230-1330	LUNCH
1330	WORKSHOP GROUPS
1530	COFFEE
1600	PLENARY - WORKSHOP GROUP REPORTS
1645	FINAL COMMENTS

ENVIRONMENT CANADA
GREAT LAKES CLEANUP FUND

WORKSHOP ON THE GREAT LAKES CONTAMINATED SEDIMENTS CLEANUP PROGRAMS

MAY 6 & 7, 1991
HOLIDAY INN, BURLINGTON, ONTARIO

DAY 2 (MAY 7): TREATMENT TECHNOLOGIES

AGENDA

0830	WELCOME - CRAIG WARDLAW, WASTEWATER TECHNOLOGY CENTRE
0840	ENVIRONMENT CANADA CONTAMINATED SEDIMENT TREATMENT TECHNOLOGY PROGRAM - CRAIG WARDLAW
0900	ENVIRONMENT CANADA SEDIMENT ASSESSMENT PROGRAM - MIKE ZARULL, NWRI, ENVIRONMENT CANADA
0920	U.S.A. SEDIMENT TREATMENT INITIATIVES - STEVE YAKSICH, U.S. ARCS TECHNOLOGY WORK GROUP
0940	ONTARIO TECHNOLOGY PROGRAMS - DOUG VALLERY, ONTARIO MINISTRY OF THE ENVIRONMENT
1000	QUESTION PERIOD
1015	COFFEE
1035	BENCH SCALE TREATMENT DEMONSTRATION CASE HISTORY - ECOLOGIC TREATMENT UNIT, DOUG HALLETT
1100	PILOT SCALE TREATMENT DEMONSTRATION CASE HISTORY - TORONTO HARBOUR COMMISSION SOIL/SEDIMENT CLEANING PILOT PLANT, DENNIS LANG
1125	INFORMATION FOR TECHNOLOGY VENDORS - CRAIG WARDLAW
1145	INSTRUCTIONS FOR AFTERNOON SESSIONS
1200-1315	LUNCH
1315	WORKSHOP GROUPS
1530	COFFEE
1600	PLENARY - WORKSHOP GROUP REPORTS
1645	FINAL COMMENTS

ENVIRONMENT CANADA

GREAT LAKE CLEANUP FUND

WORKSHOP ON THE GREAT LAKES CONTAMINATED SEDIMENTS CLEANUP PROGRAM

May 6, 1991

SUMMARY OF PRESENTATIONS

Prepared By : Karen Zinkweg

GREAT LAKES CLEANUP PROGRAMS OVERVIEW

PRESENTED BY: DONNA STEWART,
GREAT LAKES ENVIRONMENT OFFICE

Great Lakes Action Plan will take place between 1990/91 and 1993/94. Incorporating a Preservation Program, Cleanup Fund, and Health Effects Program with funding of 50, 55, and 20 million dollars respectively, totalling 125 million dollars.

The breakdown of cost for the Cleanup Fund is as follows:

YEAR	ORIGINAL ($ Millions)	RE-PROFILES ($ Millions)
1990/91	5	5
1991/92	10	8
1992/93	15	10
1993/94	25	32
TOTALS	55	55

The Great lakes Cleanup Fund principles are as follows: polluter pays, pollution prevention, zero discharge, ecosystem approach, and partnerships. The approach consists of AOCs specific projects and generic projects. The Great Lakes Cleanup Funds priorities are as follows: contaminated sediments, wastewater technology, habitat rehabilitation, non-point sources, and communication.

Contaminated Sediments will exhaust $2,200,000 between 1990- 1994, evaluating, developing, demonstrating, assessing and communicating technologies.

ENVIRONMENT CANADA, CONTAMINATED SEDIMENT REMOVAL PROGRAM

PRESENTED BY : IAN ORCHARD,
ENVIRONMENT CANADA, EP-OR

The Great Lakes Action Plan is a five year plan focusing on the improvement of AOCs water quality and uses. The Great Lakes Clean-up Fund in one component of the action plan. It purpose is to develop and demonstrate technologies, funding remedial programs, and meet Federal responsibilities in the AOCs. The Great Lakes Cleanup Fund has three major programs focusing of contaminated sediment, removal, treatment and assessment.

The program intent is not to actually clean-up AOCs but to evaluate and demonstrate technologies capable of undertaking full-scale clean-ups.

The contaminated sediment removal technology demonstration program has been separated into several phases:

* Request for expressions of interest
* Request for proposals
* Review and assess technologies
* Focus on Manufactures & Developers of equipment
* Selected demonstration sites
* Comprehensive proposals
* Removal, handling, transport & pre-treatment

The program consists of the following:

* Inventory & Classification of equipment
* Selection of suitable technologies
* Demonstration sites
* Evaluation of criteria
* Operation & performance standards
* Regulatory & legal requirements
* Environmental Audit

U.S.A. SEDIMENT REMOVAL INITIATIVES

PRESENTED BY : RUSSELL K. TILLMAN,
U.S. ARCS PROGRAM

Analysis of Dredged Material Placed in Open Waters

Calculate boundary layer fluid properties and sediment motion for analyzing behaviour of open-water disposal areas, using field data sets. Improve on and develop new techniques to predict short and long term fate of dredged material.

Material Properties Related to Navigation and Dredging

Develop instruments and operating procedures for rapid surveys of fluid mud properties. Define navigable depth in fine-grain sediment. Develop instruments for analyzing properties of consolidated sediments. Establish dredging-related soil and rock descriptors.

Dredge Plant Equipment and System Processes

Improve dredge head design for dredging compacted fine sand and cohesive mud. Improve jet pump designs for sand bypassing operations. Develop systems to increase dredge payloads for fine-grain sediments. Design portable single-point mooring buoy for hopper dredge direct pump-out.

Vessel Positioning, Survey Controls, and Dredge Monitoring Systems

Develop real-time system for measuring project site tide and wave conditions in offshore open waters. Develop three-dimensional positioning system for dredging and hydrographic surveying operations using GPS satellite constellation. Evaluate productions meters used in various dredging situations. Develop automated inspection monitoring and reporting system for use on any type of dredge.

Management of Dredging Projects

Evaluate the effects of dredging decisions and project changes. Optimize use of open-water disposal sites. Analyze dredging cost-estimating techniques. Prepare dredging Manuals incorporating state-or-the-art technology.

CURRENT CANADIAN PRACTICES AND PROGRAMS RELATING TO DREDGING AND DISPOSAL

PRESENTED BY : ANSER KHAN,
PUBLIC WORKS CANADA

Recent Federal regulatory developments include: Federal Environmental Assessment and Review Process (EARP), Canadian Environmental Protection Act (CEPA), and Fish Habitat Policy (Fisheries Act). These policies are managed jointly by Department of Fisheries and Oceans (DFO) and Ministry of Natural Resources (MNR).

Provincial Regulations consists of the Proposed Sediment Quality Guidelines (SQGs), consisting of:

No-Effect Level:	No toxic effects observed on aquatic organism; all biological resources protected; water quality and use guidelines met.
Lowest Effect Level:	Level of sediment contamination tolerated by majority of benthic organisms; lowest level at which ecotoxic effects are determined.
Limit of Tolerance:	Levels at which pronounced disturbance of bottom dwelling community expected; detrimental to majority of benthic species.

The SQGs can be applied to lake-filling, sediment monitoring, remedial action plans, dredged material disposal, habitat restoration of protection and spills cleanup.

The SQGs will be used to evaluate open-water disposal for any material removed form the bottom of a watercourse. Analyses are to be performed, the dredged material will have to meet the chemical quality requirement and disposal in open-water.

When the dredged material doesn't meet the open-water requirements, A decision for the disposal must be made. Options include un-restricted or restricted disposal on land, or disposals in Confined Disposal Facility (CDF).

CASE STUDY - WELLAND RIVER DREDGING DEMONSTRATION PROJECT

PRESENTED BY : PHIL MILES,
ACRES INTERNATIONAL LIMITED

An increasing awareness and concern for environmental issues on the part of Atlas Specialty Steels, over the past several years has resulted in the Company taking an active position to eliminate or minimize the impact of its Welland operation on the surrounding environment.

The Welland River Project is located in the Regional Municipality Of Niagara (RMON). Industrial waste has been found at three locations between RMON water treatment plant and the RMON Water Pollution Control Plant approximately 2 km further downstream.

Working with the Ministry of the Environment (MOE), numerous plant changes have been made to ensure all its operations meet government environmental regulations. In 1976, and 1979, wastewater treatment facilities were installed. Presently, process water, are treated and recycled within the plant.

A review and recommendations of appropriate cleanup technologies and preparation of a schedule for the cleanup formed part of the reef study carried out by Acres. Prior to removal

of any river contaminants, silt curtains and containment booms will be placed around the areas requiring remediation. Regular monitoring of downstream sediment loss and water quality will be carried out in compliance with government agency requirements.

The trial excavation would be used to address the following concerns:

* Excavation method efficiency and monitoring
* Contractor performance
* The effectiveness of silt curtains and containment booms
* The monitoring of downstream sediment loss and water quality
* The effectiveness of settling ponds and water treatment
* The selection of a suitable fixation agent

CASE STUDY - COLLINGWOOD HARBOUR

PRESENTED BY : DR. GAIL KRANTZBERG
ONTARIO MINISTRY OF ENVIRONMENT

The decision to situate the demonstration in Collingwood Harbour is based on the presence of material with characteristics representative of other Areas of concern (AOC). In addition, since not a lot is known of the performance of the modified dredges in the Great Lakes, the substantial area of clean sediment in the harbour promotes the site as a control location.

To facilitate discussion on the proposed demonstration project, the following summarizes the interests expressed by the RAP Team, PAC and the community. This project would support several of the use goals identified in the RAP.

Specific interest in this project has been expressed by the Collingwood Terminals, since dredging would enhance grain handling and vessel entry. The Collingwood shipyards have contaminated sediment in their slips, and removing it now would avoid future problems. The Town of Collingwood supports the demonstrations if the Harbour is to be de-listed as an AOC.

Dredging Collingwood harbour now could remove future restrictions on dredging and eliminate dredged sediment disposal restrictions as a possible use impairment as suggested by the International Joint commission (IJC).

Sediment collected within the shipyard's dry dock and launch basin has concentrations of Zn and Pb that exceed the Ministry's severe effects level and would be of concern if this material was acting as a source to the harbour.

CASE STUDY - PORT HOPE HARBOUR

PRESENTED BY: SANDRA WESTON
ENVIRONMENT CANADA, EP-OR

Port Hope Harbour has been designated as an Area Of Concern (AOC), located on the North shore of Lake Ontario. The Harbour consists of a turning channel and an entrance basin. The major industry is Cameco's Refinery operations which is located on the turning basin. In addition Port Hope Yacht Club located on the north east corner.

The harbour contains approximately 90,000 m^3 contaminated sediment, concentrations of uranium and thorium series radionuclides, heavy metals & PCBs are found in the Turning basin,

however, concentrations are highest in the southwest corner.

Contamination is believed to be primarily the result of waste management practices associated with radium and uranium refining operations in Port Hope prior to 1948.

Stage I Report has been completed and approved by COA. It is imperative to note that the radionuclide content in the sediments of the turning basin and west slip require that storage and disposal of any removed sediments be in a low level radioactive waste management facility licensed by the Atomic Energy Control Board (AECB).

The remediation of Port Hope Harbour is a joint effort to clean up the harbour by several groups that have the common goal of developing an environmentally sound plan which reflects the views of the Port Hope community.

CASE STUDY - PORT HOPE HARBOUR

PRESENTED BY: DENNIS MAIN,
LOW LEVEL RADIOACTIVE WASTE MANAGEMENT OFFICE

Studies to Date:

Field Char., Conceptual Design and Cost Estimate (July 1987)

MacLarentech Inc., Canadian Dredge, and Golder Assoc. provided a dredging feasibility study, water quality impact estimate, and determined if wastewater treatment was required.

Completed By SENES Consultants Limited.

Environmental Assessment of Dredging (October 1987)

Development of Cleanup Criteria (June 1987)

Conceptual Cleanup Wastewater Treatment Plant (June, 1990)

Developed conceptual plant and a cost estimate.

Project Components

* Regulatory Approval & Liaison
* Community Consultation & Liaison
* Environmental Monitoring
* Health Physics & Contamination Control
* Safety and Emergency Response
* Design and Construction Management
* Field Operations:
  - Studies
  - Construction
  - Decommissioning/Restoration
* Waste Disposal.

Regulatory Liaison

* Atomic Energy Control Board
* Environment Canada
* Ontario Ministry of the Environment
* Transport Canada
* Small Craft Harbours
* Fisheries and Oceans.

WORKSHOP GROUPS

PORT HOPE HARBOUR

SANDRA WESTON

TRANSPORTATION OF RADIOACTIVE MATERIALS

Concerns were raised about Transportation laws with regards to shipment of materials, specialized type of containers, Emergency Response, and Treatment.

PREFERRED LOCATION OF PROJECT

The location should be close to shore, preferable on the Northern shore, however the east has the closet access. A location of shallow depth with contaminated material is also desirable.CLEAN UP CRITERIA

The clean up method should not be a hazard. Efficiency of sediment technology and structure stability should be assessed.

AECB LICENSED WORKERS

Training and licence must be acquired for certain tasks and activities. Precautions should be taken for spills and leaks, by using spill barriers. Showers facilities for workers should be available.

HAMILTON HARBOUR

TOM MURPHY

SCREENING: The Environmental Assessment Review Process (EARP) should be used as a guideline. Baseline conditions should be included in the proposal to ensure that your action plan does not give a negative environmental impact on "clean" areas. Environmental and regulatory approvals are obtained from MOE, Fisheries, Environmental Canada, and Stakeholders (RAP)/(PAC).

PRETREATMENT: Separation by means of hydrocyclones. Using a hydraulic dredge, will liquids require treatment? Will sewage treatment plant take contaminated fluids?

DISPOSAL: Storage will be available in the CDF for one year.

MONITORING: Pilot Scale will be monitored for suspended solids, air emissions, specific for each protocol.

TRANSPORT: Distance from demonstration site.
Method of travel - barge.
Health and Safety.
Contingency Plans.

COLLINGWOOD HARBOUR

DR. GAIL KRANTZBERG

Flows tend to circulate in a counter clockwise direction, with greatest mixing at the mouth of the approach channel and poorest mixing in the southern portion of the harbour. Sources to the harbour are the sewage treatment plant and Blackash Creek.

Treatment, for the most part, is not relevant to Collingwood Harbour sediment. One possibility is pre-treatment to maximize solids to liquid ratios. An additional possibility is

to treat metal contaminated sediment form the Shipyard ships.

Public Works is currently acquiring the data for sediment thickness. All of the west side of the harbour has sediment below the lowest effect level. Sediment in the central and eastern areas marginally exceed the lowest effect level in some locations.

The wetlands in the southwest perimeter of the harbour were classified as Class 2 wetlands in 1986.

Negotiations with the grain terminals and Canadian Steamship Ltd. for participation in the project is ongoing. The Deputy Commissioner of the Town supports the project and is acquiring commitment form the Town to be a partner in the demonstration. The Public Advisory Committee of the RAP is anxious to see the project to completion since removal of sediment that exceeds the lowest effect level can assist in delisting Collingwood Harbour as an Area of Concern.

WELLAND

PHIL MILES

Pre-Demonstration Studies

Baseline sediment data was collected in three phased river investigations and in a floodplain study. Chemical / physical data were documented in two reports with a third in preparation.

River water quality data is to be determined prior to dredging program.

Bioassays are being carried out by MOE on river sediment. Bioassays and bio-monitoring are to be carried out by Environment Canada.

An Environmental screening document is in preparation as a requirement of EARP.

Numerous permits/approval are necessary to carry out the demonstration. Agencies include local city/municipality, MOE, MNR, Transport Canada, and Niagara Peninsula conservation Authority.

Removal

Approximately 30,000 m^3 of contaminated river sediment is to be removed, 1,000 m^3 will be removed in the demonstration project.

The preferred location for the demonstration is to use an upstream area so as to avoid recontamination during the larger river cleanup.

The Welland river is shallow and isolated requiring portable equipment.

Containment measures include silt screens/curtains and oil booms, this will depend on nature of contamination for other projects.

Water quality monitoring before, during, and after dredging, should include methods to determined dredging effectiveness.

Transport

Suction dredging in the Welland River will convey dredgate in a closed pipeline up to approximately 1.5 km.

Pretreatment and disposal options are presently being studied. Ultimate disposal site will be Atlas' Moe approved industrial waste disposal site approximately 2 km downstream from dredging site.

SUMMARY NOTES FROM CLEANUP FUND WORKSHOP, MAY 6 & 7, 1991.

DAY 1

INTRODUCTION PRESENTATIONS
IAN ORCHARD of ENVIRONMENTAL PROTECTION
G. SHERBIN of GREAT LAKES ENVIRONMENT OFFICE

Clean Up Fund is a five year program extending from 1990 to 1995.

Funds allocated: 1990/91 $5 million
1991/92 $10 million
1992/93 $15 million
1993/94 $20 million

Principles of Clean Up Fund:
- Polluter Pays
- Pollution Prevention
- Zero Discharge
- Ecosystem Approach
- Partnerships

Approach:
- AOC Specific Projects
- Generic Projects

Priorities:
- Contaminated sediments
- Wastewater technology
- Habitat rehabilitation (L. Superior, Hamilton Harbour)
- Non-point sources (Urban storm water/ Agricultural Runoff)
- Communication

Contaminated sediments (2.2 million 1990-1994):
- How clean is clean?
- Evaluate technologies
- Develop, demonstrate and assess remediation
- Communication
- Innovation, flexibility

3 Major Programs of Clean Up Fund:
1) Contaminated sediment removal
2) Treatment
3) Assessment

Stages of Clean Up:
- Request for expression of interest
- Request for proposals (Manufacturers of equipment)
- Review and assess technologies (focus on the manufacturers and developers of equipment)

Stages of Clean Up (continued):

Select demonstration sites (varied by types of contamination in sediments and applicability to other sites)
Inventory and classification of equipment
Select suitable technology and match with demonstration site
Evaluation criteria (Request for proposals document)

Operational and performance standards
Regulation and legal requirements
Environmental audit (by both contractor and an independent)

Demonstrations over a 5 day period (500-1000 m^3 removal)
Pre-demonstration study
Environmental screening document
Removal and transportation of material
Monitoring
Identify pre-treatment needs
Final report

Time Frame:

May 6 & 7: Workshop Information Session and distribution of Request For Proposals (RFP) document
June 10: Deadline for submission of RFP
June 10 to July 8: Review individual proposals
July 8: Select technologies and make decision of demonstration sites
July 19: Inform vendors of decision
July and August: Project planning
September: Demonstrations start
December 31: Final report due (flexible deadline)

GAIL KRANTZBURG of ONTARIO MINISTRY OF THE ENVIRONMENT

Evaluation procedure to establish areas of concern:

Establish severity of contamination
Examine options for restoration
Match with technologies
Compare current environmental conditions with current targets (chemical and environmental) and biological information
Classification: severe - removal and enforce immediate action
intermediate - site dependent
marginal - no immediate concern
Scientific information and policy decision: Removal depends on local consensus

Areas of Concern (Severe Chemical Contamination):

Thunder Bay: creosote, PAHs
Peninsula Harbour: mercury
St. Mary's River: coal tar, PAHs, oil and grease

Areas of Concern (Continued):
Hamilton Harbour: coal tar, PAHs, oil and grease, metals, some PCBs
Toronto Harbour: PCBs, metals (Humber River), radioactive wastes (Inner Harbour)
Port Hope: radioactive wastes

Things to consider when contemplating sediment removal:
Physical properties of the sediment
High risks of contaminants
Strength, water content of sediments

Depositional zones in the water basin: sediment of low stress, fine texture, high organic and high water content would have a high spillover capacity and may contaminate other, clean regions. In this case, hardening of sediment may be necessary to facilitate removal.

In the Interim: wait for technology development

Starting Points to Determine Targets:
No Effect: according to biological guidelines
Lowest Effect: 95% of benthos unaffected
Severe effect: 95% of benthos impaired

RUSS TILLMAN of U.S. ARMY CORPS OF ENGINEERS

Assessment and Removal of Contaminated Sediment: U.S. equivalent to the Clean Up Fund Program
Considers both treatment and removal of sediment in Great Lakes

Dredging Research Program: began in 1988, 7 year program
Examines the physical and mechanical aspects of dredging (Another program studies the environmental effects of dredging)

Objectives (to save money and enhance the environment):

(1) Analysis of the fate of dredged material in the open waters; will it migrate into environmentally sensitive areas
Developing PC Based disposal model
Developing long term/short term prediction models: currents, waves, tidal patterns

(2) Underlying material properties with respect to navigation management: depth, soil and rock composition

(3) Efficiency of dredges: improved drag head design, systems for monitoring, single pore design

Objectives (to save money and enhance the environment):

(4) Increase the capacity of CDFs: separate the water and fine grained sediment (hydrocyclone), improve site location (if disposed into open water: add an automatic inspection and monitoring system for the effect of wave actions)

(5) Management: optimize and take inventory of open water disposal sites, study capping in open water (developed from case studies, ie, Seattle; controlled release from cap)

Available information about this program:
- Published technical notes
- PC Programs
- Workshops
- Information Bulletin: Dredging Research

ANSRA KHAN of PUBLIC WORKS CANADA

All Clean Up Projects should follow the guidelines stated by:
- Federal and Provincial Acts
- Great Lakes Water Quality Agreement
- Open Water Disposal Guidelines (concentration of metals and organics that render sediment unfit for open water disposal)
- MOE Guidelines for Physical, Chemical and Biological Tests for extent of contamination (severe, intermediate or marginal) and to determine if sediment should be disposed of in a CDF

Locations of Major CDFs:
- Thunder Bay, Collingwood, Walpole Island, Oshawa, Hamilton

Environmental Assessment Review Process:
- SEPA: ocean dumping act
- Fisheries Act: protect fish habitat
- Ministry of Natural Resources: seek approval that fish habitat has not been affected
- Ministry of the Environment: improve open water guidelines to improve ecology of the area. New guidelines, new allowable limits.

Sites to be dredged in the immediate future: Collingwood Harbour, Port Hope Harbour
- Sediment will be placed in CDFs and treated

Types of CDFs:

Walpole Island: Lake St. Clair and St. Clair River

Empty contaminant into small cell, decants into reservoir, pump into the main cell, clean, flow back into the water body. Contaminant remains in CDF, capped with clean mud. No threat to the environment is evident, there is no effect of mercury leakage (main concern, some PCBs)

Hamilton Harbour: Disposal cells: main cell, reservoir cell.

Thunder Bay: (20 - 25 year design life)

Multicellular. Contaminated mud pumped into the interior cell, when full topped off with clean mud, gassed, closed off

PHILIP MILES of WELLAND RIVER DEMONSTRATION PROJECT

Welland River is the site chosen for the pilot clean up project for the fall of 1991, 500-1000 m^3 of sediment will be removed.

Welland River has been identified with zones of high Cr, Ni, Cu, Mn, Pb, Fe, oil and grease contamination. They are sizeable historical deposits (before 1976) from 2 sewer outfalls and the outfall of Atlas Specialty Steel. There are dead zones of no plants or benthic animals at the contamination zones.

3 Areas of Concern:

Offshore and downstream from McMaster Outfall pipe (1400 m^3)
Offshore and downstream of Atlas Mansfield Outfall Pipe (2700 m^3)
Downstream (1000 m^3)

Clean Up Committee Members:

Federal, Provincial, Regional and Municipal Governments
Public Advisory Committee of the RAP
Atlas Specialty Steel
Acres International (consulting firm)

According to the old sediment contamination guidelines, 5100 m^3 needed to be removed, but with the new guidelines, there is 30000 m^3 of severely contaminated sediment. The lowest effect level measured is higher than the upstream ambient level. Therefore, bioassays are currently being performed to see if the ambient levels are acceptable biologically.

Sediment from the site is a loose silt/clay deposit. Removal technique is a suction dredge with the modifications of a barge mounted hydraulic clamp, horizontal auger and a land based hydraulic clamp. The maximum depth of removal is 4½ m. The dredge

is similar to the Mudcat Dredge although it is smaller and portable. This type of dredging was proposed to be the best option because it would result with the least environmental damage, less restoration will be required and the sediment movement into the water column will be minimized, reducing the possibility of movement downstream.

4 Phases of the Pilot Scale Demonstration:

(1) Equipment Design and Environmental Screening:
Modifications made to Mudcat dredge.
Impacts during future clean up can be identified and mitigated.

(2) Clean Up Specifications and Dredge Fabrication

(3) Dredging Demonstration and Environmental Monitoring
Water quality measurements made before, during and after demonstration.
Dredge tested in clean sediment first to see if it is operating properly.
Ongoing Biological Assessment: bioassay and biomonitoring; before, during and after.

(4) Project Assessment
Final Report including environmental assessment of work, and assessment of equipment and cost (5100 m^3 will cost $1.5 million)

GAIL KRANTZBURG of MINISTRY OF THE ENVIRONMENT, COLLINGWOOD HARBOUR STUDY

The large concern of Collingwood Harbour is eutrophication rather than contamination. There is however little historical Zn and Pb levels from historical ship building and Blue Mountain Pottery operations. The Zn levels in the dry dock area are 1000 ppm which is greater than the lowest effect level. Tests are currently being performed to determine if there are any biological problems at this level. PCB levels also exceeded the lowest effect levels but there were no biological effects observed in the regions of PCB contamination.

The harbour is quite shallow; a depth of 2 feet in the turning basin and the deepest measured depth was 2 m in the area where the dredging is proposed. The benthic community is plentiful: 2-5000 benthos/m^2. Biological tests being performed in the field and lab (Hexagenia and mussels) show that the sediment in the potential dredging location is as clean as the control, rendering it a good location for a demonstration site. If the operation does not work, there will be no negative consequences to the surrounding environment. If, however, the operation does work, the next step

would be to dredge from the contaminated CSL property and fill the dredged hole with clean mud from elsewhere in the harbour.

Constraints to the Demonstration Project:

Class 2 wetland containing protected game extends into the harbour.
Navigational marker.
Dredge capabilities: removal of 10000 m^3 of soft sediment that cannot be remobilized, difficult at shallow depths.

Partners in the Demonstration Project:

CSL
Collingwood Terminals
Public Works

SANDRA WESTON, PORT HOPE HARBOUR RAP COORDINATOR

Port Hope Harbour is located on the north shore of Lake Ontario. Its sole industry is Cameco, a refinery, located on the west side of the turning basin. A Yatch Club is located at the north east corner of the turning basin, restricting its access. Contamination extends 90 000 m^3 in the turning basin and west slip.

Contamination in Port Hope is mainly radioactive: radium, uranium, thorium, poloninm and lead isotopes, with some PCB's and heavy metals. 95% of the contamination is found in the turning basin. The contamination is historical, dating back before 1948. Historically, waste was stored in low level radioactive waste facilities. Presently, no such facility is available. Low level radioactive wastes are detected in landfill sites.

Other groups working interactively with the Port Hope Harbour RAP:

Atomic Energy Control Board
Federal Government: Low Level Radioactive Office
Energy Mines and Resources
Community Groups
Department of Fisheries and Oceans
Transport Canada
Small Craft Harbours

DENNIS MAIN of LOW LEVEL RADIOACTIVE WASTE MANAGEMENT PROGRAM, PORT HOPE ONTARIO

Clean Up Demonstration Project 1987-88

230 m^3 contaminants on the land were removed
Clam shell dredging was used followed by hydraulic dredging.
Dredging occurred in a confined space/test cell in the harbour.

Contaminant release and fate of contaminants was examined. This small scale dredging project was practice for working with contaminated sediments.

Phase 2 Dredging Project is under deliberation right now.
Will test residual contamination, and similar parameters as before, ie. water quality
Instead, this project will take place in the turning basin, extracting moderately contaminated sediment.

A sheet metal wall, extending 1½ m above the water surface will be used to mark out a test cell 5 m^2 in area.
Bench scale water treatment will be performed with the extracted water to reach water quality concurrent to the drinking water guidelines.
6 - 7 L per second will be pumped out of the area.

Factors to be considered for the bench scale project:
Regulatory Approval and Liaison
Community Consulting and Liaison
Environmental Assessment
Waste Disposal

Total Cost for Bench Scale Demonstration:
$560 000 total cost
40% Construction Costs
26% Design and Engineering
20% Technical Support and Laboratory Expenses
9% Health Studies

WORKSHOP GROUPS

DAY 1 HAMILTON HARBOUR DR. TOM MURPHY

PRE-DEMONSTRATION STUDIES

Baseline data is available from the scientists, in NWRI Reports, journals, etc.

Documentation is available: metal, PAH and PCB concentrations from core and grab samples from Tom Murphy's reports. Ultrasonics; conductivity meter will detect metals

Screening Document: Jim Smith, chairperson for Ontario Environmental Assessment Review Process (ERP) in Toronto will distribute a guideline. State baseline conditions in your document to ensure that your action plan does not give a negative environmental impact on the "clean areas".

Environmental and Regulatory Approvals:
- Ministry of the Environment
- Department of Fisheries and Oceans
- Environment Canada
- Stakeholders (RAP)/Public Advisory Group
- ERP (will do an environmental review in all cases, even bench scale

REMOVAL

Volume: 500 - 1000 m^3 for bench scale
- For total clean up operation of Hamilton Harbour, 55000 m^3 contaminants needed to be removed/treated. Focus on the hotspot, shallow water, moving, source for other parts of the harbour, boats stir up sediment.
- Hydraulic dredge for most areas, clamp of some sort for solid portion of coal tar clumps (approximately 5%).
- Worst sediment is approximately 80 cm deep

Physical Properties:
- Soft sediment in most areas, lumps of coal tar near the outfall pipe. Some debris from historical dredging and dumping 200 m from the site of dredging.
- Need camera to map the bottom of the harbour.
- COD and BOD is high.
- Microbial counts are suppressed, toxic to <u>Bacillus</u> and <u>Photobacteria</u>.

Location for Demonstration:
- Hotspot must be dredged, ideal location for demonstration of previously tested and proven effective method. Demonstration of untested protocol should be in clean area, for example, Carroll's Point.
- Ottawa Street Slip: relatively isolated, could redirect water and confine the area.

Access to Dredge Location:
Open area, good access, only a marine dock, large lakers do not travel in the area.
Care must be taken so outfall pipes are not blocked.
Need permission from Stelco, J.I.Case, McKeel.

Type of Removal Technology:
Hydraulic dredge for 95% of the sediment
Clamp for 5% of the sediment
Less toxic sites: in situ treatment

Operational and Performance Standards:
Dredge can leave holes that fall in and re-contaminate sites.
Prevent residual from Pilot Scale operation
Caution of losses of hydrocarbons/volatiles from removed sediment
Sets of standards set by Ian Orchard that are specific for each site - available to contractors in the RFP form

Containment:
Enclose area to be dredged by steel walls

Monitoring Requirements:
Pilot scale: air emissions/volatiles, dusts, suspended solids around the site/turbidity of the water
Temperature, gas content and human health
Guidelines in RFP, specific for each site
Environmental audit by a government official to double check assessment by consultant
Bioassays

TRANSPORT

Containment of sediment in transport:
Distance of travel:
Physical Environment:

CDF before treatment
Concerns: Handling the sediment twice; to CDF and from CDF, located next to highway and bird colony, volatiles
Need some type of enclosed container with walls and a lid

Method of transport:
Barge, truck

Health and Safety:
Scott Pack with air supply
Protect all parts of skin from exposure
Anyone using Hamilton Harbour sediment should thoroughly examine the data and make up their own comprehensive safety guidelines for all workers

Contingency Plans:
Treat like a hazardous waste
Ask for help if concerned

PRE-TREATMENT

Separation:
Hydrocyclone: How clean is clean?

Solids vs. Liquids:
Hydraulic dredge: Need some type of treatment for the contaminated fluids. Will sewage treatment plant treat them?

Federal and Provincial Standards:
Permits may be needed. Check with ERP Toronto

DISPOSAL

Availability of Disposal Location:
Method of Disposal:
Disposal of concentrate?
High naphthalene content therefore can not dispose in an open pond, need a sealed box.

Linkage with Treatment Option:
Agreement made with the Hamilton Harbour Commission for storage in a CDF for one year. Treat stored material

Final Report:
December 31, 1991 flexible deadline

Day 2

CRAIG WARDLAW

WASTEWATER TECHNOLOGY CENTRE
ENVIRONMENT CANADA

GREAT LAKES

CLEANUP FUND

CONTAMINATED SEDIMENT TREATMENT

TECHNOLOGY PROGRAM (COSTTEP)

GREAT LAKES CLEANUP FUND

* A PROGRAM ESTABLISHED BY ENVIRONMENT CANADA IN 1990 TO FUND RESEARCH AND DEMONSTRATION PROJECTS RELATING TO THE CLEANUP OF THE GREAT LAKES

* IS DESIGNED TO PARALLEL PHASE 2 (SELECTION OF REMEDIAL OPTIONS) OF THE REMEDIAL ACTION PLAN PROGRAM

* ONE COMPONENT OF THE CLEANUP FUND IS AIMED AT CONTAMINATED SEDIMENTS

* ADMINISTERED BY ENVIRONMENT CANADA'S GREAT LAKES ENVIRONMENT OFFICE

COSTTEP

* WASTEWATER TECHNOLOGY CENTRE SELECTED BY THE GREAT LAKES ENVIRONMENT OFFICE TO ADMINISTER THIS PROGRAM

* COSTTEP INITIATED IN 1990 AND WILL CONCLUDE IN 1993

* THE GREAT LAKES CLEANUP FUND ALSO FUNDS SEDIMENT REMOVAL AND SEDIMENT ASSESSMENT PROGRAMS

* MANDATE IS

- TO DEMONSTRATE AND ASSIST IN THE DEVELOPMENT OF SEDIMENT TREATMENT TECHNOLOGIES,

- TO COMPILE A DATABASE OF TECHNOLOGIES,

- TO PREPARE A FINAL REPORT RECOMMENDING THE BEST TECHNOLOGIES FOR GREAT LAKES SEDIMENT REMEDIATION,

- TO COMMUNICATE THE RESULTS TO RAP TEAMS, OTHER GOVERNMENT AGENCIES AND THE PUBLIC

* DEMONSTRATION ACTIVITIES IN 1990/91

- ADVERTISED THE PROGRAM EXTENSIVELY AND FULLY REVIEWED OVER 140 DIFFERENT EXPRESSIONS OF INTEREST RECEIVED

- INITIATED THE BENCH SCALE DEMONSTRATION PROGRAM WITH FOUR TECHNOLOGIES:

ECOLOGIC - THERMAL
DEARBORN - BIOLOGICAL
UMATAC/TACIUK - THERMAL
SIALLON - ENCAPSULATION

* ACTIVITIES PLANNED FOR 1991/92 AND BEYOND

- CONTINUE BENCH SCALE PROGRAM

- INITIATE PILOT SCALE PROGRAM

- ASSEMBLE ASSESSMENT CRITERIA

- DEVELOP DATABASE

- EXPLORE PARTNERSHIPS TO AVOID DUPLICATION AND STRETCH THE BUDGET

- INITIATE FULL SCALE DEMONSTRATIONS IN 92/93

* EXPECTED RESULTS

- SUMMARY SHEETS ON EACH TECHNOLOGY DEMONSTRATED WILL BE DISTRIBUTED

- FULL REPORTS AVAILABLE ON EACH TECHNOLOGY DEMONSTRATED

- YEARLY AND FINAL PROGRAM REPORTS AVAILABLE

- DATABASE OF ALL KNOWN TECHNOLOGIES COMPILED

- REPORT OUTLINING POSITIVE AND NEGATIVE FEATURES OF EACH TECHNOLOGY WITH RECOMMENDATIONS FOR USE WILL BE PREPARED

* BUDGET

FISCAL YEAR	AMOUNT ($K)
1990/91	450
1991/92	1100
1992/93	2100
1993/94	2100
TOTAL	5750

APPROXIMATELY 75% OF EXPENDITURES WILL BE ON TECHNOLOGY DEMONSTRATIONS

* TECHNOLOGY CATEGORIES

SOLIDIFICATION/STABILIZATION

BIOLOGICAL TREATMENT

CHEMICAL TREATMENT

EXTRACTION (METALS AND ORGANICS)

INCINERATION

ALTERNATE THERMAL TREATMENT

OTHER TREATMENT

* ADDITIONAL CATEGORIES

PRE/POST TREATMENT

NON-TREATMENT (SUPPORT SERVICES)

IN-SITU TREATMENT

CAPPING

DISPOSAL

NO ACTION

SOLIDIFICATION/STABILIZATION

* 18 TECHNOLOGIES IN CATEGORY WITH 6 REFERRED TO STAGE 2

* INCLUDES ALL PROCESSES THAT REDUCE THE MOBILITY OF CONTAMINANTS

* VENDORS SELECTED ARE:
  - D. COMRIE (MISSISSAUGA, ONT.)
  - WASTECH (OAK RIDGE, TENN.)
  - OH MATERIALS (OAKVILLE, ONT.)
  - ECO FIX (SAINT-LAURENT, QUE.)
  - MORRISON BEATTY (MISSISSAUGA, ONT.)
  - VOLKER STEVIN/ESDEX (COOKSTOWN, ONT.)

BIOLOGICAL TREATMENT

* 22 TECHNOLOGIES IN THIS CATEGORY WITH 11 REFERRED TO STAGE 2

* INCLUDES BIOREACTORS, COMPOSTING, LANDFARMING

* VENDORS SELECTED ARE:
  - OH MATERIALS (OAKVILLE, ONT.)
  - FOUNDATION CO./SILT NV (SCARBOROUGH, ONT.)
  - IHC DREDGE (MIDLAND PARK, NJ)
  - R. CAVE & ASS. (OAKVILLE, ONT.)

BIOLOGICAL TREATMENT (CONT.)

* VENDORS SELECTED (CONT.)
  - SEVENSON/WASTESTREAM (BURLINGTON, ONT.)
  - INST. OF GAS TECH. (CHICAGO, ILL.)
  - DEAN ENVIRONMENTAL (TECUMSEH, ONT.)
  - CHEM SECURITY (N. VANCOUVER, BC)
  - KISECKI ENVIRONMENTAL (EDMONTON, ALTA.)
  - SNC (MONTREAL, QUE.)
  - D. BROMLEY (EDMONTON, ALTA.)

CHEMICAL TREATMENT

* 10 TECHNOLOGIES IN THIS CATEGORY WITH 5 REFERRED TO STAGE 2

* INCLUDES PROCESSES THAT ADD A CHEMICAL THAT REACTS WITH THE CONTAMINANTS IN THE SEDIMENT

* VENDORS SELECTED ARE:
  - BEAK (GUELPH, ONT.)
  - ENSOTECH (SUN VALLEY, CALIF.)
  - JAN DE NUL NV (AALST, BELGIUM)
  - INTERNATIONAL WASTE TECH. (WICHITA, KANSAS)
  - SANIVAN (BURLINGTON, ONT.)

EXTRACTION

* 27 TECHNOLOGIES IN THIS CATEGORY WITH 8 ORGANIC AND 6 INORGANIC REFERRED TO STAGE 2

* INCLUDES ALL PROCESSES WHICH REMOVE CONTAMINANTS FROM SEDIMENT

* ORGANIC VENDORS SELECTED ARE:
  - RECYCLING SCIENCES INT. (CHICAGO, ILL.)
  - BERGMANN USA (STAFFORD SPRINGS, CT.)
  - RESOURCES CONS. CO. (BELLEVUE, WASH.) AND B.H. LEVELTON (VANCOUVER, B.C.)
  - ALBERTA RESEARCH/NRC (DEVON, ALTA.)
  - CF SYSTEMS (WOBURN, MASS.)
  - NRC (OTTAWA, ONT.)

EXTRACTION (CONT.)

* ORGANIC VENDORS SELECTED (CONT.)
  - BIOVERSAL (FAIRFAX STATION, VA.)
  - INST. OF GAS TECH. (CHICAGO, ILL.)

* INORGANIC VENDORS SELECTED ARE:
  - IHC DREDGE (MIDLAND PARK, NJ)
  - ALTECH (WILLOWDALE, ONT.)
  - TALLON (GUELPH, ONT.)
  - GHEA ASSOCIATES (ROSELAND, NJ)
  - ELECTROKINETICS (BATON ROUGE, LA)
  - BEAK (GUELPH, ONT.)

INCINERATION

* 12 TECHNOLOGIES IN CATEGORY WITH 7 REFERRED TO STAGE 2

* COSTTEP WILL NOT FUND DEMONSTRATIONS IN THIS CATEGORY AT THIS TIME

* VENDORS SELECTED ARE:
  - CHEM SECURITY (N. VANCOUVER, BC)
  - JAN DE NUL NV (AALST, BELGIUM)
  - SANIVAN (BURLINGTON, ONT.)
  - IHC DREDGE (MIDLAND PARK, NJ)
  - OH MATERIALS (OAKVILLE, ONT.)
  - AQUA GUARD (VANCOUVER, BC)
  - SNC (MONTREAL, QUE.)

ALTERNATE HEAT

* 14 TECHNOLOGIES IN THIS CATEGORY WITH 3 REFERRED TO STAGE 2

* INCLUDES ALL TECHNOLOGIES USING MEDIUM TO HIGH TEMPERATURES WITHOUT OXYGEN

* VENDORS SELECTED ARE:
  - SNC (MONTREAL, QUE.)
  - LURGI CANADA (TORONTO, ONT.)
  - OH MATERIALS (OAKVILLE, ONT.)

"OTHER" TREATMENT

* 6 TECHNOLOGIES IN THIS CATEGORY, NONE REFERRED TO STAGE 2

* 2 TECHNOLOGIES SEEN TO HAVE SOME DEVELOPMENTAL POTENTIAL
  - EMERY ASSOCIATES (COLBORNE, ONT.)
  - ORTECH (MISSISSAUGA, ONT.)

* PROGRAM MAY FUND ONE OR TWO DEVELOPMENTAL PROJECTS IN THE FUTURE

PRE/POST TREATMENT

* INCLUDES DEWATERING, PARTICLE SIZE AND DENSITY SEPARATION, AND TREATED SEDIMENT HANDLING

* 12 TECHNOLOGIES IN CATEGORY WITH 5 REFERRED TO STAGE 2

* VENDORS SELECTED ARE:
  - OH MATERIALS (OAKVILLE, ONT.)
  - JAN DE NUL NV (AALST, BELGIUM)
  - BERGMANN USA (STAFFORD SPRINGS, CT.)
  - FOUNDATION CO./SILT NV (SCARBOROUGH, ONT.)
  - IHC DREDGE (MIDLAND PARK, NJ)

NON-TREATMENT VENDORS

* 21 TECHNOLOGIES OR SERVICES IN CATEGORY

* COSTTEP WILL NOT DIRECTLY FUND DEMONSTRATIONS IN THIS CATEGORY BUT THESE FIRMS MAY SUBCONTRACT TO OTHER VENDORS

REQUEST FOR PROPOSALS 1991/92

* BENCH SCALE/TREATABILITY STUDIES FOR WELLAND RIVER (ATLAS STEEL) WITH THE POTENTIAL TO PROCEED TO PILOT SCALE LATE THIS YEAR

* TREATABILITY STUDIES FOR PRETREATMENT POTENTIAL OF HAMILTON HARBOUR, THUNDER BAY HARBOUR, ST. MARY'S RIVER SEDIMENT

MIKE ZARULL

NATIONAL WATER RESEARCH INSTITUTE
ENVIRONMENT CANADA

FEDERAL ASSESSMENT ACTIVITIES

GUIDELINE DEVELOPMENT - ACTION LEVELS

BIOLOGICAL

STRUCTURAL AND FUNCTIONAL

REFERENCE CONDITIONS

MEASURES OF STRESS AND RECOVERY

SHORT TERM (PHYSIOLOGICAL)

LONG TERM (ECOLOGICAL)

ACTION LEVELS - AN EXAMPLE

1. NOT STRESSED

2. SLIGHTLY STRESSED

} NO ACTION

3. MODERATELY STRESSED

4. HIGHLY STRESSED

} ?

5. SEVERELY STRESSED - IMMEDIATE ACTION

ASSESSMENT AND THE CLEANUP FUND

DEMONSTRATIONS - "HOT SPOTS"

ASSESSING SUCCESS

Immediate/Short Term

Definative

Standardized

Replicable

Sensitive

General

Ecologically Significant

APPROACH

IN VITRO BIOASSAYS - FUNCTIONAL

BENTHOS OF THE GREAT LAKES

CORE TESTS - GUIDELINE

BEFORE AND AFTER

ORGANISM	ENDPOINT
Tubifex tubifex (worm)	Reproduction
Chironomus riparius (midge)	Growth
Hyalella azteca (scud)	Reproduction
Hexagenia limbata (mayfly)	Growth

IN SITU REMEDIATION

1. CHEMICAL TREATMENT

2. CAPPING

3. ENHANCED BIOREMEDIATION

DOUG HALLETT

ECO LOGIC

Quant au matériel d'essai qui sera encore utilisable à la fin du projet, il ne peut être subventionné que partiellement.

Les travaux de démonstration sont financés jusqu'à concurrence de 20 à 30 p. cent du coût total, selon l'importance des risques techniques et commerciaux.

Quel est le processus de sélection?

La Direction de la recherche et de la technologie reçoit les demandes de subvention présentées dans le cadre du Programme de mise au point des technologies de dépollution et en coordonne l'examen. Il y a normalement **deux dates limites de dépôt chaque année.**

Une fois effectué un tri préliminaire visant à déterminer si les demandes sont admissibles au programme, la direction invite au moins deux organismes gouvernementaux à en faire un examen technique détaillé.

Les demandes sont ensuite étudiées par le Comité consultatif sur les technologies de dépollution, qui réunit des représentants du ministère de l'Environnement, du ministère de l'Industrie, du Commerce et de la Technologie, du ministère de l'Énergie, du ministère du Trésor et de l'Économie, de la Société Innovation Ontario, de la Table ronde sur l'environnement et l'économie, du Conseil national de recherches et d'Environnement Canada.

Ce comité peut convoquer le requérant à une entrevue pour discuter divers aspects du projet. La Direction de la recherche et de la technologie avise le requérant par écrit de la décision du Comité dès qu'elle est rendue.

NOTA : Les demandes contiennent parfois des documents confidentiels. La confidentialité des renseignements sera respectée dans la mesure du possible tout au long du processus d'examen. Toute demande précise en ce sens doit être faite au moment de la présentation du formulaire et être conforme aux dispositions de la *Loi de 1987 sur l'accès à l'information et la protection de la vie privée.*

Quels sont les critères de sélection?

Le Comité fonde ses recommandations sur les critères de sélection que voici :

- la contribution nette que le projetapporte à la protection de l'environnement (y compris les retombées indirectes) par suite de la commercialisation;
- la mesure dans laquelle le projet répond aux besoins techniques et aux lois et règlements du ministère de l'Environnement;
- le degré d'excellence du projet sur les plans technique et scientifique;
- le caractère novateur de la technologie;
- les chances de commercialisation en Ontario;
- les possibilités d'exportation;
- les avantages industriels et économiques; et
- les moyens financiers du requérant et ses compétences en gestion.

Quelle est la première étape à franchir pour présenter une demande de subvention dans le cadre de ce programme?

Pour obtenir des directives, des formulaires de demande ou tout renseignement concernant la prochaine date limite de dépôt, veuillez écrire à l'adresse suivante ou composer le numéro ci-dessous :

Direction de la recherche et de la technologie
Ministère de l'Environnement
135, avenue St. Clair ouest, 12e étage
Toronto (Ontario) M4V 1P5
Téléphone : (416) 323-4657
Télécopieur : (416) 323-4437

Le requérant qui désire obtenir une réponse préalable concernant le bien-fondé de son projet peut préparer un avis d'intention (résumé de 2 à 3 pages) au moins six semaines avant de présenter la demande détaillée et la proposition. Cet avis doit comprendre une description du projet, ses avantages pour l'Ontario, les débouchés, les plans de commercialisation et des données financières (ventes annuelles, budget, cotisants).

industrielle, de technologies inédites. On cherchera ainsi à établir leur performance, leur fiabilité et leur rentabilité.

La démonstration de technologies étrangères est également subventionnée en vertu du Programme. On essaiera de déterminer si elles sont applicables au contexte ontarien.

Sept grandes catégories de technologies, de produits et de procédés sont visées par le programme de subvention :

- le recyclage des vieux pneus;
- les 3 « R » (réduction, réutilisation et recyclage);
- la gestion des déchets;
- les instruments d'analyse;
- l'épuration des eaux usées et le traitement de l'eau;
- la lutte contre la pollution atmosphérique; et
- l'analyse socio-économique.

Quels sont les organismes admissibles?

Sont admissibles les organismes suivants, à condition qu'ils soient installés en Ontario :

- les sociétés canadiennes et les filiales d'entreprises étrangères;
- les organismes provinciaux figurant à l'annexe III et définis dans les directives du Conseil de gestion datées du 29 juillet 1988;
- les groupes d'intérêt public;
- les universités;
- les instituts de recherche attachés à une université; et
- les municipalités et les offices de protection de la nature.

Les organismes fédéraux et les autres organismes provinciaux des annexes I et II peuvent participer à des entreprises communes en tant que partenaires secondaires.

Quelle est l'échelle de projet privilégiée par le Programme?

Les projets doivent habituellement s'échelonner sur trois ans au plus. La contribution maximum accordée dans le cadre du Programme ne dépasse pas 50 p. cent du coût total.

En règle générale, la somme versée en vertu du Programme ne dépasse pas 500 000 $ par année pendant trois ans. Cependant, s'il s'agit d'un programme d'envergure dont les avantages nets pour l'environnement sont considérables, on pourra recommander une contribution supérieure à 500 000 $.

Quels sont les frais admissibles?

Sont admissibles les frais directs ou indirects engagés pour les éléments suivants :

- recherche, mise au point et démonstration (ex.: traitement et salaires, déplacements, location de bureaux ou de laboratoires pour les fins exclusives du projet);
- acquisition et installation du matériel;
- analyse chimique et contrôle du rendement;
- transfert des technologies, publications comprises;
- vérification des comptes, quand le ministère de l'Environnement le demande; et
- les autres frais jugés raisonnables.

Quels sont les frais qui ne sont pas admissibles?

Normalement, les recherches fondamentales ne sont pas subventionnées, à moins qu'il s'agisse d'un élément relativement mineur des travaux d'ensemble essentiel à la réussite du programme global.

Les frais reliés à la commercialisation, à la production industrielle, au financement du déficit et au marketing ne sont pas admissibles. Il en va de même pour les structures fixes et les réparations qu'elles requièrent.

INFORMATION PACKAGE ON

ECO LOGIC'S SUPER ELIMINATOR:

A THERMO-CHEMICAL REDUCTION PROCESS

January 2, 1991

by

ELI Eco Technologies Inc.
143 Dennis Street
Rockwood, Ontario
N0B 2K0

(519) 856-9591
(416) 450-7691

FAX (519) 856-9235

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1.0 INTRODUCTION

For the past two years, ECO LOGIC has been conducting research on a method of decontaminating hazardous wastes using a patented thermo-chemical reduction process (U.S.A. patent No. 4 819 517, issued on April 11, 1989 entitled "Process for the Destruction of Organic Waste Material"). This patent is pending in Canada, Germany, France, Italy, Belgium, Denmark, Sweden, Spain, the U.K. and Japan and is solely owned by ECO LOGIC.

The research has been funded by the National Research Council Industrial Research Assistance Program, the Defence Industrial Research Program administered by the Department of National Defence, and by ECO LOGIC. Research and development to date has focused on bench-scale testing of surrogate compounds, testing actual waste samples with a larger lab-scale destructor, and construction of a mobile pilot-scale field unit for processing contaminated harbour sediment.

ECO LOGIC's destruction process is particularly suitable for wastes that are primarily aqueous, such as harbour sediments, landfill leachates and lagoon sludges. It will also be useful to the military worldwide in undertaking the clean up of PCBs, chlorinated solvents, chlorinated dioxins, and other organic chemicals which may be contained in harbour sediments, soil, hydraulic fluids, cleaning fluids, defoliants, mustard, and residual chemical warfare agents.

2.0 BACKGROUND

There is a growing sense of awareness and concern about the state of our environment, and the lack of appropriate ways of dealing with some of the problems which have been created. ECO LOGIC was formed in 1986 specifically to address the need for a clean-up tool for one of the most difficult problems, that of severely contaminated aqueous wastes such as harbour sediments, landfill leachate, and lagoon sludges. The criteria that ECO LOGIC has used in developing the process includes:

* destruction efficiency
* possibility of dioxin or furan formation
* continuous monitoring and process control suitability
* suitability for aqueous wastes
* mobility
* cost

The patented ECO LOGIC process addresses all of these criteria. The thermo-chemical reaction that makes the ECO LOGIC process possible is the ability of hydrogen to dechlorinate organic and chlorinated organic molecules at elevated temperatures. Bench-scale tests have shown that a well-mixed combination of hydrogen and trichlorobenzene (half of a PCB molecule) subjected to a temperature of 850^{o}C or higher for a period of less than one second will result in 99.9999% destruction or better. In the case of chlorinated organic compounds, such as polychlorinated biphenyls (PCBs), the products of the reaction include hydrogen chloride, methane and ethylene. This reaction is enhanced by the presence of water, which can also act as a reducing agent. Consistent results have been obtained for over 100 tests during the last two years.

The ECO LOGIC process is not an incineration technology. Destruction of chlorinated organic waste using incineration and pyrolytic processes is accomplished by breaking contaminant molecules apart with high temperatures and combining them with oxygen, usually from air. PCBs first fragment into chlorobenzenes, which can combine with oxygen to form dioxins and furans, compounds more toxic than the original PCBs. The ECO LOGIC process uses hydrogen at elevated temperatures to reduce, rather than oxidize, chlorinated organics. Since there is no free oxygen in the

reducing atmosphere, no dioxin or furan formation is possible. As well, since combustion air is not required, there is no nitrogen to use up reactor volume and heating, resulting in the reactor being much smaller than an incinerator handling the same throughput.

Other non-chlorinated hazardous organic contaminants, such as polycyclic aromatic hydrocarbons (PAHs), are also reduced to smaller, lighter hydrocarbons, primarily methane and ethylene. Because of the tendency of the reaction to produce lighter, more volatile gases, the process lends itself to continuous monitoring of the destruction efficiency. ECO LOGIC has purchased a very sophisticated on-line mass spectrometer system (V&F CIMS-500) which is capable of measuring many organic chemicals on a continuous basis. Although PCBs can be measured directly, they are not very volatile and take longer to pass through a sampling system than other lighter compounds such as chlorobenzenes. Since chlorobenzenes are the initial breakdown products of incomplete PCB destruction, the efficiency of PCB destruction can be measured very quickly by continuously monitoring chlorobenzene concentrations. The information from the mass spectrometer can be tied in with the process controller so that an increase in chlorobenzene concentration (signalling a decrease in PCB destruction efficiency) halts the input of waste and alerts the operator. For PAH destruction, benzene concentrations can be monitored in the same fashion.

The main chemical reactions are shown in Figure 1. Hydrogen and a PCB molecule with four chlorine atoms attached are reacted at 850^{o}C to form HCl and benzene. In the second reaction, which occurs at the same time, benzene and hydrogen react to produce ethylene. In the third reaction, a non-chlorinated alkane hydrocarbon reacts with hydrogen to form methane. The presence of water enhances all of these reactions, as does an excess of hydrogen, and an increased residence time in the reactor.

FIGURE 1

THERMO-CHEMICAL REDUCTION REACTIONS

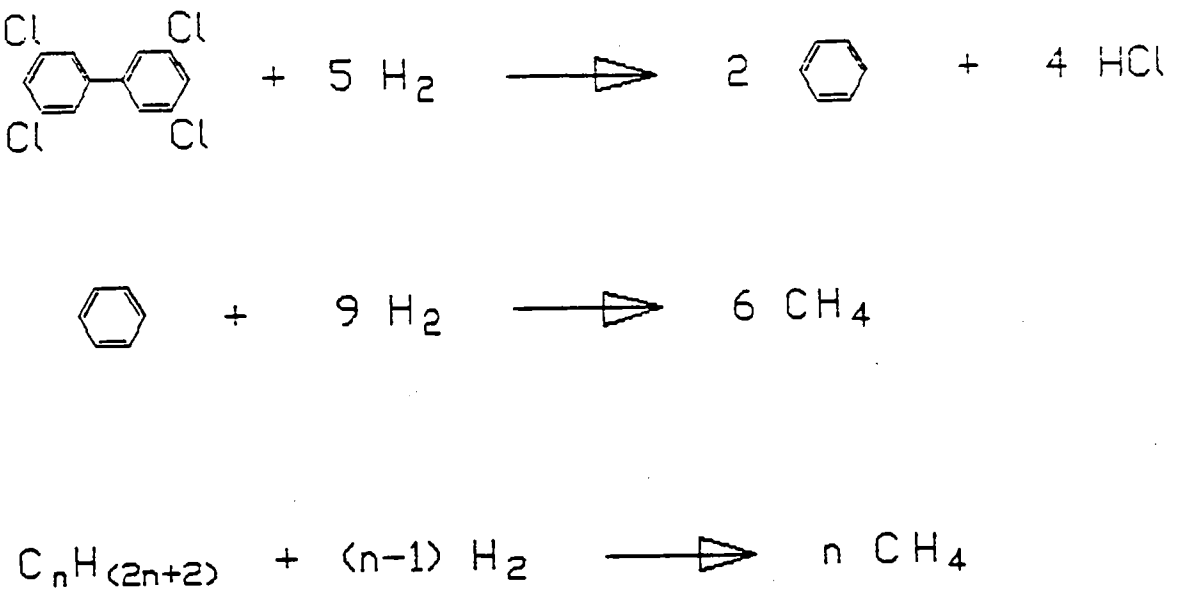
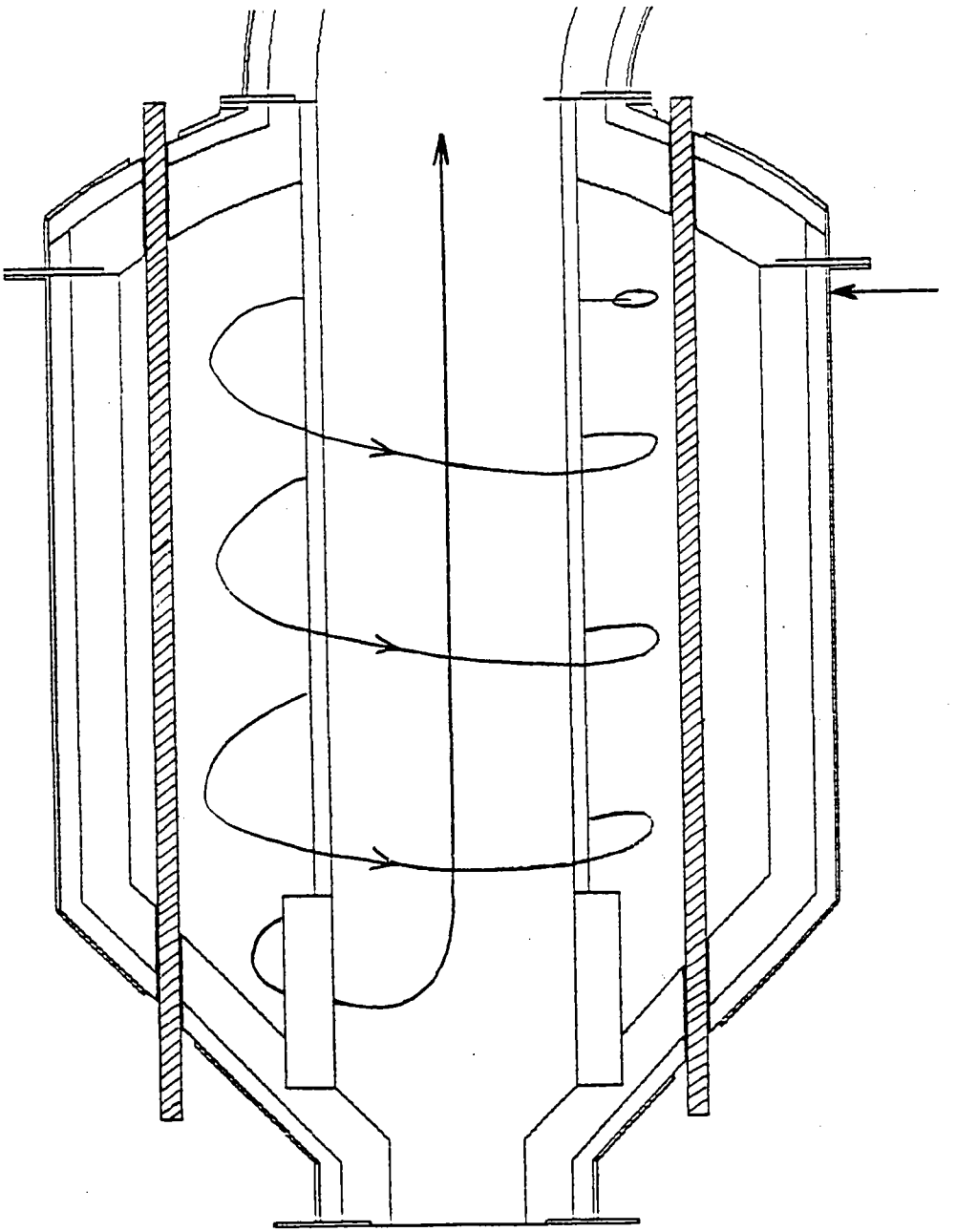


Figure 2 shows a schematic of the reactor module designed to accommodate the thermo-chemical reaction. A mixture of preheated waste and hydrogen is injected by nozzles mounted tangentially near the top of the reactor. The mixture swirls around a central ceramic tube past globar heaters and is heated to 850^{o}C by the time it passes through the ports at the bottom of the ceramic tube. Particulate matter of up to 5 mm diameter not entrained in the gas stream impacts the hot ceramic walls of the reactor, thereby volatilizing any organic material associated with the particulate. That particulate exits out of the reactor bottom to a quench tank, while finer particulate entrained in the gas stream flows up the ceramic tube into the exit elbow and through the retention zone. The reduction reaction takes place from the bottom of the ceramic tube onwards, and the organic waste is completely dechlorinated and reduced to methane, ethylene, and hydrogen chloride in less than one second. Depending on the water content of the waste, carbon monoxide and hydrogen may also form from the reaction of water with methane.

FIGURE 2

THERMO-CHEMICAL REDUCTION REACTOR



3.0 TESTING

Original work on this hazardous waste destruction process began with bench-scale research using a reactor developed under the National Research Council (Canada) IRAP-M Program. Further work for the Defence Industrial Research Program allowed the development of a larger laboratory-scale reactor capable of processing 0.5 kg/hr of water contaminated with PCB askarel fluids. This unit allowed the initial development of the process control and continuous monitoring equipment necessary for field experimentation. However, this laboratory reactor did not produce consistent results due to occasional short-circuiting of wastes, such as PCBs, from the injector directly to the scrubber. The reactor and input system have been modified from a vertical configuration to a diagonal configuration to prevent this short-circuiting. Mixing of waste in the boiler and co-feeding with steam resulted in a smoother and continuous rate of delivery, and better destruction efficiencies.

ECO LOGIC will soon be demonstrating the pilot-scale hazardous waste processor to decontaminate harbour sediment from Hamilton harbour. This test program will conclude during the spring of 1990. A series of 15 4-hour characterization tests will be followed by performance tests of longer duration. A comprehensive emission testing program will be conducted during the tests to determine destruction efficiencies.

4.0 LAB-SCALE REACTOR SYSTEM

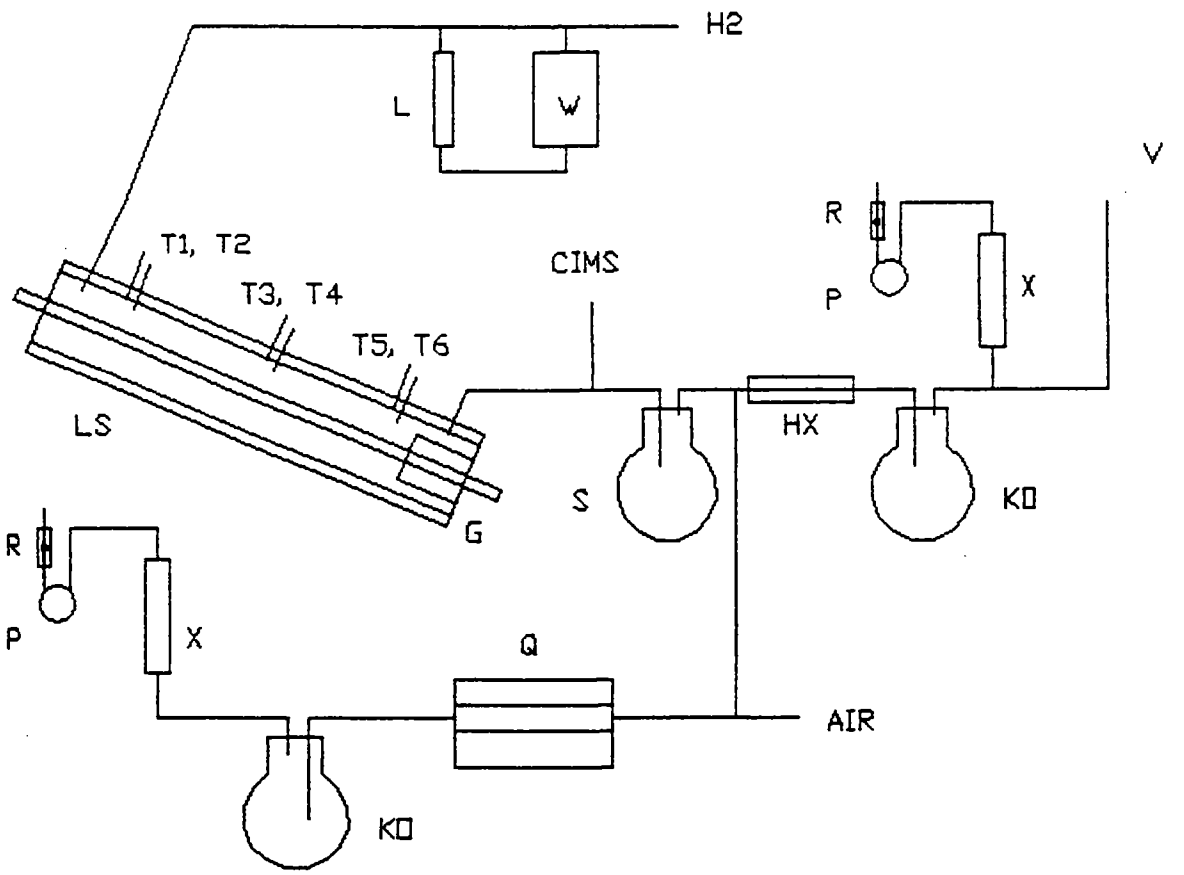
The lab reactor system is designed to mimic the operation of the pilot-scale field demonstration unit, process real waste samples, and yield information about the destruction efficiency of the process.

Figure 3 shows a schematic of the system. The lab-scale reactor (LS) is a single cylindrical chamber .3 m in diameter and 1.8 m long, and is heated by a glo-bar passing through the central axis. The reactor is insulated and has a relatively cool area (G) where solids can collect after passing through the reaction zone. Liquid waste (L), steam from the waste (S), and hydrogen (H2) are metered into the reactor at known, measured rates. The electric waste boiler (W) has the option of preheating the waste to 120-130^{o}C. The temperature of the reactor is controlled and measured in three locations, both inside and outside the inner stainless steel liner (T1-T6), so that radiant effects can be measured.

Once the gases and fine particulate exit the reactor, a small sidestream is drawn through the on-line mass spectrometer (CIMS) while the majority of the gas flows to the first condensation flask. This flask (S) simulates the scrubber in the pilot system, and is kept at 35^{o}C so that scrubber water contamination characteristics can be simulated. Most of the gas flow then passes through a heat exchanger tube (HX) where the rest of the water is condensed and collected in the knockout flask (KO). The gas is then dry enough to draw some of it through an XAD2 resin trap cartridge (X) using a valved pump (P) and rotameter (R) to measure the flow. The rest of the gas is vented (V) but would normally be recirculated in the larger pilot system. By analyzing the scrubber flask water, the knockout flask water, and the XAD2 resin, the total amount of contaminant not destroyed by the reactor alone can be determined.

FIGURE 3

LAB-SCALE REACTOR SYSTEM SCHEMATIC



To represent the destruction efficiency obtained using the boiler and reactor combined, a second sidestream is drawn from the main stream immediately after the scrubber flask. This is drawn through a quartz tube furnace (Q) along with air metered in through a valved rotameter. A water knockout flask dries the incinerated gas stream prior to it passing through an XAD2 resin tube system.

Several process parameters are monitored continuously with the process control system, including waste steam flowrate, waste liquid flowrate, hydrogen flowrate, reactor pressure, reactor temperatures, boiler temperature, scrubber flask temperature, knockout flask temperature, and quartz oven temperature. As well, concentrations of 10 compounds are monitored and recorded continuously by the on-line mass spectrometer system. Other process variables which remain relatively constant are recorded manually.

5.0 MOBILE PILOT-SCALE FIELD UNIT ON SITE AT HAMILTON HARBOUR

The mobile pilot-scale field unit reactor module is 1.8 m in diameter and 2.7 m tall without the exit elbow. Figure 4 shows a complete process schematic of the field demonstration unit now under construction. Waste liquid and suspended solids (W) are pumped from a small storage tank to a heat exchanger vessel for preheating to 150°C by a small boiler. Steam from the watery waste and hot liquid is metered continuously to the reactor and injected along with hydrogen (H_2) through atomizing nozzles. Recirculation gases (R) also enter the reactor near the top after passing through steam-heated and gas-fired heat exchangers. Heavy particulate exits as grit (G) out the bottom and fine particulate and gases pass up the ceramic tube where the gas-phase reduction reaction takes place. The atomized liquids and solids swirl around the central ceramic tube and are vapourized at 900°C for 2 - 3 seconds. Additional residence time is provided by the retention zone elbow and extension pipe prior to the scrubber. Once the gases enter the scrubber, they are quenched by direct injection of scrubber water spray. Hydrogen chloride is removed by contact with the scrubber water as the gases pass through the scrubber media, which is carbon steel on the down leg and polypropylene on the up leg of the scrubber. Scrubber water is collected in a scrubber tank through a large water-sealed vent at the bottom of the scrubber that also acts as an emergency pressure relief duct. The scrubber water is cooled to below 35°C using a heat exchanger fed by water from an evaporative cooler. Sludge and decant water are the two effluent streams from the scrubber and both are held in tanks for batch analysis prior to disposal.

The gases that exit the scrubber consist only of excess hydrogen, reduction products such as methane and ethylene, and a small amount of water vapour. Approximately 95% of this gas is recirculated back into the reactor after reheating to 500°C, and about 5% of the hydrocarbon-rich gas (HC) is used as supplementary fuel in the boiler. The boiler uses propane as its main fuel to produce steam used in the heat exchanger that preheats the waste to 150°C.

PROCESS SCHEMATIC

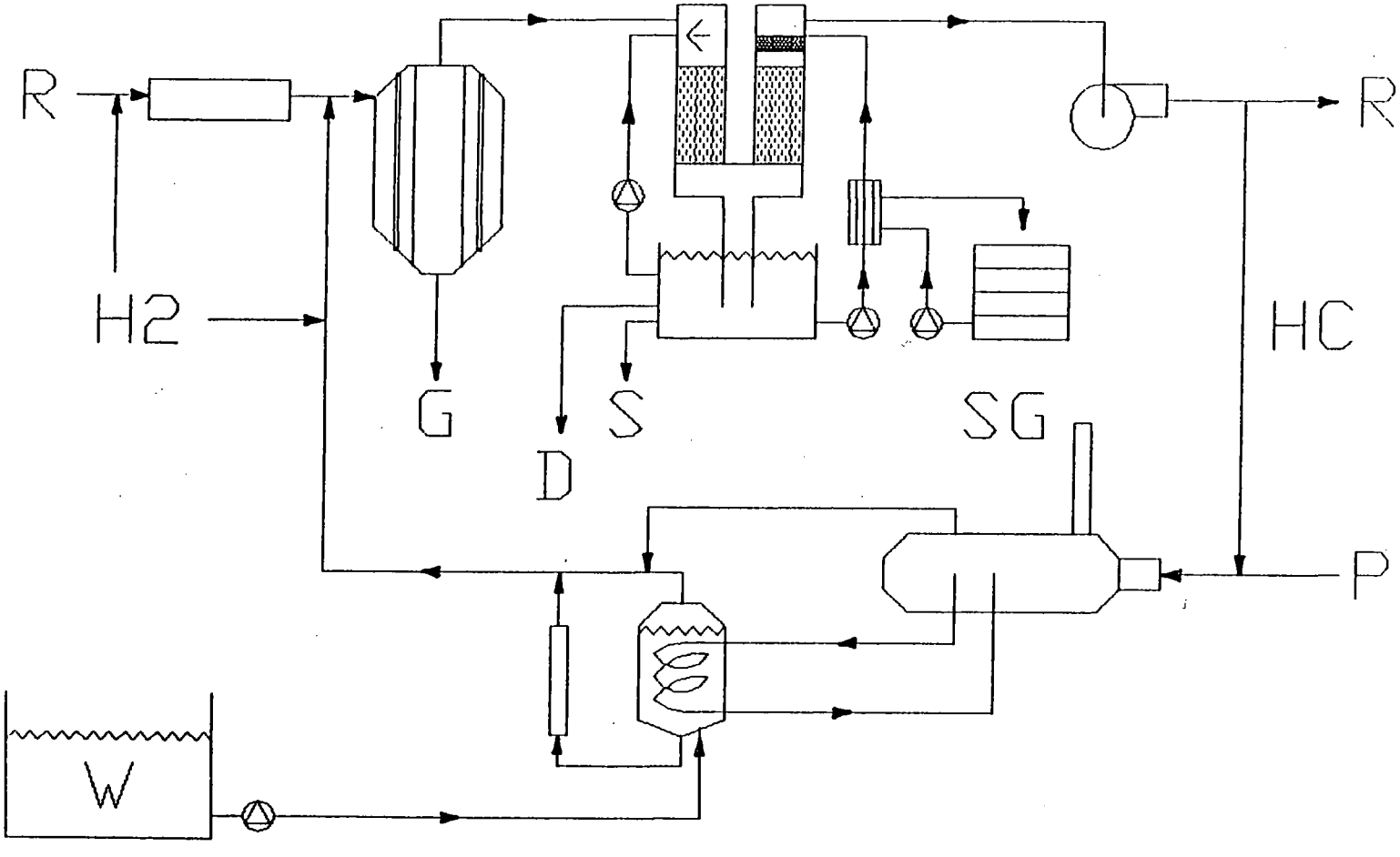


FIGURE 4

The only air emissions are from the boiler in the form of stack gas. Since the fuel going into the boiler is very clean, and contains no chlorine, emissions from the boiler should be insignificant.

In case of a process upset where total destruction of hazardous organic compounds was not occurring, the on-line mass spectrometer would automatically divert all gases into a recirculation mode. The waste feed would be stopped and recirculation would continue until the continuous analysis indicated the reaction was again occurring optimally. During this time, the scrubber water may have become contaminated and require treatment itself, but no escape of or incineration of chlorinated organic compounds would occur. Since 95% of the gas stream is recirculated under normal conditions, this procedure would not be a drastic action. In the event that processing could not continue, a small charcoal scrubber would be used to capture organic compounds during purging of the reactor.

The equipment described above is now mounted on two standard 45-foot drop-deck trailers. Figure 5 shows the layout of the equipment on the two trailers. A process control trailer containing the on-line mass spectrometer, process control system, and other analysis equipment is located near the two equipment trailers.

Testing is scheduled to be completed at our Hamilton Harbour site by June 1991 at which time we will be performing demonstration runs to qualified observers interested in using this technology to help them remediate their hazardous waste problems.

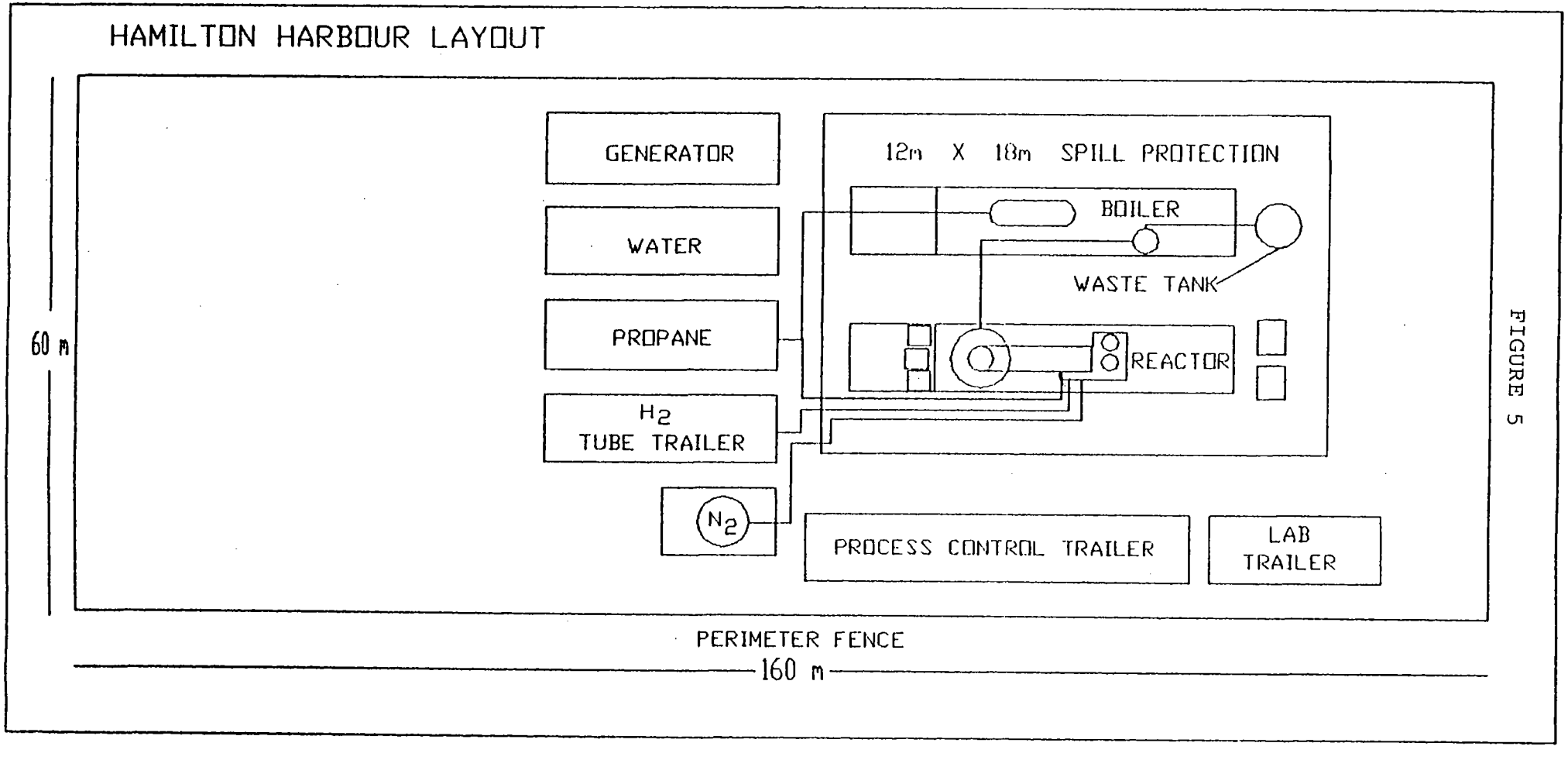

HAMILTON HARBOUR LAYOUT
60 m
GENERATOR
WATER
PROPANE
H2
TUBE TRAILER
N2
12m X 18m SPILL PROTECTION
BOILER
WASTE TANK
REACTOR
PROCESS CONTROL TRAILER
LAB
TRAILER
PERIMETER FENCE
160 m

FIGURE 5

6.0 A COMPARISON OF THE ECO LOGIC PROCESS WITH AVAILABLE METHODS

The patented ECO LOGIC process distinguishes itself in the way in which contaminant molecules are broken apart into "acceptable" compounds. The process is efficient because it allows high throughput of 12 tons per day through a relatively small portable flow-through apparatus. Capital and operating costs are lower than current technologies of similar capacity.

Incineration/pyrolysis processes break contaminant molecules apart with heat (approximately 1,200^{o}C). The temperature must be within a relatively narrow range otherwise contaminant molecule reformations are likely to take place. Even at correct temperature, other factors in the processes can cause undesirable side reactions with equally hazardous products such as chlorinated dioxins. The ECO LOGIC process requires heat (about 900^{o}C), but the breakup of contaminants is achieved by the injected reducing agent, free hydrogen. Reformations or chlorinated dioxin residuals cannot occur because there is no oxygen.

Processes using sodium or potassium to break up organic contaminants can deal with hazardous chemical concentrations no higher than 0.1% in non-aqueous matrices. Moreover, such processes handle wastes in small batches. The ECO LOGIC process will handle waste concentrations with up to 10% chlorine strength and actually works better in the presence of water.

The ECO LOGIC process allows for continuous throughput. Current bench-scale testing has shown the potential to recover valuable pure solvents such as benzene from the destruction of PCBs. The destruction and recovery process is also a semi-closed loop, with no combustion of chlorinated species occurring. These two features should make hazardous waste processing much more cost-effective and more acceptable to the public and the environment.

7.0 NET BENEFITS OF THE ECO LOGIC PROCESS

Mobility/Size - Incineration systems are carried on a number of large transport vehicles, require weeks of set-up time, occupy large areas when set up (football fields) and, as a consequence of such overheads, must be used with high volume, lengthy burns. ECO LOGIC's waste processor requires two standard tractor trailers, is completely mobile (compared to transportable), requires only days to set up, and occupies little more area than the vehicles. Minimum runs may be less than a single unit's daily capacity.

Scale of job - The continuous throughput process is also well-suited to high volume long run jobs, compared to sodium and potassium stripping methods, which are typically small batch processes. Throughput capacity of the ECO LOGIC process can be increased by ganging reactor units on a single ancillary support and control system, allowing flexibility of operation, and redundancy of design.

Aqueous Content - Some of the largest and most serious contaminant clean-up requirements are soils and sediments having a high water content. Incineration technologies (e.g. rotary kiln systems) consume very large amounts of energy to heat up the water component to the incineration temperature (over 1,000^{o}C). As well, since they use air (79% nitrogen) for combustion, and must combust all the organic material, they require approximately 10 times the volume for the same residence time of reaction. Sodium and potassium processes are precluded from treating water-bearing wastes because of explosive reaction potential. ECO LOGIC's destructor must also heat water, but to temperatures which are 30% lower, and the water component actually enhances the chemical reduction process. In addition, the use of hydrogen (no excess nitrogen) in the reaction reduces the gas volume of the products and, therefore, the size of the reactor required.

No Dioxin/Furan Emissions - Since oxygen is not used in the reaction, formation of chlorinated dioxin or furan molecules is precluded. Furthermore, if a process upset does occur, the CIMS-500 continuous organic emission monitor will automatically divert the

sidestream gas flow to the boiler back into the reactor, so that no air emissions occur. The waste stream would be shut off automatically and the gas stream recirculated until the problem was rectified. A charcoal filtration unit can be locked into the recirculation line if the reactor had to be shut down.

Cost - The ECO LOGIC forecast model has priced the destruction of large volume (>300 tonnes) of PCB contaminated sediments at $500/tonne. Rotary kiln incineration tonnage prices are higher than $1,500/tonne. The combination of hardware requirements and process characteristics suggest lower capital cost of the ECO LOGIC system, by a factor of 5 to 10 times, compared to incineration processes. Operating economies are predicted to be from three to five times lower than incineration technologies of comparable capacities.

8.0 GENERAL STRATEGY

ECO LOGIC will enter the market to supply hazardous waste destruction services itself with its own machines, and to sell equipment to companies that already supply services, or, to sell to large chemical producers or users where ownership is economically advantageous. The service market must be the initial focus in order to demonstrate the machine and obtain approvals in jurisdictions where units might be sold when the technology has buyer (versus user) acceptance.

We would encourage interested parties with organic hazardous waste samples of approximately 1 gallon to submit these for analysis and lab-scale destruction on a contractual basis in our Rockwood facilities. All results will be kept confidential.

This offers potential clients the opportunity to obtain direct information on the application of this technology to the resolution of their hazardous waste problems.

After the lab-scale testing, an opportunity may exist to view the full-scale mobile unit located on site at Hamilton Harbour.

For more information, please do not hesitate to contact:

ELI ECO TECHNOLOGIES Inc.
(519) 856-9591

Douglas J. Hallett, Ph.D.
President

Jim Nash, Manager
Sales & Business Development

9. WASTES SUITABLE FOR DESTRUCTION

CHEMICALS:

Non-halogenated / halogenated biphenyls

Non-halogenated / halogenated benzenes

Non-halogenated / halogenated phenols

Non-halogenated / halogenated cycloalkanes

Non-halogenated / halogenated alkanes

Non-halogenated / halogenated dioxins

Non-halogenated / halogenated dibenzofurans

Polyaromatic hydrocarbons

* NOTE: Halogenated means: Chlorinated
Brominated
Fluourinated

TYPICAL WASTES:

PCBs

Pulp mill wastes

Chlorinated solvent waste

Contaminated coal tars

Solvent still bottoms

Chlorophenols / Wood treatment waste

Pesticide wastes

Landfill leachates

Lagoon bottoms

DENNIS LANG

TORONTO HARBOUR COMMISSION

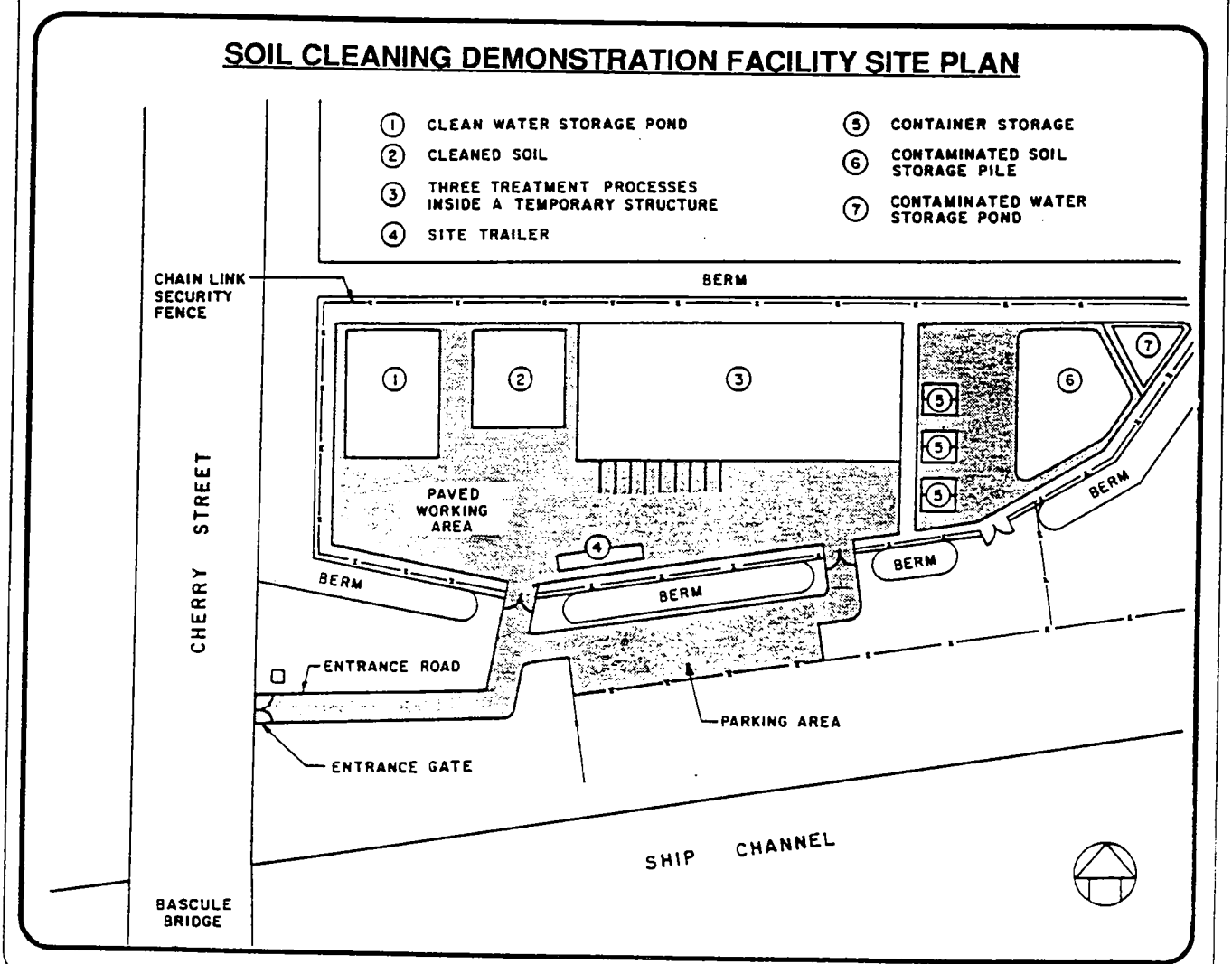
The Toronto Harbour Commissioners

SOILS RECYCLING PLANT DEMONSTRATION PROJECT

Published by the Toronto Harbour Commissioners *April 1991*

FIRST FULLY INTEGRATED SOIL CLEANING FACILITY

The Toronto Harbour Commissioners (THC) propose to construct and operate a soil recycling demonstration plant to demonstrate the technologies needed to clean contaminated soils in the Port Industrial District of the Toronto waterfront. This "green industry" demonstration project will be the



first facility of its kind to demonstrate three technologies working in series to clean contaminants from soil to produce clean soil that is reusable on industrial land.

During 1990, the Toronto Harbour Commissioners' Engineering Department, with SNC Inc. as their consultants, conducted a study to evaluate currently available technologies for cleaning soil. That study determined that it was environmentally and economically feasible to clean the type of contaminated soils that exist in the Port Industrial District. In January, 1991, the THC announced that it would proceed with a $4.3 million demonstration project, to demonstrate the effectiveness of the three technologies it has selected to clean contaminated soils. The demonstration plant should be operational by August, 1991, and will likely operate for up to six months.

The Toronto Harbour Commissioners own most of the land in the Port Industrial District. Actually, most of this land, approximately 400 hectares or 1,000 acres, was created by the THC. The THC has leased these lands to industrial developers for the past 80 years, and much of this land has supported a number of industries during that period. Some of the industrial uses, although they met the regulatory requirements of their time, left the land contaminated to such an extent that it must now be cleaned before new industrial uses will be permitted. Today, there are no soil cleaning plants anywhere that could clean these contaminated lands, and the only currently available site remediation technique is to excavate contaminated soil and remove it to a licensed landfill for disposal. Such a technique does not solve the problem of soil contamination, it merely moves it from one location to another.

The THC's soil recycling plant is designed to remove contaminants from soils and will allow for recycling of the contaminants and the cleaned soils. Metals removed from the soil will be suitable for recycling to a metals refining industry. Organic contaminants will be biodegraded by naturally occurring bacteria. The cleaned lands will be available for redevelopment by clean "green industry".

Once the industrial lands are cleaned there will be no registration of soil contamination on the title. Industrial developers and their lenders will be assured that there are no significant environmental risks associated with developing on the cleaned lands. For its part, the THC will ensure that only clean industry uses the cleaned lands so that industry will never again contaminate the soil or groundwater in the Port Industrial District.

DEMONSTRATION PLANT LOCATION

The Toronto Harbour Commissioners (THC) propose to locate the soils recycling demonstration project on a site immediately east of Cherry Street, on the Texaco refinery lands, just north of the ship channel. Entrance to the site will be off Cherry Street, just north of the ship channel bascule bridge.

The entire two hectare demonstration plant site will be surrounded by a berm and fenced. Within the plant site the area will be divided to separate stored contaminated soil awaiting treatment from the working plant area where cleaned soils are also stored. Working surface areas will be paved and properly drained, and run-off water will be col-

lected for use in the soil cleaning process. Any excess water will be treated before being discharged to sanitary sewers.

The soils cleaning plant will be enclosed in a temporary structure, which will help with noise abatement and will provide protection from the weather. Air emissions from all processes will be collected and treated before being discharged to atmosphere. Noise monitoring will be continuous, to ensure that noise levels are kept within permissible limits. Soil materials stored on site either awaiting treatment or testing before disposal will be covered to prevent dust from blowing off-site.

We will have a control gate at the entrance off Cherry Street to control access to the demonstration facility. An information kiosk beside the control gate, along the Martin Goodman Trail, will provide information on the demonstration facility and how people can arrange for a tour of the facility. We will have a trailer on-site to facilitate tours and to provide detailed information on the complete soils recycling demonstration programme.

SOIL CLEANING DEMONSTRATION

1. SOIL WASHING

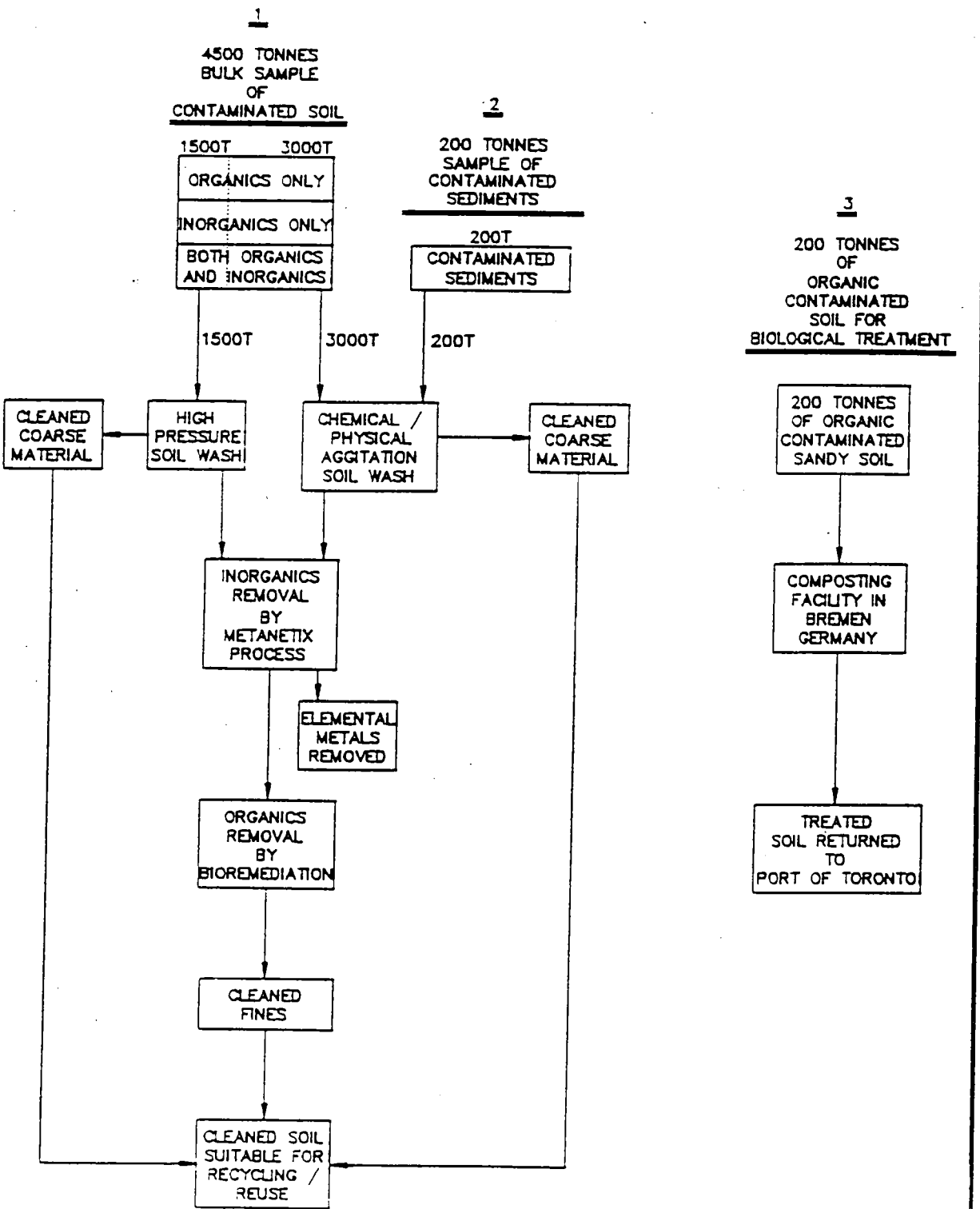
Soil washing is the first of three integrated technologies to be demonstrated. Because the large majority of contaminated soils in the Port Industrial District are sandy silty soils, soil washing is an economical and effective first step in removing contaminants from the soil.

There are two general methods currently being applied for washing large volumes of contaminated soils. One method uses high pressure water jets, with no added chemicals, to blast contaminants off the larger soil particles. The larger cleaned soil particles are then easily separated from the fines and water where the contaminants are concentrated. We expect that about 80% of the bulk contaminated soil will result in cleaned sand after this washing process, and the remaining 20% will contain the contaminants in a contaminated slurry that will require further cleaning. Particles larger than 63 microns will be removed as clean sandy soil suitable for recycling as backfill material.

Another soil washing method uses scrubbing action and chemicals to break the bonds holding contaminants to larger soil particles. This process produces much the same result as the high pressure wash process, except that the plant facility will be larger to accommodate retention of slurried soils to provide the longer time required for the scrubbing and chemical action to work. As with the high pressure wash system, about 80% of the bulk contaminated soil will be discharged as clean sand suitable for recycling as backfill, and the remaining 20% will contain the contaminants in a contaminated slurry that will require further treatment.

We propose to test the effectiveness of both soil washing methods. To test the high pressure wash process we will send up to 1500 tonnes of contaminated soil to a wash plant in Berlin, Germany, for washing. All of the cleaned soil and

TORONTO HARBOUR COMMISSIONERS
SOIL RECYCLING DEMONSTRATION PLANT



slurry will be returned to our demonstration plant where we will further treat the contaminated slurry. To test the soil scrubbing wash process we will lease a wash facility from Bergmann U.S.A. which will wash up to 50 tonnes per day on-site and will be fully integrated with the two following soil cleaning technologies. Up to 3000 tonnes of contaminated soils will be washed by the Bergmann wash plant which will remain on-site for about four months.

Soil washing plants of both types are currently operating at commercial scale in Holland and Germany, where some have been operational for over five years. In Europe, contaminated soils are washed to produce about 80% cleaned sand and 20% contaminated fines. They reuse the cleaned sand for road construction or in concrete mix. They only dewater the contaminated fines so they can be transported to licensed landfills for disposal, whereas we propose to treat the contaminated fines so that all of the soil is cleaned and reusable.

2. HEAVY METALS EXTRACTION

To remove toxic heavy metals from contaminated soils we have selected a process referred to as the Metanetix Process. In this process, the contaminated slurry is mixed with a lixiviant for several hours, to weaken the bonds holding the metals to the soil particles. The slurry is then put through a processor unit where it comes in contact with specially selected chelating agents which attract the metals and remove them from the slurry. A further process then separates the metals from the chelating agents which are then regenerated and reused. The metals removed are relatively pure in form and will be suitable as feed stock in a metals refining process so they are fully recycled.

All of the lixiviant and chelating agents used in the process are commercially available off-the-shelf products. Only the process application of these products is patented. However, the process is very simple, efficient and economical. Our integrated demonstration will be the first large scale test of this process to remove heavy metals from contaminated soils. Bench scale tests and pilot scale tests have already been completed with excellent results. We now want to demonstrate the effectiveness of this process for removing metals from contaminated slurries produced by both wash methods on a continuous feed basis as would exist in a full scale plant, and to monitor the effects of altering the process and how this affects the next step in the treatment, the removal of organic contaminants.

3. BIOLOGICAL SLURRY REACTOR

To remove organic contaminants from the contaminated slurry we have selected a bioremediation process referred to as the Biological Slurry Reactor provided by SNC Inc. This process involves a series of tanks, or reactors, where organic contaminants are treated. We expect to utilize a series of reactors. The first reactor will mix

chemicals with the contaminated slurry to ensure that the molecules of organic contaminants will be biodegradable. Subsequent reactors provide an optimum environment for natural bacteria to grow and feed on the nutritious organic compounds, digesting them and degrading them until the residual levels of organics are less than the limits set for soils suitable for industrial use.

The process is totally enclosed so that all waste streams are environmentally controlled and managed. Air emissions will be treated and polished before any discharges are made. Any water removed from the treated slurry, to produce a dried recyclable soil, will be returned to the process. The cleaned dried soil will consist of very fine material, and will be mixed with the cleaned sand to produce a compactable clean backfill material, or it may be added to clean topsoil for use in landscaping.

PORT INDUSTRIAL SOILS

There are likely large volumes of contaminated soils throughout the Port Industrial District. We estimate there could be upwards of 2 million tonnes of contaminated soils that will require treatment before they can be reused on industrial land. Some soils are contaminated with hydrocarbons, some are only contaminated with toxic levels of heavy metals, whereas some soils have both hydrocarbon (organic) and heavy metals (inorganic) contaminants.

Our demonstration plant will be designed to wash all the contaminated soil it treats. However, not all contaminated soil will have to be treated for both inorganics and organics removal. The plant will be capable of bypassing either the inorganics treatment or the organics treatment when such treatment is not necessary.

To ensure that a representative sample of soil is being treated by our demonstration plant we will treat three distinct samples of contaminated soil - one sample will have primarily heavy metal contamination, one sample will have primarily organics contamination, and one sample will have some of both. We want to test the effectiveness of our selected treatment technologies under a variety of conditions, since actual soil contamination conditions vary considerably over the Port Industrial District and a full scale facility would have to be effective in treating whatever contaminated soil it would receive.

ONLY A DEMONSTRATION

It is important to emphasize that the proposed soils recycling demonstration project is only a demonstration of available technologies to clean soils. This facility will be totally dismantled at the conclusion of the test which we estimate should be completed between August 1991 and February 1992. If a full scale facility to clean contaminated soils should be developed, it will be the subject of an entirely separate application complete with full public participation and regulatory review. This demonstration project is considered to be a vital step towards determining the environmental and economic feasibility of developing a full scale programme to clean contaminated soils and groundwater in the Port Industrial District.

OTHER RELATED DEMONSTRATIONS

There are other possible soil cleaning technologies and related activities that may be demonstrated in conjunction with our soils recycling demonstration project.

For instance, we propose to ship up to 200 tonnes of sandy soil contaminated with organics to a composting-type of commercially operating soil cleaning plant in Bremen, Germany, while we are enroute to delivering up to 1500 tonnes of contaminated soil to a wash plant in Berlin. This process adds straw materials to the soil and landfarms the soil in beds up to 1.5 metres deep under controlled conditions. The end product, after three to six months, is a biodegraded soil that is suitable for topsoil and landscaping. The disadvantage of this process is that it treats all of the bulk contaminated material and, because of the addition of straw, turns it into topsoil. Heavy metals are not removed by this process. The treated soil would not be suitable for backfill where it would have to support roads or buildings or other structures. The advantage of the process is that it is simple to operate and very economical if operated on a large scale.

We may also ask for regulatory approval to test the effectiveness of our process to clean contaminated harbour sediments, especially since we will have a Bergmann wash plant on-site for about four months. Such wash plants are being used in Europe to clean contaminated sediments. In our demonstration plant we would also be able to demonstrate whether the contaminated sediments could be totally cleaned, that is, not just washed but have metals and organics removed so that the clean fines can be reused.

We have been approached by other technology suppliers to allow them to demonstrate the effectiveness of their processes to decontaminate our soils. We propose to offer them samples of the same soils we will be testing in our integrated facility, so they can process the contaminated soil at their facilities and we can then compare the results.

Much work has yet to be done to improve soils sampling and analytical techniques, so that accurate results can be available quickly enough to respond to the needs of the treatment facilities. Once we have regulatory approval to proceed with the demonstration project we intend to advertise to ask developers and suppliers of state-of-the-art soils sampling and analyses technologies to demonstrate the effectiveness of their technologies as part of our demonstration project. Such demonstrations should be very valuable to us and to regulatory agencies as well as to the technology suppliers.

GREEN INDUSTRY DEMONSTRATION PROJECT

Our soils recycling demonstration project will be a large scale "green industry" demonstration project that will focus considerable attention on the Metropolitan Toronto area. Site remediation is fundamental to redevelopment of industrial land and so the success of our project is vital to the redevelopment of the Port Industrial District. Similarly, if the technologies we will be testing prove to be feasible for cleaning our contaminated soils they may have broad application for cleaning similar types of contaminated soils elsewhere. The Toronto Harbour Commissioners are pleased to be the forerunners in this vital area of technology development, and have committed $4.3 million from their own resources to fund this project. The THC does not derive any of its resources from tax revenues, and is pleased to fund this project and make its results available at no cost to the public.

FURTHER INFORMATION

For more information regarding the data contained in this fact sheet, please contact:
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Or
Dennis Lang,
Director of Engineering
... (416) 863-2047,
... FAX (416) 863-4830,
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For more details on our community outreach activities, please contact:
Ms. Linda Lynch,
Environmental Watch Inc.,
...by telephone at (416) 369-9049,
...by FAX at (416) 364-7736,
or write...
Environmental Watch Inc.,
181 University Avenue,
Suite 2100,
Toronto, Ontario,
M5H 3M7

Prepared by the Toronto Harbour Commissioners' Engineering Department

WORKSHOP GROUPS

DAY 2 IAN ORCHARD

1. a) Radionuclides, dioxins and furns missing. Should break PAH's into carcinogens and non-carcinogens. Do not need such an extensive list of chlorinated hydrocarbons (see table titled Sediment Criteria Comparisons), only a few indicators. Maybe include results from leachate tests.

b) Different criteria would be needed for sediment removed from sites in federal jurisdiction and stored in provincial jurisdiction. Ontario numbers are not action levels, they are based on exposure of 100 species. A 5% impairment result would constitute lowest effect level, and 30-50% would be severe effect. Problem for contractors; turnaround time and price limits for number of tests that can be run.

c) Too strigent: Too many factors listed, contractor should not be expected to analyse all compounds listed. Need a site specific and use specific guideline.

Not strigent enough: Need disposal criteria for disposal in open water.

2. a) Vendors opposed to being separated into categories, unfair competition advantage/disadvantage according to number of vendors in the category. They think the best "X number ofcandidates" should be accepted regardless if all categories are covered. Some technologies can fit into more than one category.

b) Incineration is at an unfair advantage.

c) More emphasis on in-situ treatment is needed.

SEDIMENT CRITERIA COMPARISONS

PARAMETER	ONTARIO		U.S. EPA			WISCONSIN		FEDERAL REPUBLIC OF GERMANY			GREAT LAKES BACKGROUND CONCENTRATIONS	
	Lowest Effect Level	Severe Effect Level	Non-Polluted	Moderately Polluted	Heavily Polluted	MAC Lake Michigan	MAC Lake Superior	Clay Soil Standard	Arable Land Standard	Limit for Improvement Investigations	Present	Past
Antimony (At)												
Arsenic (As)	6	33	< 3	3-8	> 8	10	10	(9)	(20)	50	1.1-10.5	--
Beryllium (Be)												
Cadmium (Cd)	0.6	10	–	--	> 6	1.0	1.0	0.3	3	20	0.9-2.5	0.6-1.3
Chromium (Cr)	26	110	< 25	25 - 75	> 75	75	100	90	100	800	32.0-163.0	36.0-62.0
Lead (Pb)	31	250	< 40	40-60	> 60	50	50	20	100	600		
Mercury (Hg)	0.2	2	–	–	≥ 1	0.1	0.1					
Nickel (Ni)	16	75	< 20	20-50	> 50	50	100	–[4]	(50)	500	24.0-95.0	36.0-57.0
Selenium (Se)						1.0	1.0				0.6-1.2	1.8
Silver (Ag)												
Thallium (Tl)												
Zinc (Zn)	120	820	< 90	90-200	> 200	100	100	95	300	3000	62.0-192.0	74.0-106.0
% Total Organic Carbon	1	10										
Total Sulfur												
Acid Volatile Sulfide												
Total Phenols												
Oil and Grease			< 1000[2]	1000-2000	> 2000	1000						
pH												
Acenaphthene												
Acenaphthalene												
Anthracene												
Benzo(a)anthracene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Benzo(ghi)perylene												
Benzo(a)pyrene												
Chrysene												
Dibenzo(ah)anthracene												
Fluoranthene												
Fluorene												
Indeno(1,2,3-cd)pyrene												
Naphthalene												
Phenanthrene												
Pyrene												
Total PAHs	(2)	(11000)										
Total PCBs	0.07[1]	530	–[3]	–[3]	≥ 10	.05	.05					

NOTES:

- All units are in µg/g (ppm) dry weight unless otherwise noted
- ( ) denotes tentative guidelines
  Lowest Effect Level (LEL) and Severe Effect Level (SEL) are based on the 5th and 95th percentiles respectively of the Screening Level Concentration (SLC)
- – denotes that values have not been established

1. No Effect Level given as 0.01
2. Hexane Solubles
3. Pollutional classification of sediments with total [PCB] between 1.0 and 10.0 mg/kg dry weight determined on a case-by-case basis
4. Under development

RESPONSE TO WORKSHOP QUESTIONS-GENERAL COMMENTS

JEFFERY NEWTON, INTERNATIONAL WASTE TECHNOLOGIES

(1) Relative to the testing of the treated sediment material I suggest the use of the U.S. TCLP requirements modifying the leach solution to the water in the vicinity of the disposal area and a solvent extraction of the treated material analyzed by GC/MS that would give a picture of the reduction of the inherent organic toxicity of the contaminated sediment. The solvent extraction would be used as an indicator of desirability in the case of equal and acceptable leach results. There would be a dilution factor in both the leach and solvent tests. Leach and solvent tests would be done at 30 and 120 days to give an idea of trends.

(2) Categories of treatment are inevitable, at least politically. Different forms of treatment have different technical and economical charcteristic ranges. What I am trying to achieve in the field of chemical treatment is a wide range of treatments in terms of metals and organics in a long term chemical process, ease of use and monitoring, and relatively low cost so more contaminated material can be treated for a given budget.

(3) In-situ treatment of sediments should be at least looked at and possibly field tested because of the desirable economics and the fact that it can be done and may have lower risk characteristics in some situations.

STEVE YAKSICH

U.S. ARCS TECHNOLOGY WORK GROUP

ARCS CONCEPT PLANS

PURPOSE AND SCOPE

- Applications of ARCS guidance
- Full-scale remediation
- Estimate costs/losses

STATUS OF PLANS

- Buffalo (started)
- Saginaw (started)
- Grand Calumet (FY 92 start)
- Sheboygan (FY 92 start)
- Ashtabula (FY 92 start)

ARCS PILOT-SCALE DEMONSTRATIONS

SELECTION PROCESS

COORDINATION

CURRENT DEMO PLANS

DEMONSTRATION SELECTION

LITERATURE REVIEW

- Evaluate all technologies
- Rank technical feasibility
- Recommendations for ARCS

SELECTION STRATEGY

- Screen technologies ready for pilot-scale demo
- Match technologies and AOCs
- Recommendations for ETWG

SELECTION

- Maximize diversity of technology demonstrations

ARCS DEMONSTRATION COORDINATION

SUPERFUND

Ashtabula

Sheboygan

SITE PROGRAM

ENFORCEMENT

Grand Calumet River

ENVIRONMENT CANADA

ARCS DEMONSTRATION PLANS

BUFFALO RIVER

GRAND CALUMET RIVER

SAGINAW RIVER/BAY

BUFFALO RIVER DEMONSTRATION

- TECHNOLOGIES

  Low Temperature Thermal Extraction

  Solidification/Stabilization

- QUANTITY

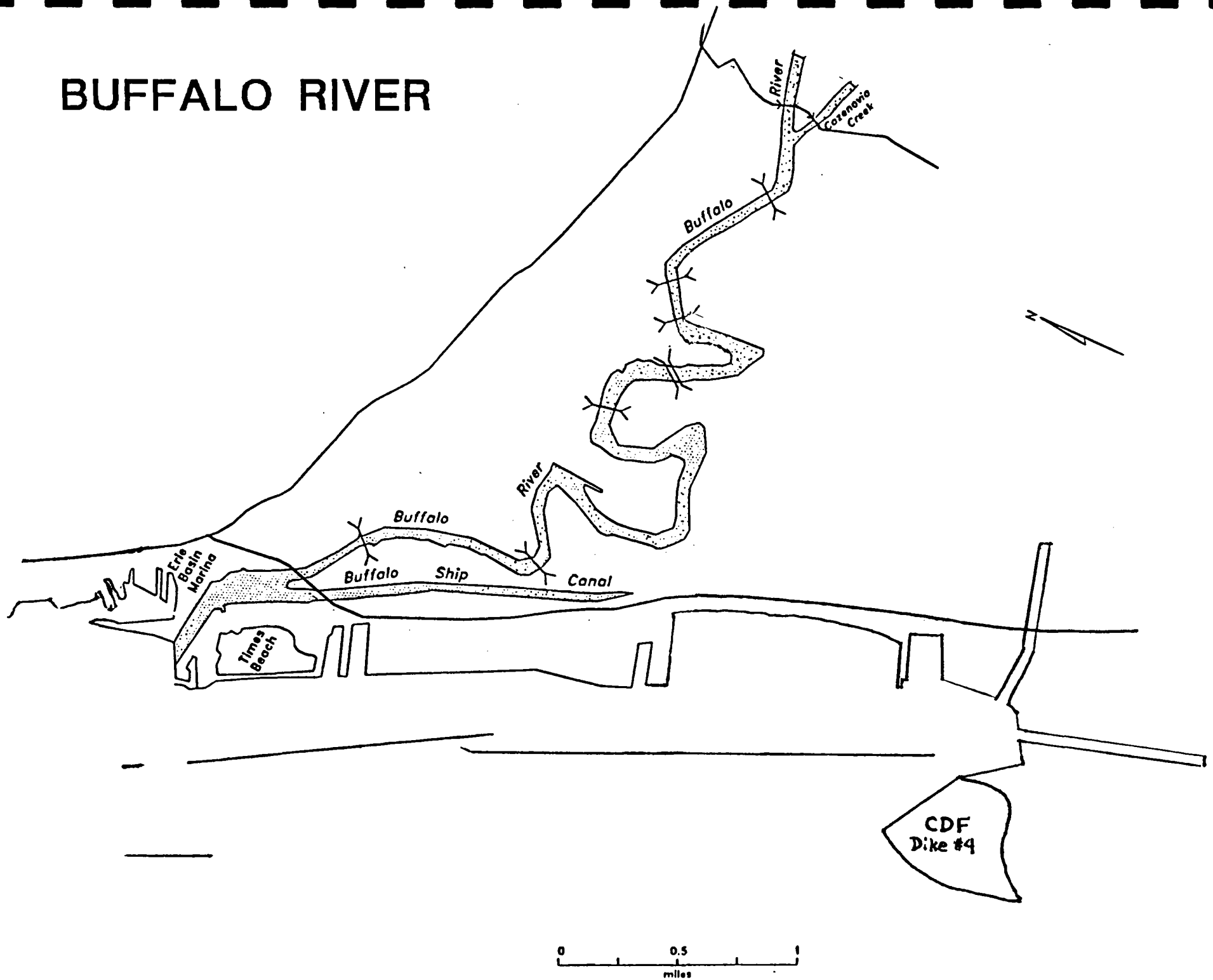
  10-50 cubic yards

- SAMPLE LOCATION

  Undetermined

- DEMO LOCATION

  Buffalo CDF (Dike #4)


BUFFALO RIVER
River
Cazenovia Creek
Buffalo
N
River
Buffalo
Erie Basin Marina
Buffalo Ship Canal
Times Beach
CDF Dike #4
0
0.5
1
miles

GRAND CALUMET RIVER DEMONSTRATION

- TECHNOLOGY

  Chemical Extraction (B.E.S.T.)

- QUANTITY

  5-10 cubic yards

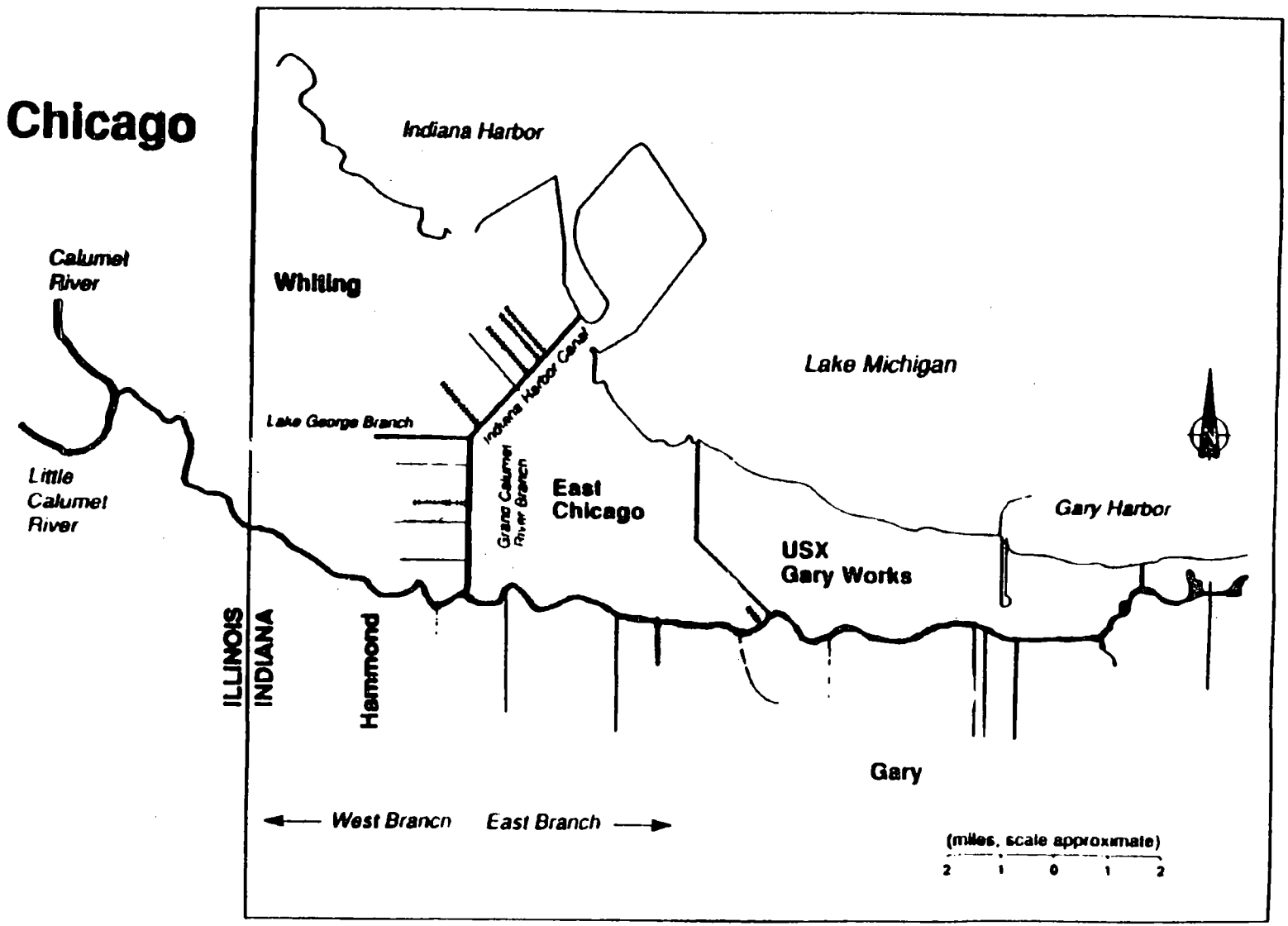
- SAMPLE LOCATION

  Undetermined

- DEMO LOCATION

  USX Gary Works

GRAND CALUMET RIVER



SAGINAW RIVER/BAY DEMONSTRATION

- TECHNOLOGIES
  - Hydrocyclone
  - Chemical Extraction
  - Bioremediation
- QUANTITY
  - 5-2,000 cubic yards
- SAMPLE LOCATION
  - River and outer harbor
- DEMO LOCATION
  - Saginaw Bay CDF

SAGINAW RIVER/BAY

DOUG VALLERY

ONTARIO MINISTRY OF THE ENVIRONMENT

Environmental Technologies

RESEARCH AND TECHNOLOGY BRANCH

Partnerships for a Cleaner Environment

There's no more important task in this decade than finding new ways to protect and improve our environment. It's a task that will take time, imagination, painstaking work, co-operation—and money.

The Environmental Technologies Program is designed to encourage Ontario organizations to get involved in this vital work. Through this program, major financial assistance is available to companies, universities and other groups committed to making a difference in the environment.

To support the development of new products and processes that will help reduce pollution and protect our land, water and air, the Ministry of the Environment will spend $30 million over five years. Funding will cover up to 50 per cent of the costs of research and development, including field trials and technical demonstrations.

This can be a winning situation for everyone—the organizations that develop the new products and processes, the government, all those who ultimately benefit from the new technologies and, most of all, our environment.

What are preferred projects for funding under the Environmental Technologies Program?

A major goal of the program is to support technologies that can be marketed both locally and globally. Both research and experimental development leading to the commercialization of products or processes will qualify for funding. Projects leading to commercial development are preferred over those involving only applied research.

Preference will also be given to projects that seek to prevent or reduce pollution at the source rather than further down the pipe or up the stack. Favoured projects will assist municipalities and the private sector in meeting the requirements of Ministry of the Environment's regulations and strategies.

What kinds of projects are eligible?

Several different kinds of projects will fall under the scope of the Environmental Technologies Program. These include research leading to the development of an innovative process, product or equipment prototype.

Technology development, up to the level of full-scale field trials and technical demonstrations to

prove performance, reliability and cost effectiveness of the new technology, will be eligible for funding.

Under the program, environmental technologies developed elsewhere may be tested for their suitability to Ontario conditions.

Seven major categories of technologies, products and processes are eligible for funding:

- tire recycling;
- the 3Rs (reduction, reuse and recycling);
- waste management;
- analytical instrumentation;
- water and sewage treatment;
- air pollution control; and
- socio-economic analysis.

Who can apply for program funding?

Only organizations operating or residing in Ontario are eligible for funding under this program. These include:

- Canadian corporations or subsidiaries of foreign-owned firms;
- provincial "Schedule III" agencies (as defined in the Management Board of Cabinet Guidelines of July 29, 1988);
- public interest groups;
- universities;
- university-based research institutes; and
- municipalities and conservation authorities.

A federal or other provincial (Schedule I or II) agency may participate as a minor partner in a joint venture with the principal proponent.

What project scale will be favoured for funding?

Most projects funded under the Environmental Technologies Program will take three years or less to complete. Government funding for any one project will not exceed 50 per cent of the total cost.

Contributions from the Environmental Technologies Program to an individual project will usually be less than $500,000 per year for each of three years. However, this maximum may be exceeded for very large projects that will have major environmental benefits.

What costs are eligible for program funding?

Both direct and indirect project costs may be eligible, including costs for:

- research, development and demonstration (salaries and wages, reasonable travel expenses, lease of office space or laboratory facilities specifically for the project);
- supply and installation of equipment;
- chemical analysis and performance monitoring;
- technology transfer and publication;
- project audit costs, as requested by the Ministry of the Environment; and
- other costs deemed reasonable.

What costs are not eligible for program funding?

Basic research costs are not eligible, except where a relatively small component of research is essential to the success of the project as a whole.

No costs associated with commercialization, full-scale production, deficit financing or marketing are

eligible for program funding. Permanent structures and their repair are excluded. Testing equipment that will be used after the project is complete will be considered eligible only for partial funding.

Demonstration projects will be funded to the extent of 20 or 30 per cent, depending on the level of technical and commercial risk involved.

What is the selection procedure?

The Research and Technology Branch (RTB) of the Ministry of the Environment receives applications for funding under the Environmental Technologies Program and co-ordinates their review. Normally there will be **two closing dates each year.**

After a preliminary screening procedure to determine eligibility, applications go through a detailed technical review by a panel of at least two reviewers from different government agencies.

They are then considered by the Environmental Technologies Advisory Committee, which includes representatives of the Ministries of the Environment, Industry, Trade and Technology, Energy, and Treasury and Economics, as well as Innovation Ontario Corporation, the Round Table on the Environment and the Economy, the National Research Council and Environment Canada.

This committee may ask applicants to attend interviews to discuss their projects. When the process is complete, the RTB will advise applicants, in writing, of the committee's recommendation.

Note: Applications may contain material that is confidential, and every effort will be made during the review process to make sure that confidentiality is maintained. Specific requests for confidential treatment of proposals should be made at the time of application and should conform to the requirements of the Freedom of Information and Privacy Act, 1987.

What criteria are used to select projects for funding?

Recommendations will be based on these criteria:

- net contribution to environmental protection (including spin-off benefits) through commercial development;
- the project's effectiveness in addressing the Ministry of the Environment's technical and regulatory requirements;
- the scientific and technical excellence of the project;
- the degree of innovation in the proposed technology;
- the likelihood of commercialization in Ontario;
- export potential;
- industrial and economic benefits; and
- financial and management capability of the applicant.

What is the first step in applying for funding under the program?

For program guidelines, application forms and information on the next submission date, please write or call:

Research and Technology Branch
Ministry of the Environment
135 St. Clair Avenue West, 12th floor
Toronto, Ontario M4V 1P5
Telephone: (416) 323-4657
Fax: (416) 323-4437

To obtain an early conceptual response, an applicant may wish to submit a notice of intent for a project before preparing a detailed proposal. The notice of intent—a two to three-page executive summary—should be submitted at least six weeks before the final submission date and should include a description of the project, its benefits to Ontario, an outline of market projects and commercialization plans, and financial information (annual sales, project budget, contributors).

Associations pour un environnement meilleur

Il n'y a pas de tâche plus importante en cette décennie que de trouver de nouveaux moyens de préserver et de mettre en valeur notre environnement. C'est là une tâche de longue haleine, pour laquelle il faudra beaucoup d'imagination, de détermination, de coopération...et d'argent.

Le Programme des technologies de dépollution cherche à encourager les organismes ontariens à participer à cette tâche d'envergure. Il offre une aide financière importante aux compagnies, aux universités et aux groupes intéressés à améliorer la qualité de l'environnement.

Le ministère de l'Environnement consacrera 30 millions de dollars au cours des cinq prochaines années à la mise au point de nouveaux produits et procédés de dépollution et de protection des milieux terrestre, aquatique et atmosphérique. La somme consentie couvrira 50 p. cent des coûts de recherche-développement, y compris les démonstrations techniques et les essais sur le terrain.

Ce programme profitera à tous: les organismes qui mettent au point les produits et procédés novateurs, le gouvernement, tous ceux qui bénéficieront de la nouvelle technologie et, surtout, l'environnement.

À quel type de projet accorde-t-on la préférence?

Le programme vise d'abord à appuyer la mise au point de technologies qui pourront ensuite être vendues sur les marchés locaux et internationaux. Les projets de recherche et de démonstration menant à la commercialisation de produits ou de procédés sont admissibles. La préférence est donc accordée aux projets destinés à la commercialisation plutôt qu'aux recherches appliquées.

Ont aussi la préférence les projets qui préviennent ou diminuent la pollution à la source plutôt qu'à la fin du cycle de fabrication ou à la sortie de la cheminée. Les projets retenus aideront les municipalités et les entreprises privées à respecter les prescriptions réglementaires et stratégiques du ministère de l'Environnement.

Quels sont les types de projets admissibles?

Le Programme de mise au point de technologies de dépollution vise plusieurs types de projets, dont les recherches menant à la mise au point d'un produit ou d'un procédé innovateur, ou à la création d'un prototype.

Sont également admissibles l'essai sur le terrain et la démonstration technique, à l'échelle