Eldorado Uranium Refinery R.M. of Corman Park, Saskatchewan

Report of the Environmental Assessment Panel

JULY 1980

PANEL REPORTS
TO THE MINISTER OF THE ENVIRONMENT
ON THE PANEL PROJECTS

1. Nuclear Power Station at Point Lepreau, New Brunswick. (May 1975)

2. Hydro Electric Power Project, Wreck Cove, Cape Breton Island, Nova Scotia. (August 1976)

3. Alaska Highway Gas Pipeline Project, Yukon Territory. (Interim report, August 1977)

4. Eldorado Uranium Refinery Proposal, Port Granby, Ontario. (May 1978)

5. Shakwak Highway Project, Yukon Territory - British Columbia. (June 1978)

6. Eastern Arctic Offshore Drilling - South Davis Strait Project. (November 1978)

7. Lancaster Sound Offshore Drilling Project. (February, 1979)

8. Eldorado Uranium Hexafluoride Refinery, Ontario. (February, 1979)

9. Roberts Bank Port Expansion, British Columbia. (March, 1979)

10. Alaska Highway Gas Pipeline, Yukon Hearings. (August, 1979)

11. Banff Highway Project. (October, 1979)

12. Boundary Bay Airport Reactivation. (November 1979)

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Cat. No. En 105-15/1980
ISBN 0-662-50884-X

Government of Canada
Gouvernement du Canada

Environmental Assessment Review
Examen des évaluations environnementales

Ottawa, Ontario
K1A 0H3

The Honourable John Roberts, P.C., M.P.
Minister of the Environment
Ottawa, Ontario
K1A 0H3

Dear Minister:

In accordance with the Federal Environmental Assessment and Review Process, the Eldorado Nuclear Ltd. Environmental Assessment Panel has completed a review of a proposal to construct a uranium refinery in the Rural Municipality of Corman Park, near Saskatoon, Saskatchewan. We are pleased to submit this report for your consideration.

The Panel's review has led to the overall conclusion that it cannot endorse construction of the proposed refinery. While available information was sufficient to permit the Panel to conclude that the impact on the physical environment would be minimal, it was unable to reach a conclusion on the potential impact on the human environment. The Panel has outlined, therefore, three options which should be considered before a decision is made on the siting of a refinery in the Province of Saskatchewan.

Yours sincerely,

John S. Klenavic
Chairman
Eldorado Nuclear Ltd.
Environmental Assessment Panel

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EXECUTIVE SUMMARY

PROPOSED SITE

AIR PHOTO OF SITE AREA

The Environmental Assessment Panel has reviewed a proposal by Eldorado Nuclear Ltd. to construct a $100 million uranium refinery at a site near Warman in the Rural Municipality of Corman Park, 23 km northeast of Saskatoon, Saskatchewan. The refinery would process uranium concentrates produced at Saskatchewan mines. The product, uranium hexafluoride, would be exported from Canada.

In July, 1979, Eldorado issued an Environmental Impact Statement based on guidelines issued in June, 197G. This document served as the main input to the review of the project.

The Panel solicited comments on the Environmental Impact Statement and the project from the public and from technical agencies and in January, 1980, held public meetings in the vicinity of the proposed site. The Panel considered issues relating to the need for the project, the potential impact on the physical and human environment and project monitoring. After carefully considering the information presented, the Panel reached a number of conclusions and has formulated certain recommendations which are contained in this report.

The Panel's review has led to the conclusion that because of the uncertainty with respect to social impact, it "cannot endorse the site selected by Eldorado for the proposed refinery.

While available information was sufficient to permit the Panel to conclude that the impact on the physical environment would be minimal, the Panel was unable to reach a conclusion on the potential impact on the human environment. A distinctive community, potentially affected by the project, does exist but the social impacts of the project upon this community have not been properly identified or assessed. These potential impacts on the community surrounding the refinery at Warman are too important to be ignored in reaching a judgement on the overall acceptability of the project. In addition, the Panel was also concerned that the project might be incompatible with the proposed recreational development at nearby Cathedral Bluffs.

The Panel also concluded, however, that the refinery and plant process were generally acceptable provided certain conditions were met. In the Panel's opinion, Eldorado demonstrated that it was reasonable to plan for another refinery in Canada and that a site in Saskatchewan would be consistent with existing federal and Saskatchewan government policies. Should an appropriate site be found, the Panel has outlined a number of recommended conditions for proceeding. Before any decision is made on a refinery site, however, the following three options should be considered:

1. Further information be provided by Eldorado with respect to the potential social impacts of the Warman proposal, with subsequent public review. The Panel has outlined a number of site-specific guidelines to assist the proponent in this regard.
2. One or more alternative sites in Saskatchewan be selected and evaluated with regard to social and environmental impacts and submitted for public review.
3. One or more sites in Saskatchewan be evaluated and reviewed in comparison or conjunction with the Warman site. This would be a combination of options 1 and 2.

The Panel has also made a number of supplementary recommendations addressed to governments, as a result of the environmental assessment and review of Eldorado's proposed uranium refinery.


ENVIRONMENTAL ASSESSM

CHAPTER 1

THE FEDERAL ENVIRONMENTAL ASSESSMENT AND REVIEW PROCESS

People see this (the public meetings) as possibly their only opportunity to register their concern. That's why they come to speak, and that's why we, as a citizens group, cannot speak for them, and we, as an executive would not want to pretend to speak for some 860 people. They will be coming and speaking on their own behalf as well.

Ernie Hildebrand
War-man and District
Concerned Citizens Group

I am a citizen of Saskatoon. I just want to contradict one point made as far as it has to do with the Minister of the Environment. I'm against any kind of referendum or anything like that. I think it is totally up to the Minister of the Environment. That is the democratic system to elect your representatives of government and have them decide what's going to happen.

Ken Hirsch

1 .1 INTRODUCTION

This report to the Minister of the Environment, on Eldorado Nuclear Ltd's proposed uranium refinery near Warman, Saskatchewan, has been prepared by an Environmental Assessment Panel constituted under the Federal Environmental Assessment and Review Process (EARP). This Process was established by Cabinet, December 20, 1973, to ensure that:

a) environmental effects are taken into account early in the planning of new federal projects, programs and activities;
b) an environmental assessment is conducted for all projects which may have an adverse effect on the environment before commitments or irrevocable decisions are made, and those which may have significant adverse effects are referred to the Minister of the Environment for formal review, and
c) the results of these assessments are used in planning, decision-making and implementation.

Federal projects are considered to be those initiated by federal departments and agencies, those for which federal funds are solicited, and those involving federal property. Federal departrnents and agencies are bound by Cabinet decision. Proprietary Crown Corporations and regulatory agencies, however, are invited rather than directed to participate in the Process.

On February 15, 1977, the Federal Environmental Assessment and Review Process was amended by Cabinet to allow persons outside the federal governrnent to serve on Panels.

Eldorado Nuclear Ltd., a proprietary Crown Corporation, decided to refer the project to the Federal Environmental Assessrnent Review Office for a Panel review after determining that its proposed refinery could have potentially significant environmental effects, and after consultation with the appropriate regulatory agency, the Atomic Energy Control Board.

A referral for a refinery in each of the provinces of Ontario and Saskatchewan was received in July, 1975, and a Panel was formed. The Panel commissioned a Working Group to assist it in preparing guidelines for the preparation of an Environmental Impact Statement for each of the Ontario and Saskatchewan proposals. The Working Group consisted of some of the Panel members together with representatives from the Provinces of Ontario and Saskatchewan, the Atomic Energy Control Board and Eldorado. The guidelines were adopted by the Panel as then constituted and published in June, 1976.

1.2 THE ONTARIO REVIEWS

The Ontario proposal was submitted for a Panel review first. An Environmental Impact Statement was prepared for a site near Port Granby, Ontario. In June, 1977, Panel membership was changed with the addition of two members who were not public servants. In May, 1978, following public meetings held in late 1977 and early 1978, the Panel's report (Report No. 4) was released. The Panel concluded that the refinery itself and the refinery processes, as then outlined, could be environmentally acceptable on an appropriate site if a number of conditions were rnet. The Port Granby site, however, was found to be unacceptable for a variety of reasons related to air quality, waste management, land use and social impacts.

Following the rejection of the Port Granby proposal, Eldorado identified potential sites in each of the Port Hope, Sudbury and Blind River areas of Ontario. The Federal Cabinet in June, 1978, agreed

that the final choice of a site for the new refinery would be made following completion of the Environmental Assessment Panel's report on the three sites. The Panel's report (Report No. 8), issued in February, 1979, concluded that all three sites could be acceptable for the project provided certain conditions were met.

In July, 1979, it was announced that the Federal Cabinet had concurred with Eldorado's selection of Hope Township as the preferred site for the Ontario refinery. Site preparation began in early 1980 but was suspended when the Federal Cabinet reviewed the earlier decision and determined that the refinery would be located at Blind River. It is understood that Eldorado is considering further proposals in Ontario.

1.3 THE ENVIRONMENTAL ASSESSMENT REVIEW IN SASKATCHEWAN

1.3.1 Panel Composition

In August, 1979, Eldorado reconfirmed its intention to refer the proposed Saskatchewan refinery to the Federal Environmental Assessment Review Office for a review by an Environmental Assessment Panel. The Minister of Environment announced the formation of a new Panel in October. Its composition was as follows:

Mr. John Klenavic
Panel Chairman
Federal Environmental Assessment Review Office
Hull, Quebec

Dr. Glen Beck
Department of Economics and Political Science
University of Saskatchewan
Saskatoon, Saskatchewan

Prof. Reg Lang
Faculty of Environmental Studies
York University
Downsview, Ontario

Dr. Allan Olrnsted
Department of Sociology
University of Calgary
Calgary, Alberta

Dr. Don Rennie
Department of Soil Science
University of Saskatchewan
Saskatoon, Saskatchewan

Dr. David Scott
Freshwater Institute
Fisheries and Oceans Canada
Winnipeg, Manitoba

Mr. Kim Shikaze
Environmental Protection Service
Environment Canada
Toronto, Ontario

Brief biographies of the Panel Members may be found in Appendix I.

Mr. Bob Connelly, Federal Environmental Assessment Review Office, served as Executive Secretary to the Panel.

1.3.2 The Environmental Impact Statement

On the basis of the Panel guidelines issued in June, 1976, consultation with the Saskatchewan Department of Environment, and experience gained in the Ontario reviews, Eldorado prepared its Environmental Impact Statement for a site near Warman in the Rural Municipality of Corman Park, which adjoins the City of Saskatoon. The Environmental Impact Statement was made public on July 25, 1979. It consisted of an introduction and chapters on the project description, physical environment, human environment, and monitoring; detailed technical

appendices and a public involvement supplement were issued later. This documentation served as the main information input to the review of the project.

1.3.3 Public Information and Participation Programs

The Environmental Assessment and Review Process involves review and comment by the public, particularly from people who live in the vicinity of the proposed project, as well as by local governments and federal and provincial agencies. Public information and participation programs were undertaken separately by Eldorado and, on behalf of the Panel, by staff of the Federal Environmental Assessment Review Office.

1.3.3.1 The Eldorado Proaram

Eldorado conducted a public information program in the Rural Municipality of Corman Park, City of Saskatoon and Town of Warman to inform the public concerning the project and its implications. Beginning in January, 1979, meetings were arranged in the area with various citizen groups and individuals to discuss the project.

To acquaint individuals with a uranium refinery, Eldorado arranged and helped finance numerous visits of Saskatchewan residents to Port Hope for tours of the existing refinery and meetings with citizens living in that area. Eldorado also conducted open house sessions in Rosthern and Warman and participated in other forums such as debates and a seminar. Meetings and discussions with citizen groups, individuals and the media continued up to the time of the public meetings in January, 1980.

1.3.3.2 The Panel Proaram

The Panel secretariat attempted to ensure that all persons and organizations in the local area having an interest in the project were informed of the Panel public meetings and of the opportunities to make their views known.

A series of advertisements was placed in local and regional newspapers announcing the nature of the review, availability of the Environmental Impact Statement, time and location of the meetings, and procedures for the review. Panel staff were regularly interviewed by radio, television and newspaper reporters in the area. Meetings with Panel staff and representatives of the citizen committees, formed to participate in the review, were held to explain the nature of the review process. Information distributed to persons on the project mailing list included press and information releases, reviews prepared by government agencies and individuals, brochures describing the review process, biographies of Panel members, and the agenda and procedures for the public meetings. Copies of the Panel reports and transcripts of the meetings held in Ontario were also made available.

The Panel invited comments on the Environmental Impact Statement and the project as a whole by Novernber 1, 1979. A Compendium of Briefs containing the written presentations was published on November 11, 1979 and distributed to persons on the mailing list. Eight supplements to the first compendium, containing submissions received after the deadline, were issued up to January 16, 1980.

To gain a better understanding of the project setting and to learn more about the Mennonite people who comprise the majority in the immediate area of the proposed site, the Panel in October, 1979, invited Dr. David Schroeder, a theologian at the Canadian Mennonite Bible College, to address it and local citizen groups on the subject of

Mennonite settlement and community life. A transcript of the meeting was made available to interested parties. Many of those attending the presentation also accompanied the Panel and Eldorado officials on a tour of the proposed site and the surrounding area.

As a result of the written presentations contained in the November 11, 1980, Compendium and its review of the Environmental Impact Statement, the Panel issued a letter to Eldorado on November 26, 1979, requesting: additional information on hydrogeology and vegetation of the site and surrounding area, monitoring mechanisms and accidental and other discharges over the complete life of the plant, socio-economic characteristics of the nearby communities and institutions, applicability and control of federal, provincial and municipal regulations, and plans and by-laws covering the site and the proposed project. Eldorado's response to this request was made during the public meetings.

1.3.4 Public Meetings

Public meetings were conducted to permit the Panel to learn of concerns about the project and to allow interested persons to comment on the Environmental Impact Statement and the project.

Nine days of meetings, in the afternoons and evenings, were originally scheduled over a three-week period as follows: January 8, 9, 10 in Martensville (near Warman), January 15, 16, 17 in Saskatoon and January 22, 23, 24 in Martensville. Simultaneous interpretation in English and French was provided in Saskatoon. In an attempt to accommodate the large number of people who wished to speak, the Panel arranged four additional sessions on January 18 and 19 in Saskatoon and January 21 in Martensville.

The first day was set aside for introductory statements by participants and for government agencies' technical reviews of the overall project. A number of general sessions were scheduled to allow registered speakers to present overviews on the project. Specific sessions were allocated for more detailed discussion of the following issues: impact on the natural environment, socio-economic and community impact, waste management, land use and impact on agriculture and neighbouring land, effects on health and occupational safety, and monitoring and control. After each issue session, as time permitted, presentations on general issues were also made. The extra session held on January 21 was devoted to the subject of project rationale. The final day included a session devoted to catching-up on outstanding matters, followed by a closing session to receive concluding statements from participants.

The Panel arranged for various independent witnesses to be present to take part in discussions during sessions on the physical environment, socio-economic impact and project rationale; others appeared during various sessions on behalf of Eldorado and intervenors. With the exception of the closing statements session, limited opportunities were provided following presentations for a question and answer period involving the Panel, Eldorado, independent witnesses and the audience.

Federal government agencies participating in the review included: Department of Agriculture; Atomic Energy Control Board; Department of Energy, Mines and Resources; Department of Environment; Department of Fisheries and Oceans; Department of Labour, and Department of National Health and Welfare. Provincial agencies included: Department of Agriculture; Department of Environment;

Department of Health; Department of Industry and Commerce; Department of Labour; Department of Municipal Affairs; Saskatchewan Economic Development Corporation, and Saskatchewan Mining Development Corporation. Government agencies did not identify any significant reasons why the project should be rejected.

Presentations were also made on behalf of the Councils of the Rural Municipality of Corman Park, the Town of Warman, the Town of Martensville and the Village of Laird. With the exception of the Village of Laird, these Councils expressed support for the project. The Council of the City of Saskatoon, the largest local government in the vicinity, was unable to reach a position on the project. Two local members of the Legislative Assembly indicated their opposition to the project. During the public meetings, many local residents referred to a statement attributed to the President of Eldorado: "We won't build where we're not wanted". Eldorado equated being "wanted" with support for the project from local elected representatives.

Non-governmental organizations included business organizations, unions, a number of citizen and church groups, and public interest groups. Business organizations in the area (Saskatoon Board of Trade, North Saskatchewan Business Association, Northwest Economic Development Council, Saskatoon Industrial Development Board) as well as the Warman and District Informed Citizens Group argued that the proposal would have a substantial economic benefit to the area and that any environmental effects could be safely mitigated. Unions involved in the construction industry as well as the United Steelworkers of America and the Saskatchewan Federation of Labour also supported the project provided that precautions were taken for worker safety. The Hutterite Colony at Riverview, the closest community to the site, had no objection to the proposal provided proper environmental protection measures were taken.

The Canadian Union of Public Employees as well as the National Farmers Union were opposed to the project. Some church groups from various denominations and other interest groups were concerned about or opposed to the construction of the refinery. Concerns ranged from specific environmental problems to broader issues relating to the entire nuclear fuel cycle. The Saskatoon Citizens for a Non-Nuclear Society, for example, declared opposition to any project related to the nuclear industry. Local opposition to the project, however, came primarily from the Warman and District Concerned Citizens Group, an organization representing some people in the immediate area of the site and beyond. The opposition was based partly on religious convictions (many of its members were Mennonites) and partly on concerns about the project's impact on agriculture, the physical environment, and the health of workers and the public, as well as its possible incompatibility with the projected Meewasin Valley Authority master plan for the area. The Saskatoon Environmental Society presented a brief on perceived environmental effects of the project and also questioned the rationale for the project.

Numerous other individuals, not representing any organization, presented their views both for and against the project. The Meewasin Valley Authority, a special purpose agency with planning powers in the area, presented a written statement in advance but refused to participate in the meetings.

The public meetings demonstrated strong local interest in the project, to the

extent that some of the people wishing to speak could not be accommodated even with four extra sessions. Those who did not get a chance to speak before the Panel were encouraged to submit their views in writing. A total of 336 people appeared before the Panel. An additional 201 written presentations, and a number of petitions signed by persons either for or against the project were also submitted to the Panel. In addition it received a substantial number of technical reports and background information.

During the public meetings the Panel and its staff heard complaints concerning the procedures adopted for the environmental assessment review of the project. A discussion of procedures is included in Appendix II. A verbatim transcript was made of all the meetings. Written material presented to the Panel was compiled by the secretariat and made public. Persons appearing before the Panel and submissions made to it are listed in Appendices III and IV respectively.

CHAPTER 2

THE PROJECT

Clarkboro Ferry, South Saskatchewan River

I am hoping our farm will be handed on to the third generation in good condition, where pure milk and uncontaminated grain will continue to be produced. But who wants to saddle the future generations with the leftovers of a uranium refinery. I don't! I believe this is one legacy that our future generations do not wish to have passed on to them.

Kathy Boldt

I am disappointed, secondly, to hear some of the comparisons that are being made here by the presentations up to this point. It seems that many of you are comparing the uranium refinery here to nuclear power plants and nuclear bombs. I don't think that is fair at all. I think we should concern ourselves with the refinery itself and if we feel that its unsafe then direct our arguments towards that issue.

Dave Kessler
Mayor, Town of Warman

It (the refinery) is an extremely long-term economic benefit to this province and to this area and that is something that we should bear in mind. Were we to turn it down, what likelihood do we have in the future of other sophisticated industries locating in an area which does not wish to encourage such investments and such activities?

Iain Le May

Finally, my final question is: given the information that I am a Mennonite and share the views of many of the individuals that have spoken at these hearings; given the fact that I live within a mile of the site; and given the fact that I am deeply committed to the protection, preservation, and beautification of the river banks and valley of the South Saskatchewan River; and given the fact that vigilance is not my idea of freedom, could Eldorado please give me one way in which their refinery would improve my living space, my health, my relationship with people, my moral and ethical beliefs, my cultural ties, and the prairie agricultural landscape that I enjoy?

Louise Buhler
War-man and District
Concerned Citizens Group

2.1 INTRODUCTION

Eldorado Nuclear Ltd. has proposed the construction of a $100 million refinery near Warman, Saskatchewan, to process uranium concentrates (yellowcake) produced at Saskatchewan mines. At the refinery the uranium would be converted into uranium hexafluoride and then exported. Following enrichment and conversion to uranium dioxide in the receiving countries, this fuel would be used in their nuclear power stations.

Eldorado currently produces 5 000 tonnes per year of uranium as UF_6 at its Port Hope refinery. An additional capacity of 9 000 tonnes is planned for Ontario. The proposed Saskatchewan refinery, also with a 9 000 tonne capacity, would be almost identical to the refinery proposed for Ontario.

2.2 SITE SELECTION

Eldorado began examining the feasibility of locating a refinery in Saskatchewan in 1975. Fourteen sites were examined in the following areas: Estevan, Melville, Moose Jaw, Nipawin, North Battleford, Prince Albert, Regina, Saskatoon, Swift Current, Weyburn and Yorkton. After further investigation, Eldorado rejected six of the areas primarily on the basis of an inadequate supply of good quality water; two others were rejected for economic and technical reasons. The sites selected in order of preference were Warman, Vanscoy, Moose Jaw and North Battleford. Following more detailed studies at Warman and Vanscoy, Eldorado selected the site near Warman and prepared an Environmental Impact Statement as a focus for the review of the project.

2.3 REGIONAL SETTING

The proposed site is located 23 km northeast of Saskatoon (population 142 000) in the Rural Municipality of Corman Park (Figure 1). It is 5 km southeast of Warman (population 1 600), 12 km east of Martensville (population 1 550) and 2 km west of the South Saskatchewan River. The Riverview Hutterite Colony (population 63), the closest corrnnunity, is 3 km southeast of the plant site. There are two residences, to the northeast and to the southeast, within 1 km of the property and within 3 km of the plant site itself.

The proposed site is located in the vicinity of an agriculturally productive area. The Warman area is within the Saskatoon milkshed. Yield in the Crop District which includes Saskatoon and the Rural Municipality of Corman Park indicates average to above-average rates for the major agricultural crops in the province.

Within the area between Saskatoon and Rosthern (45 km north of the proposed site) is one of the largest and oldest concentrations of Mennonite people in Saskatchewan. Mennonites began to settle in sizeable numbers in the area around 1895. The more conservative Mennonites are concentrated around Hague (30 km north of the site) and Osler (9 km north). Over the years, many Mennonites in this area have continued an agrarian life style.

Until the building of Highway 11 from Saskatoon to Prince Albert, the Mennonite communities remained physically and socially isolated in the region. Studies have shown that considerable change took place after completion of the highway. Increased access to Saskatoon, the industrial and service centre for the region, reduced the traditional role of the Mennonite supply centres of Rosthern, Hague, Osler and Warman. The increased use of Martensville and Warman as commuter communities for the northward-expanding

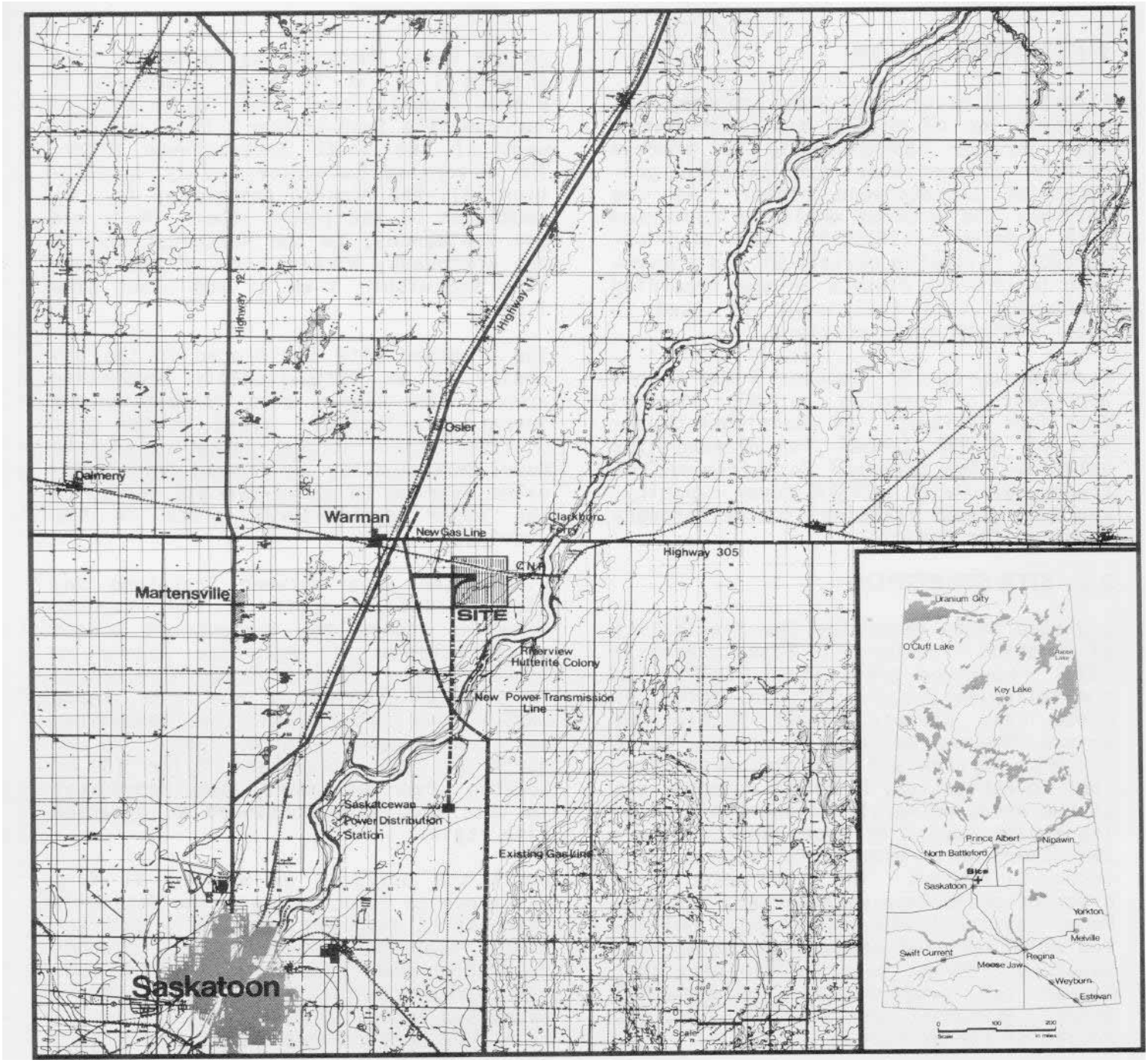

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Figure 1, Area Map

city of Saskatoon, as well as the location of light industry in this part of the region, has resulted in further changes to the Mennonite community. Saskatoon, developing at a rapid rate, is creating demands for residential, industrial and recreational lands in the South Saskatchewan River Valley.

In May, 1979, the Legislative Assembly of Saskatchewan passed an Act creating the Meewasin Valley Authority (MVA). The MVA's development control powers and its long-range plan both potentially affect the proposed project. Under the Act the MVA is required to consider applications for proposed improvements in its control zone and decide whether or not they are consistent or in accordance with the 100-year conceptual plan for the South Saskatchewan River environment in and around Saskatoon. The proposed plant site would lie outside the control zone but within the MVA's buffer zone (Figure 2). The master plan proposes the creation of a series of developments or activity nodes along the South Saskatchewan River. One of these, the Cathedral Bluffs Node, is partly within the buffer zone of the Eldorado property. It is intended to be developed into a major year-round recreational area, thereby raising a potential conflict with the refinery.

2.4 SITE DESCRIPTION

The property consists of 580 hectares (9 quarter sections or 1 440 acres). Approximately two-thirds of the land is farmed for cereal grains' and the remainder is pasture land. Access to the property would be provided from the existing grid road to the south and via the CN rail line running through the northern portion of the property. The refinery, including all buildings, roads and chemical storage areas, would occupy 16 hectares (40 acres). Most of the remaining 564 hectares would comprise a buffer zone, with a radius of 1 000 metres as required by the Atomic Energy Control Board (Figure 2).

Major components of the plant would include the warehouse and sampling building, the uranium trioxide (UO_3) area, the fluorine cell area and the uranium hexafluoride (UF_6) area. In addition there would be laboratories, a powerhouse, an incinerator for combustible solid waste, maintenance and storage areas, and an administration building (Figure 3). The plant would require an all-weather road and rail service as well as access to water, natural gas and electric power.

Approximately 1 hectare would be required for on site storage[1] of low-level radioactive wastes generated by the refinery. In addition a lagoon system would be constructed to collect and monitor storm runoff and treated effluents. This system would also include a storage lagoon for fire protection purposes.

2.5 PLANT PROCESS

The refining of yellowcake, a concentrate from mining/milling operations, to UF_6 is a proprietary process

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1 Storage is understood to be the retention of hazardous materials (in this case low-level radioactive waste) in such a manner that they have no significant effects on humans or the environment, can be monitored, and can be retrieved at a future time for further use or disposal. Disposal is understood to be the permanent placement of hazardous materials such that they have no significant effect on humans or the environrnent; further monitoring is not required and there is no intention of retrieving the material.

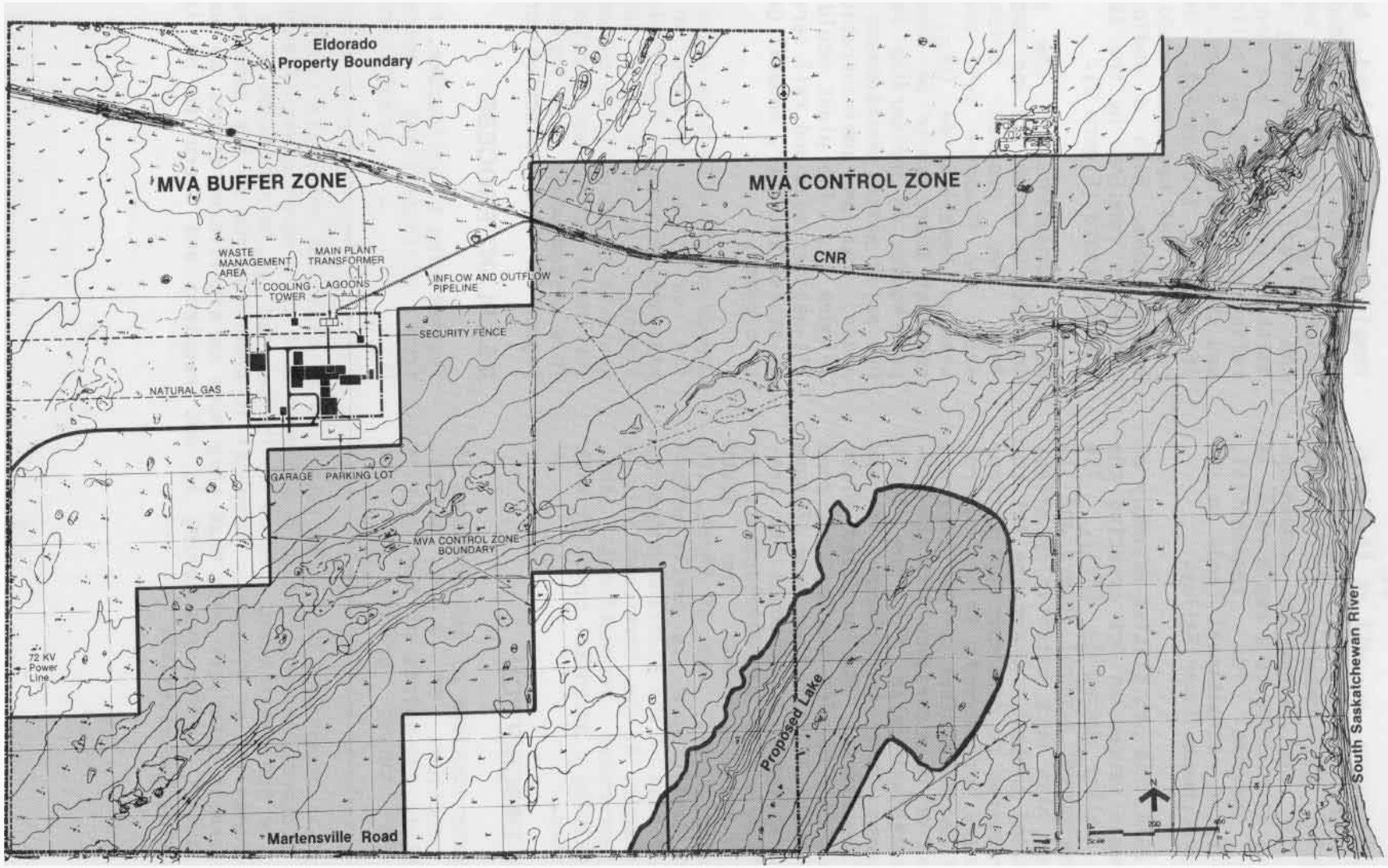

Figure 2, Site Plan

developed by Eldorado. It incorporates the experience gained from the existing Port Hope refinery as well as new technology developed in recent years. The process is presented schematically in Figure 4.

The proposed refinery would be designed to produce 9 000 tonnes per year of uranium as UF_6. If future demand warranted, the plant could be configured to produce uranium dioxide (UO_2) for natural uranium fuel.

The refinery would process approximately 12 500 tonnes of yellowcake per year. It would operate 24 hours per day, 7 days per week. Yellowcake, supplied from Saskatchewan mines, as well as feed chemicals would be delivered by truck and rail.

The resource requirements for the refinery would include:

- 1 610 to 3 120 cubic metres per hour of natural gas or 1 350 to 2 600 litres per hour of fuel oil;
- 75 cubic metres per hour of water;
- 10 megawatts of electrical power;
- 12 500 tonnes per year of yellowcake, and
- approximately 7 000 tonnes of chemicals such as ammonia, hydrofluoric, nitric and phosphoric acids per year.

To reduce air and water emissions, solid waste and chemical consumption in the process, a number of internal recycle systems have been proposed. In particular nitric acid, uranium, hydrogen fluoride and potassium hydroxide would be recovered and recycled.

2.6 WASTE MANAGEMENT

2.6.1 Air Emissions

The proposed refinery would emit sulphur dioxide, nitrogen oxides, uranium, hydrogen fluoride, fluorine, ammonia, radioactive and non-radioactive particulates and small quantities of radon gas. These emissions would originate primarily from five separate sources:

- the absorber stack, handling U03 plant emissions;
- the vent stack, handling most UF_6 plant emissions;
- the boiler stack, handling emissions from the boiler and the solid waste incinerator;
- the hydrogen incinerator roof vent, handling UF_6 plant reduction reactor off-gas, and
- the hydrogen seal pot vent, handling excess hydrogen generated in the fluorine cells.

Eldorado has proposed a treatment system to scrub hydrogen fluoride from exhaust gas streams and to remove airborne particulates from the absorber stack, vent stack, and the hydrogen incinerator and seal pot vents. The hydrogen fluoride scrubbing system would also include a second stage designed to handle ventilation flow in the case of a process upset. This scrubber system would be connected to an emergency power supply to ensure continuous operation.

2.6.2 Wastewater Discharges

Wastewater from the proposed refinery would include- quantities of ammonia, chromium, nitrate, phosphorous, potassium, sulphate and uranium.

It would be discharged from:

- the refinery process as effluent from the U03 plant nitrate water treatment facility and the UF_6 plant sump treatment facility, and
- the service area as cooling tower blowdown, potable water filter backwash, demineralization plant water, boiler blowdown and sanitary and laundry waters.

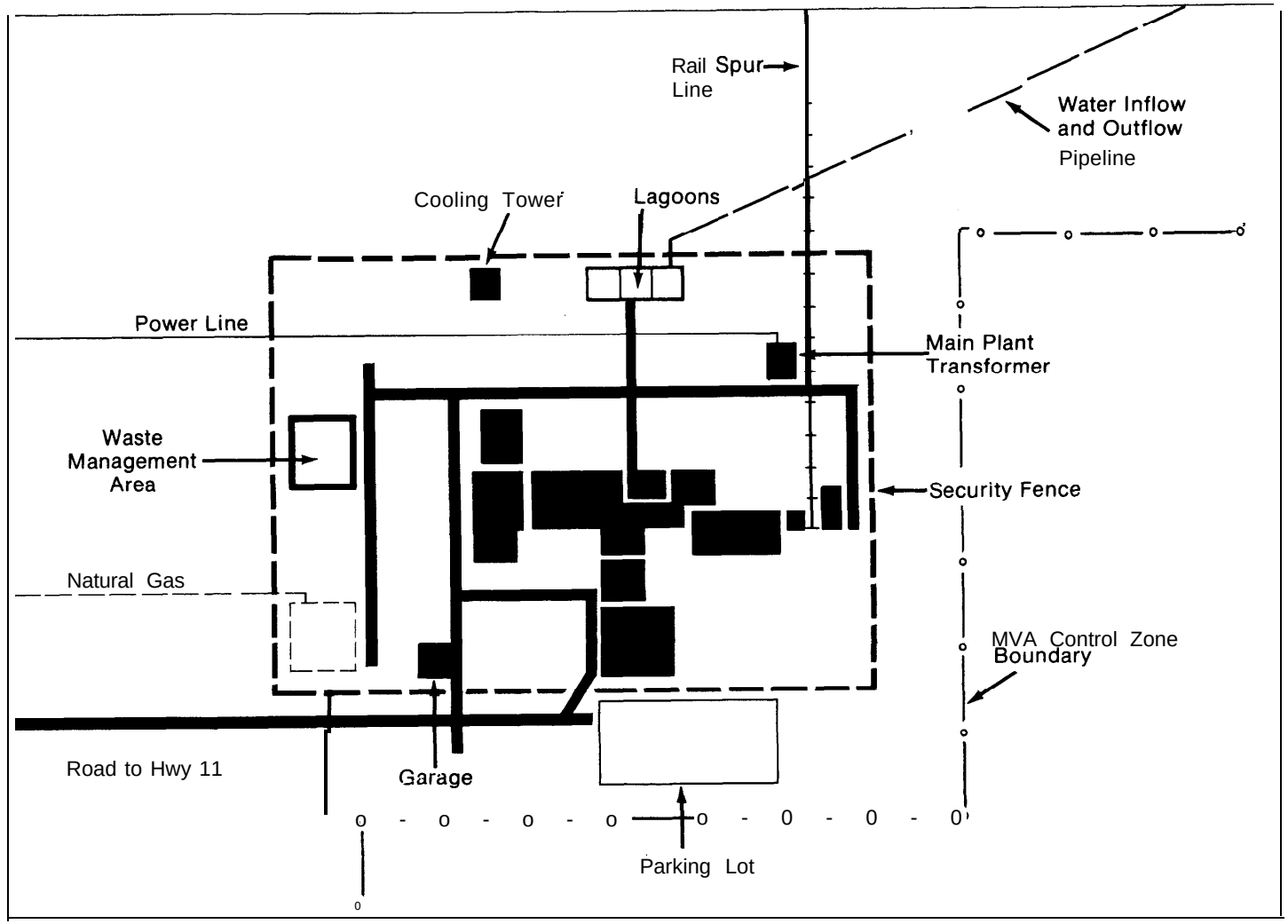

Figure 3, Detailed Site Layout

The effluent from the U03 plant would be neutralized prior to discharge. Effluent (condensate) from the UF_6 plant would be discharged directly to the lagoon system. The cooling tower system would require periodic addition of corrosion-inhibiting chemicals such as chromium, zinc and phosphate. If a system with chromium were used, Eldorado would introduce a chromate removal system prior to discharge. Filter backwash and boiler blowdown water would undergo settling prior to 'discharge. Regenerate streams from the water softener in the demineralization plant would be neutralized before being discharged. Sanitary and laundry water would be treated in a biological sewage treatment plant. A total flow of 18.7 to 24.7 cubic metres per hour from these sources would be discharged to the fire water lagoon which would be designed for five to ten days retention.

Two additional lagoons have been proposed to contain stormwater runoff from the plant area, the access road to the storage area and the road network within the storage area. These lagoons would be designed to contain a once-in-ten-year storm. Both the stormwater lagoons and the fire water lagoon would be monitored; further treatment, if necessary, would be given to the effluent prior to discharge to the South Saskatchewan River.

2.6.3 Solid Wastes

The principal solid wastes generated by the refinery would be raffinate solids from solvent extraction. Approximately 1 070 tonnes per year of this low-level radioactive material would be produced. Eldorado has proposed that the raffinate would be recycled to a uranium mill in Saskatchewan, not only to dispose of this "waste" but also to recover further uranium (its uranium content would be as high as some refinable uranium ores). Facilities for temporary storage would be constructed on site to allow for weather and other interruptions in transporting the material to the uranium mill.

Storage facilities would also be required for low-level radioactive wastes which could not be recycled. This would include U03 plant sump solids (7.5 tonnes per year), calcium fluoride solids frorn the UF_6 plant sump treatment facility (616 tonnes per year), fluorination reactor ash (4.3 tonnes per year), uranium precipitate from the recovery system (11.3 tonnes per year) and solid waste incinerator ash (13.2 tonnes per year). All such wastes would be placed in sealed steel drums and stored on site. Approximately 300 square metres of storage would be required annually. The design of the storage area would allow for incremental addition of storage buildings for a period of up to ten years, after which it is expected that a disposal facility would be available.

Any non-radioactive solid wastes would be handled in a conventional manner. Additional radioactive waste such as scrap equipment which cannot be economically decontaminated would be stored on site.

2.7 DECOMMISSIONING

The lifetime of the facility, in engineering terms, was estimated to be thirty years but could be longer. Ultimately it would depend on future developments in rnarkets for refined uranium products.

It was Eldorado's intention to dismantle all process equipment and plant structures, and ensure that the site would be totally decontaminated with no restriction on its future use. It was expected that low-level radioactive wastes generated and stored in the early years of the plant operation would have

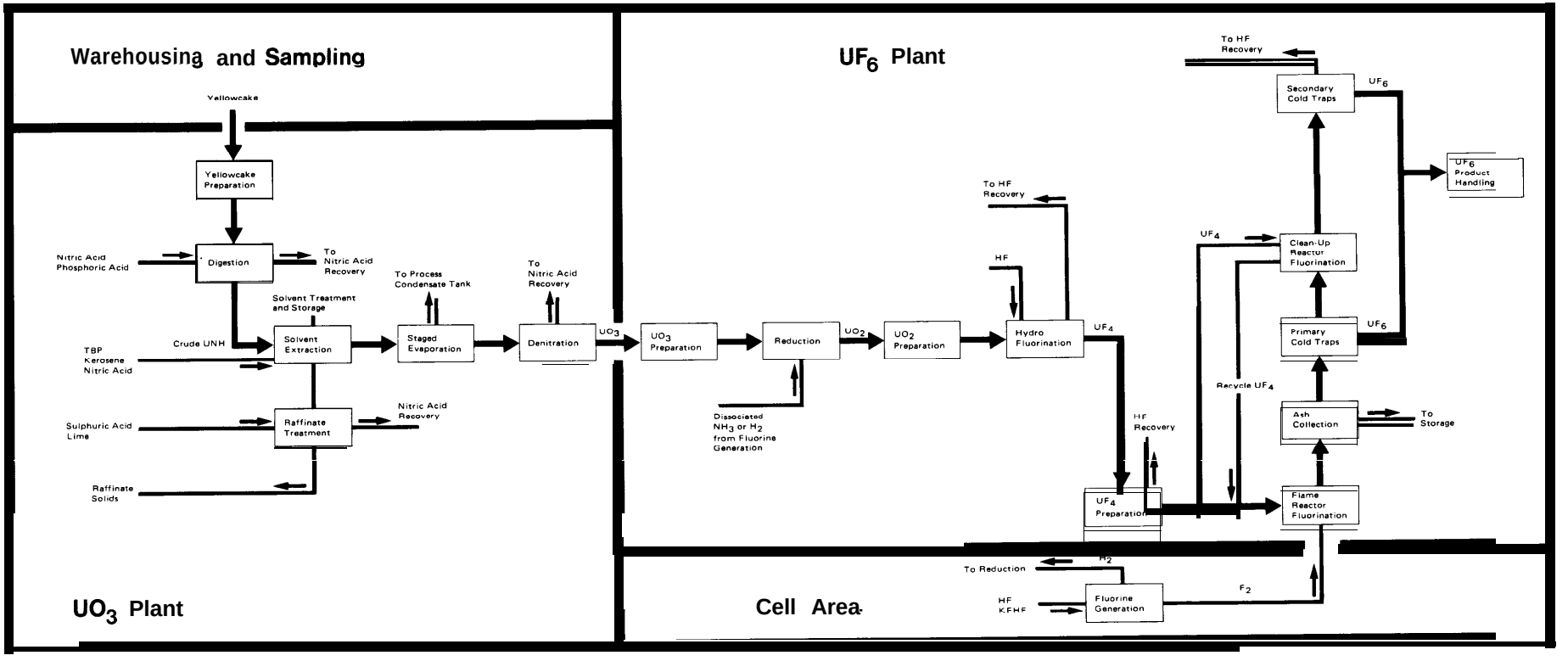

Figure 4 Process Schematic

been removed to a final disposal facility well before decommissioning[2]. Eldorado, citing experience elsewhere, expected that the plant would be relatively easy to decommission since only the uranium solids and solutions in the plant itself would be contaminated; scrap metal would not be radioactive.

Under AECB licensing procedures, a detailed decommissioning plan would be required when Eldorado announced its intention to cease plant operations.

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2. Eldorado would be required by the Atomic Energy Control Board during its licensing process to identify plans for and to make a commitment to establish a final disposal facility.


ELDORADO
NUCLEAR LT
STAN FROST
FRANK HUESTON


ENVIRONMENTAL ASSESSMENT
PANEL

CHAPTER 3

ISSUES

Further processing of our natural resources prior to export constitutes a major element in the manufacturing element in the strategy of the Government of Saskatchewan. At present, Saskatchewan is in a unique position. World demand for our resources is very strong, a fact which gives us a particular advantage in attracting investment and developing our resources on terms favourable to the residents of Saskatchewan. Too often in the past, Saskatchewan mineral and agricultural products have been shipped out of the province in raw form to, be processed elsewhere. This leads to a substantial loss of jobs. Generally speaking, processing activities employ more people than resource extracting activities. Our bargaining position has never been better to encourage industry to do more of the processing here in Saskatchewan.

Don Jesse
Saskatchewan Department of
Industry and Commerce

Anyone engaged in Canada's energy industry has a social obligation to increase the world energy supply to this country and to others. The form that the energy takes doesn't really matter. Conservation, solar, wind, oil, natural gas, coal and uranium-all of them are needed.

Andy Roake
Eldorado Nuclear Ltd.

In my view, it is unethical to place uranium hexafluoride onto the export market, when one knows there is a very high risk that some of it will be diverted for use in nuclear weapons. There can surely be no doubt that this risk is very real.

Peter Prebble
Member Legislative Assembly,
Saskatchewan

Nuclear energy is here and it is here to stay. As with any other natural resource it can be used but also misused. The problem then becomes one of first identifying these uses and abuses, and the characteristics of the resource on which they are based. Next we need to take measures that will reduce any risk to an acceptable level and to put these measures into laws and regulations. Lastly, persistent vigilance and enforcement or rules is required. The whole process demands extensive research and open debate. Such takes time. If that time is not available and we are forced into a position of crisis management, resource utilization will become less than rational and therefore detrimental to mankind. Let us proceed wisely.

Walter Kupsch

3.1 INTRODUCTION

This chapter presents an analysis of the issues which the Panel found to be significant during its environmental assessment review of the project. The Panel addresses, first of all, a number of general concerns which were non-site specific. These are: the need for and alternatives to the project, alternative sites, and nuclear weapons proliferation. Site-specific issues are grouped according to natural environment concerns (factors which affect the human environment through the natural environment) and human environment concerns. Under the former, the Panel discusses issues relating to the air environment; the aquatic environment; the terrestrial environment and hydrogeology; waste treatment, disposal and transport; and monitoring and control. Issues addressed as human environment concerns include: social and community impacts, health and safety, agriculture and other land use, and monitoring. The relative importance of the various issues or emphasis to be given to them is explicitly stated where necessary.

3.2 GENERAL CONCERNS

3.2.1 Need for and Alternatives to the Project

In dernonstrating the need for a third uranium refinery in Canada, Eldorado argued that its proposal would conform to Canada's export guidelines, would contribute to the world energy pool, and would meet future market demands.

Eldorado cited conformance to Canada's policy of requiring, in the absence of special exemption, upgrading uranium to the most advanced form possible prior to export. Canada's export guidelines also state that all exports must be for peaceful purposes and appropriate nuclear safeguards must be in place. In addition a producer's unconrnitted uranium resources must be sufficient to meet its share of the thirty-year domestic requirement.

The role of nuclear power in the context of world energy demand was raised frequently at the public meetings. Eldorado pointed to the increasing global requirement for energy together with decreasing supplies of fossil fuels and the contribution of the new refinery to world energy supply. A number of participants, citing a general cutback in projected nuclear power plants, argued that increased UF_6 capacity was not needed. Eldorado in turn cited from a number of recent international studies and based its projections on lowest estimates. There was general agreement that energy conservation was required but disagreement on the appropriate emphasis on other sources. Some argued that coal and nuclear power were the only viable large-scale alternatives while others felt that alternative energy sources (solar, wind, tidal, geothermal, biomass) and conservation measures deserved more research and development and incentives from governments. Eldorado argued that although the United States was making considerable investments in solar power, recent studies had concluded that its contribution toward meeting future world energy needs would be minor.

The Panel agrees that alternative energy sources and conservation measures should receive higher priority. It also recognizes, however, that the relative emphasis given to various energy sources by foreign countries will be their decision. Eldorado's analysis is based on current commitments to nuclear power. Continuing market evaluation would of necessity take into account any significant decreases in dernand for UF_6.

In examining uranium supply and markets for UF_6, Eldorado pointed out that while the refinery would depend on the mines, the mines would not depend on the refinery. The development of uranium mining is geared to assured markets. In Saskatchewan, uranium production is expected to increase from 2 500 tonnes per year in 1979 to about 4 000 tonnes in 1982. The Key Lake mines would further increase production from 7 000 to 8 000 tonnes in 1981 and to over 9 000 tonnes in 1990. Canadian uranium production capacity, according to the Department of Energy, Mines and Resources, is expected to increase from 6 800 tonnes (actual) in 1978 to 9 000 tonnes in 1980 and 15 500 tonnes in 1990 to meet domestic and world demand. Total estimated uranium available for export and hence conversion to UF_6 would be 7 700 tonnes in 1981 and 13 000 tonnes per year in 1990. In addition to refining Canadian uranium, Eldorado converts uranium from other countries to UF_6. Eldorado indicated that the quantity of foreign uranium available for this purpose would be 3 000 to 4 000 tonnes per year in 1985 and beyond.

Eldorado supplies all uranium dioxide used as fuel in Canada's CANDU reactors. In addition approximately 5 000 tonnes of UF_6 from Eldorado's Port Hope plant is exported as feedstock for uranium enrichment facilities mainly in the United States. A second 9 000 tonne capacity refinery in Ontario, expected to come on strearn in 1983, would increase Eldorado's UF_6 capacity to 14 000 tonnes per year. That figure would increase further to 23 000 tonnes per year in 1984 if the Saskatchewan refinery were constructed as proposed. The timing of construction and start-up of the refinery would depend on the timing of new uranium mines being developed in the province and on market conditions.

Alternatives to building a new refinery were discussed. Eldorado indicated that it had considered expanding the new Ontario refinery above its planned 9 000 tonne capacity, a measure said to be more economical in the short term but not feasible up to the full 9 000 additional tonnes planned for Warman. Eldorado also indicated its desire to conform to the policy of the Government of Saskatchewan, namely, to encourage maximum processing of natural resources within the province.

Given the uncertainties of predictions and the expected life of the three refineries, the Panel concluded that Eldorado had demonstrated that it was reasonable to plan another 9 000 tonne world-scale refinery. The Panel notes that Eldorado would re-evaluate its market analysis before deciding when to proceed with construction, assuming all regulatory approvals were received, and that such final decisions would be based on criteria relating to the economic viability of the plant.

3.2.2 Alternative sites

The Panel's mandate was to investigate the Warman site only. During the course of the review, however, frequent mention was made of the site selection criteria used by Eldorado in its Phase I and II studies leading to designation of Warman as the preferred site.

One of the original criteria for site selection, a water requirement of approximately 10 900 L/min. (2 400 gal/min.), led to early rejection of sites at Estevan, Melville, Regina, Swift Current, Weyburn and Yorkton. The refinery proposal for the Warman site includes a cooling tower that would reduce water consumption to approximately 1 250 L/min. (275 gal/min.). It was

argued that some of the sites might have been re-considered on the basis of this change in criterion for water supply.

Although one criterion was social and community factors, there were strong arguments that it was given inadequate consideration. Many felt that had this important factor been considered the result might have been selection of a site other than Warman.

In the Phase I study an important factor in the selection of the two sites (Warman and Vanscoy) near Saskatoon was the projected saving in construction costs. It was noted that there were large capital cost penalties for sites near Moose Jaw and North Battleford due to the cost of construction labour. Nipawin was rejected on the basis of transportation, labour availability and lack of an alternate power supply. Poor transportation, poor foundation conditions and a costly labour market were the reasons given for rejecting Prince Albert. The Saskatoon area was considered most attractive since it had lower construction costs. In addition it is a large centre with excellent educational, cultural and recreational benefits, good-quality living accommodation and ample support and service industries.

A third concern expressed at the meetings was that insufficient study had been carried out on groundwater movement at the various sites. Eldorado argued that sufficient information had been gathered on soils and geological features for site selection purposes and that further hydrogeological work conducted on the Warman site during preparation of the Environmental Impact Statement substantiated the belief that conditions were acceptable for the proposed plant.

The Panel is satisfied that the changes in design criteria were a response to improvernents in technology; as better technology becomes available, or when new technical remedies to solve a specific problem are identified, the improved design should be used. The Panel also concludes that the Warman site does meet the technical requirements for a refinery, i.e., being near railways, natural gas, roads, electricity and water, having easy access to a labour supply, and possessing an acceptable hydro-geological structure. This conclusion does not detract from the point, made in the public meetings, that other sites might also meet the technical requirements used in the final plant design. The Panel notes that the Province of Saskatchewan indicated a preference for an in-depth evaluation of alternative sites.

3.2.3 Nuclear Weapons Proliferation

During the meetings, and in many of the submissions, the Panel noted much public concern about proliferation of nuclear weapons. Eldorado's product, UF_6, is the feedstock for uranium enrichment plants which produce fuel for light water reactors. The spent fuel from these reactors can be chemically re-processed to separate plutonium, a fissionable radionuclide, which can be used either as a fuel for electrical generation or for nuclear weapons. Many participants argued that the provisions of the Nuclear Non-Proliferation Treaty and Canadian safeguards were incapable of effective control. Other individuals and groups demanded guarantees that Canadian uranium would never be used for weapons.

Eldorado responded to these concerns by noting that there are far more efficient and inexpensive ways to produce plutonium than by reprocessing spent fuel from power reactors. In addition, Eldorado strongly resented the accusation by some participants that producing UF_6 is promoting nuclear war. The Panel does

not accept the notion that Eldorado is warmongering by producing UF_6. The Panel recognizes, however, the concerns about proliferation of nuclear weapons. Because of the extent of public concern, it believes that the federal government should continue to pursue institutional means to strengthen international safeguards.

3.3 NATURAL ENVIRONMENT CONCERNS

3.3.1 Air Environment

The air emissions of major concern to participants at the meetings were hydrogen fluoride, sulphur dioxide, uranium and anhydrous ammonia.

Eldorado's system to remove hydrogen fluoride would involve the use of two scrubbers in series and a back-up system which would reduce the likelihood of elevated hydrogen fluoride emissions during plant upset conditions. According to Eldorado, normal emissions of hydrogen fluoride would be approximately 2 kg/day. Under credible accident conditions this could increase to approximately 15 kg/day. Concentrations at the property boundary under normal and under accident conditions have been predicted to be low and within proposed Environment Canada ambient air guidelines. Eldorado demonstrated that even under upset conditions hydrogen fluoride emissions would not have adverse effects on vegetation, wildlife or cattle.

Sulphur dioxide monitoring data for the city of Saskatoon indicated that maximum acceptable one-hour concentrations (450 $\mu g/m^3$) were occasionally reached, the principal source being the Queen Elizabeth Power Station.

Under worst conditions, i.e., firing the boilers with No. 6 fuel oil whenever natural gas was not available or not economical and under most unfavourable weather conditions, it was estimated that less than 10 percent would be added to ambient air levels in Saskatoon. This could have a minor impact on the city, given the levels already experienced on occasion.

Concern was also expressed as to whether hydrogen fluoride and sulphur dioxide emissions would have a combined or synergistic effect. Evidence was presented which indicated that such effects could occur only when a high concentration of hydrogen fluoride existed for extended periods of time above the threshold level[3]. Eldorado contended that such emissions would not occur at the new refinery.

The main sources of uranium would be the absorber stack, H2 incinerator and the vent stack. Total emissions were estimated to result in low ground-level concentrations at the property boundary which were well within the International Con-mission on Radiological Protection annual standard.

There was some concern over the effects of an anhydrous ammonia spill should an upset occur during off-loading. Eldorado contended that its modelling of such an upset condition was conservative and should such an event occur, it could be quickly mitigated by means of a water spray.

Emissions of ammonium nitrate and nitric acid and the attributed health problems in 1979 from the existing Port Hope refinery were frequently mentioned. Eldorado explained that the ammonium

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3 Threshold level is understood to be a level below which there is no measurable effect.

We are satisfied that if the refinery is designed and operated according to the environmental protection concepts proposed in the Environmental Impact Statement, the degradation in the quality of the receiving environment would be minimal.

John Mar
Environment Canada

Why must the nuclear refinery be located on prime agricultural land? Chemicals such as hydrofluoric acid, nitric acid, sulphuric acid and others are going to be used at the proposed refinery. There is no guarantee that accidents, such as Mississauga, Ontario experienced, will not happen here.

Lloyd Sawatzky

nitrate emissions arose principally in the production of ceramic grade UO_2 for the CANDU reactors in Canada. Eldorado pointed out that the proposed Saskatchewan refinery was not intended to produce UO_2 and thus there would not be any ammonium nitrate emissions. The nitric acid losses would be controlled through a total condensation system virtually eliminating this emission. If future demand warranted, however, the plant could be modified to produce UO_2. This would require a new Atomic Energy Control Board license since it would necessitate substantial modification to the proposed plant. The Panel emphasizes that it reviewed the refinery proposal as a UF_6 plant only.

In summary, the Panel concludes that the effects of air emissions from the proposed UF_6 refinery would not be significant.

3.3.2 Aquatic Environment

Wastewater sources and the proposed treatment system are outlined briefly in Section 2.6.2.

Eldorado indicated that process water, directed to the fire water lagoon, would be monitored continuously for pH, fluorides and conductivity. In the event of an upset, the wastewater would be treated with lime to remove fluorides and uranium as a precipitate. The area around the plant building would be paved to catch and divert stormwater to two lagoons for retention and possible treatment prior to discharge. Eldorado indicated that if all the lagoons were to become contaminated and could not handle any further water, the plant would be shut down until the effluent was treated properly.

Some concern was expressed that the South Saskatchewan River could become contaminated by the refinery discharge. Eldorado contended that the effluent would meet the Saskatchewan drinking water standards and that the small process stream added to the large flow of the river would be inconsequential.

The Panel concludes that there is no significant risk of plant effluents contaminating the South Saskatchewan River. Water use would be small and the only chemicals to be added (anti-corrosion phosphates and chromates) would be removed before the waste stream was returned to the river. Risks from spills appear negligible.

3.3.3 Terrestrial Environment and Hydrogeology

Eldorado's terrestrial survey of vegetation, birds and mammals on the site did not uncover any rare or endangered plant or animal species warranting protection. The Panel believes that the removal of vegetation and impact on birds and mammals on the site would be insignificant.

In order to determine the geological and hydrogeological characteristics of the site, Eldorado drilled piezometer holes to a depth of 48 metres and three deep stratigraphic holes to bedrock. Geological logging, groundwater monitoring and chemical testing were conducted to determine the potential effects of the refinery on the groundwater.

The future stability of the site was questioned. There was some concern that underlying the property was a large salt dome which might collapse in the future. Eldorado indicated that its deep drilling study revealed no evidence of collapse structures. The Department of Energy, Mines and Resources supported this finding.

Concern was also expressed that the Tyner Valley aquifer, underlying the site, could become contaminated. The water in

this aquifer is brackish and therefore not directly suitable for domestic consumption or most agricultural uses. Eldorado pointed out that the large till barrier between the surface waters and the underlying Tyner Valley would preclude any water exchange for many thousands of years. A hole 1.5 m in diameter was bored to 37.5 m and examination by Eldorado's hydrogeologists revealed no evidence of any fracturing or zones of significant water flow. Findings of the Saskatchewan Research Council, however, supported the presence of fractures in the unweathered till in the general vicinity of the site. The expected frequency of fracturing is low. Considering the very low probability of an accidental spill reaching the aquifer the Panel believes that the risk of contamination is quite small.

Fear was voiced that spills of hazardous substances might contaminate groundwater used for drinking and for watering livestock in the area. Eldorado indicated that the shallow weathered till, through which there would be a horizontal movement of water, showed no adverse or unusual characteristics. It was pointed out that the paved catchment area to collect stormwater and spills together with the impermeable lining in the lagoons, would reduce the chance of a spill affecting groundwater. The precise direction and horizontal movement of groundwater relative to the proposed facilities could only be determined after the plant design was completed. Wells would then be dug downstream from the plant to intercept groundwater and analyze its quality. In the event of a spill, a ditch would be excavated in a downstream direction to trap the contaminants as they moved horizontally with the shallow groundwater flow.

Overall, the Panel is satisfied that the proposed refinery is acceptable from a hydrogeological point of view. The Panel notes, however, the need to conduct a detailed surficial geology-soils survey in the immediate vicinity of the plant site and east to the river to determine the precise location of observation wells. The wells should not necessarily be installed on a grid basis but rather in accordance with physical characterization data collected on selected benchmark stratigraphic profiles.

3.3.4 Waste Treatment, Disposal and Transport

3.3.4.1 Waste Treatment and Disposal

The proposed uranium refinery would generate solid wastes (principally raffinate) containing appreciable quantities of naturally radioactive material. Concentration of radioactivity, due to the presence of radionuclides of the natural uranium and thorium decay chains, would be low but not so low that their radiological properties could be ignored. Half-lives of the important radionuclides are long; the radioactive properties are unlikely to change significantly for thousands of years. Considerable concern was expressed at the meetings about the radiation-related risks associated with the handling and storage.of waste, even at low levels of radiation.

Since technology for disposal of radioactive wastes is not available at present, Eldorado considered alternatives including on-site storage and the return to a uranium mill of raffinate which contains significant quantities of recoverable uranium. As a result of recent trials with the recycling of raffinate from its Port Hope refinery through a uranium mill at Elliot Lake, Eldorado expressed confidence that raffinate from the proposed Warman refinery could also be recycled through a

Saskatchewan mill. This could reduce the volume of waste requiring storage by approximately two-thirds.

The recycling program, opponents argued, would merely add to a waste disposal problem not yet solved since, after uranium recovery in the mill circuit, waste would be discharged to the tailings pond. Eldorado contended that the incremental amount of radioactivity in the tailings resulting from this program would be considerably smaller than if the mill were to process more ore to produce the same amount of uranium. Furthermore, Saskatchewan Environment emphasized the desirability of transporting all waste containing measurable levels of radioactivity to an operating uranium mill-waste facility since measures would not exist locally to permit handling of such waste and it would allow such wastes to be consolidated in a few locations.

The Panel questioned whether it had been determined that the recycling program would be acceptable to people living near the mines. Reference was made to problems, apparently now resolved, that developed when the raffinate was introduced to the milling circuit in Ontario. Eldorado appeared willing to discuss and gain acceptance of the recycling program in the respective mining communities involved.

The Panel considers this aspect of the refinery to be satisfactory, on the presumption that the recycling proposal would have to meet the requirements of the Atomic Energy Control Board before the refinery could be licensed.

The recycling program did not contain all of the waste. About a third of it would remain. Much of it, the calcium fluoride wastes[4] (2 700 drums per year), has potential for recycle within the metallurgical industry or for use in hydrofluoric acid production but no firm proposals were made in this regard. The disposal of this residual waste was not dealt with fully at the public meetings by Eldorado or the Atomic Energy Control Board. It would require on-site storage possibly for the life of the plant over which time a considerable volume would have accumulated.

Eldorado indicated that non-radioactive solid waste could be disposed of in local municipal landfill sites. Officials of Saskatchewan Environment felt that such a site should be owned and controlled by Eldorado in case it was contaminated with radioactive material. They pointed out that municipal facilities were not operated in a manner to preclude possible problems which could arise should contaminated material be received. The Panel concurs with this view.

3.3.4.2 Transport of Hazardous Substances

A number of concerns were raised on the subject of shipment of radioactive substances. Eldorado would ship yellowcake to the refinery from Saskatchewan mines, raffinate waste back to the mines and UF_6 to world buyers. There was concern that individuals might be exposed to radiation and that drivers of vehicles handling yellowcake might not be given adequate instructions. It was pointed out that legislation requires yellowcake to be contained in strong industrial packaging and appropriately labelled. Eldorado ships yellowcake in 45-gallon steel drums sealed with rubber gaskets;

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4 The radioactivity of the calcium fluoride was projected to be close to the minimum level at which control by the Atomic Energy Control Board is required.

the same drums would be used to return the raffinate. Eldorado contended that exposure levels to individuals from the annual shipment of refinery yellowcake and UF_6 would be negligible. Since the material will be in a dry solid form, Eldorado argued, an accidental spill would not present a significant environmental risk. A spill would be cleaned up using simple techniques without creating significant exposure to the response team or the public. UF_6 has been shipped in specially designed containers. In the few instances where a container has been involved in an accident no UF_6 has been spilled.

The other main process chemicals shipped to the plant would include hydrofluoric acid, anhydrous ammonia, nitric acid and caustic potash; lime, sulphuric acid, kerosene, tributyl phosphate and potassium bisulphide are used in lesser quantities. Concern was especially voiced about the transport and possible spills of hydrofluoric acid, which would be shipped by rail. Many people were alarmed that derailment of a hydrofluoric acid car might cause a problem similar to that which recently occurred in Mississauga, Ontario, involving a chlorine spill. Eldorado was assured by the CNR that hydrofluoric acid destined for its plant would not be shipped through Saskatoon or Warman.

Eldorado indicated that it would respond to accidents anywhere involving UF_6 shipped or consigned by the company. It would also be prepared to assist in the implementation of a Transport Emergency Assistance Plan for Saskatchewan in any chemical-related accident in which it had expertise. In particular, Eldorado would be prepared to provide an emergency vehicle complete with a crew trained in anhydrous hydrofluoric acid handling - a response capability presently not available even though this chemical now regularly passes through Saskatoon.

A final issue raised was the matter of liability in the event of accident or process upset. Eldorado carries $11 million in automobile and business liability insurance to cover compensation in the event that an upset condition caused damage beyond its property. In addition, in accordance with the Canadian Nuclear Liability Act, there would be $75 million liability for personal injury and property damage and liability for transportation of non-fissionable material of $5 million for body injury and property damage. In most cases, the transporter of materials delivered to the plant would be responsible for the material until it reached the plant.

Concern was raised about third party distress over liability. The Panel believes there would be merit in establishing an industrial accidents recovery fund that would be used to relieve public distress during lengthy periods of litigation over liability. Although Saskatchewan has been fortunate in having no need for such a fund, its creation could be a progressive step towards reducing public exposure to the risk of losses through industrial accidents. The fund could be appropriate at the federal level since the problems it would address would not be unique to any one province.

3.3.5 Monitoring and Control

Monitoring programs are designed to provide information on the impact of an activity on the surrounding environment and on the effectiveness of environmental control programs and other mitigative measures.

Eldorado's proposed monitoring program had three parts:

1. baseline data monitoring to be carried out before construction and operation and to include measurements of air, water, radiation and the biological environment, as a bench mark against which future changes in these parameters can be judged;
2. an operations compliance monitoring program inside the plant to measure the efficiency of control systems, detect process upset conditions, and ensure compliance with environmental and health regulatory requirements, and
3. an operational environmental monitoring program in the plant buffer zone and surrounding area to measure the ongoing effects of the refinery and to identify the need for any corrective measures.

During discussion of the baseline and operational environmental monitoring programs, a number of government agencies identified areas where data were insufficient. There was concern that information presented on the terrestrial environment (vegetation, mammals), aquatic environrnent (South Saskatchewan River) and groundwater was inadequate to allow comparison of future monitoring results with pre-operational baseline data. Eldorado responded that the information gathered for the Environmental Impact Statement was not expected to be sufficient for baseline purposes. After final siting and plant layout had been approved, Eldorado would develop monitoring programs incorporating suggestions made during the public meetings.

One problem raised was that the frequent farm application of phosphate fertilizer, containing small amounts of uranium from the phosphate rock, adds to levels of uranium in the soil. A baseline program would have to be carefully conducted to distinguish between plant emissions and background levels that may be slightly augmented by fertilizer application.

The proposed operational compliance monitoring program was found to be generally satisfactory by the regulatory agencies. It was recommended that provisions be made for continuous monitoring of hydrogen fluoride, particulates, sulphur dioxide and nitrogen oxides. Effluent flow to the lagoons would be monitored continuously for pH, fluorides, and conductivity; uranium, ammonia, and nitrates would be analyzed daily.

Considerable discussion ensued on the monitoring of groundwater flows and quality. Existing wells were not considered adequate for operational compliance monitoring. Eldorado gave assurances that once final site layout was approved, detailed local conditions would be determined by shallow monitoring wells and large inspection holes if necessary. Based on this information, final plans for groundwater monitoring and spill contingencies could be made.

The Panel was assured that the monitoring programs as proposed would represent an adequate basis for licensing applications. It is understood that the regulatory agencies would require additional details at that time and that they would undertake supplementary monitoring to ensure a comprehensive coordinated program.

Eldorado also proposed the establishment of a Public Monitoring Committee, to be organized as soon as the site was finalized. It would be an open forum where data on monitoring, including health and the physical environment (but excluding social impacts), and the industry and government response would be presented,

interpreted and regularly disseminated in a suitable form for the public. Some speakers felt that the Committee ought to have a role in decisions concerning plant maintenance and that it should collect its own data. Eldorado proposed that representation on the Committee would include persons appointed from the Corman Park Council, and representatives from the municipalities of Warman, Martensville and Osler; officials of Saskatchewan Environment, Environment Canada and the Atomic Energy Control Board would serve as advisors. Eldorado indicated its willingness to underwrite the Committee's reasonable financial expenses.

The Panel heard many presentations that questioned Eldorado's ability to operate the proposed plant safely. In addition, Eldorado's previous environmental problems were frequently mentioned. Those opposed to the refinery felt that Eldorado's record provided little assurance that environmental protection was a high priority. There was also concern that problems similar to those at Port Hope would arise as the plant aged. While the Panel was not charged with the responsibility of examining Eldorado's past record, it notes the variety of environmental problems that have occurred at the existing Port Hope refinery, some as a result of practices and procedures which have long since been discontinued. At the same time the Panel is aware of the significant differences between the proposed plant and that at Port Hope. The Panel feels that it is important that Eldorado should be accountable to the public in the area of the proposed plant. The Panel is of the opinion that the proposed Public Monitoring Committee would go some way toward assuring such open accountability.

The role of such a Committee should be to provide for the dissemination of monitoring information from Eldorado and the regulatory agencies together with selected social-impact data (yet to be determined), to increase industry and government accountability, and to facilitate access to Eldorado management by members of the local community. Effectiveness and credibility of the Committee would depend on three factors. First, its composition would have to represent a wide range of interests involved in and affected by the refinery, e.g., Eldorado's management, the Union representing workers in the plant, local governments, the Meewasin Valley Authority, citizens in the area (with more than one representative to include key interests within the community) and local environmental groups. Representation from the municipal councils alone would not be sufficient. Provincial and federal regulatory agencies should participate only as observers. Second, the Committee would need to have access to Eldorado and government agency monitoring information, and have clear terms of reference. Third, Committee members must be accountable to their respective constituencies. The Panel also concurs with a suggestion that the Committee should have a role in decisions to maintain the plant, especially as it grows older. Further details, including the appropriate organizational structure for the Committee and rules governing its operation, remain to be worked out in the local area, should the project proceed.

Various regulatory agencies would be responsible for ensuring that further approvals, enforcement of pollution controls and other standards, monitoring and additional mitigating measures, upon which the Panel's approval might be conditional, were actually carried out. Some people expressed confidence in the ability of the regulators to protect the public and the environment; others were concerned about the performance of

the regulators and degree of trust in them. Some people had difficulty differentiating between the regulators and the proponent; the Atomic Energy Control Board for example, was perceived by some people as being synonymous with the industry. There were also various expressions of uncertainty concerning which government authority, if any, had ultimate responsibility for controlling the refinery's operation on behalf of the public interest. The Atomic Energy Control Board, which has the authority to license the plant under the Atomic Energy Control Act, received criticism in this regard, probably in part because its complex regulatory process (site acceptance, construction approval and operating approval) appeared confusing. Saskatchewan Environment was also questioned concerning its ability to enforce effectively pollution control regulations. An example cited was the operation of the chlor-alkali plant near Saskatoon.

Eldorado stated that they would abide by provincial and municipal laws, even though they were not legally obliged to do so. Some doubted the statement in light of the company's attempt in court to dispute the constitutionality of a federal crown corporation being prosecuted by a provincial government (Ontario). The Atomic Energy Control Board pointed out that applicable provincial and municipal standards and regulations would be incorporated into its licenses. While the Atomic Energy Control Board has the authority to withdraw a license, the Panel was not clear which agency, if any, could enforce compliance with environmental protection regulations once the plant was operating.

The Panel recognizes that the withdrawal of a license for enforcing environmental protection requirements is a severe action and would likely occur only in the event of an imminent danger to human health or the environment. The Panel believes, therefore, that less extreme measures should also be incorporated into the Atomic Energy Control Board licensing provisions. The Atomic Energy Control Board, as the agency licensing the refinery, should have control measures available which would be scaled to the degree to which environmental protection regulations had been exceeded.

The Panel also feels that future reviews should require regulatory agencies to explain their control processes in relation to the proponent's project early in the public meetings as well as in the pre-meeting participation stage. In addition, these agencies should understand that they will likely be questioned on the effectiveness of their regulations to control the operation of the project under review.

3.4 HUMAN ENVIRONMENT CONCERNS

3.4.1 Social and Community Impacts

The Panel received a great deal of information on the physical environment impacts of the proposed refinery, but was presented with comparatively little information on the project's social consequences particularly with respect to the distinctive community in the area. The Environmental Impact Statement was deficient in this regard and the reviewing agencies restricted their attention to impacts on the physical environment and human health and safety. As a result, the Panel had inadequate objective data against which to judge the anecdotal evidence, personal statements and other presentations and the debate at the public meetings.

The Environmental Impact Statement, expected to be the prime source of

A claim has been made that this area is predominantly Mennonite and that these people are opposed to a nuclear refinery at War-man. It is my feeling that if the people of this community were given the facts of the situation without clouding the issue with sentiment, there would not be much objection. Whether the refinery is built in Warman or elsewhere, it still will be built. The fact of the matter is uranium is going to be a source of energy in the future. There are presently large uranium deposits in northern Saskatchewan. This uranium is going to need refining, and it would make sense for that refinery to be here, where it is close to Saskatoon, and also not too far from the site of the deposits.

George Guenther
War-man and District
Informed Citizens Group

If one had set out to choose the worst possible location in this province for the site of a uranium refinery, having regard to its social impact, one could hardly have chosen better.

Nadage McConnell

If a refinery were built here, it would stand as a symbol of destruction to our people for generations to come.

Leonard Doe11
Warman and District
Concerned Citizens Group

However, the report ignores other at least equally important, if not more important, social factors. For example, ethnicity, the communities' lifestyles, religious values, cultural values, attitudes towards the proposed refinery, power relations, the actual availability of the required labour force. For example, were the labourers asked if they would work on the proposed refinery if they were given the opportunity? And of course, the possibility of migration from these communities.

Jennie Hornosty

information for the assessment and review of the project's social impacts, was particularly disappointing. It contained little meaningful information or systematic analysis of these impacts. From the Environmental Impact Statement and evidence presented at the meetings, it was obvious that the proponent did not consider the local community as distinctive. From this perspective, whatever adverse social impacts that might occur would be no different from those that might be experienced in any Saskatchewan community. Furthermore, the proponent apparently considered the anticipated negative social impacts to be easily outweighed by the expected positive social benefits. Social benefits identified with the project, though not necessarily specific to the Warman site include:

- the requirement of 1.2 million person-hours of labour generated by a $100 million project over a two-year period, approximately 390 construction jobs at the peak of this period, and $30 to 40 million spent locally during construction;
- 200 permanent jobs representing $5 million annual income and a multiplier effect resulting in an estimated 1.6 to 2.3 jobs in support services for every job created in the refinery;
- a grant-in-lieu of taxes of approximately $300 000 per year paid to the Rural Municipality of Corman Park, with associated benefits for its taxpayers, and
- a positive impact on the Saskatoon economy and on the Saskatchewan economy generally as a result of the provision of additional needed economic diversity, assistance in lessening the dependence on agriculture and reducing the province's vulnerability to cyclical fluctuations, enhancement of local skills and reduction of local unemployment, and reduced outmigration of Saskatchewan's people.

An adequate social impact study, however, comprises considerably more than a listing of benefits and a superficial overview of social costs. Such a study typically would involve several related steps. First, the community or communities in the likely impact area would be identified. Next, the community would be profiled to reveal its past and present institutions, customs, and social and economic behaviours. Then, these community attributes would be projected into the future to obtain an impression of what the community might look like in the absence of the introduction of the project, in this case the uranium refinery. At the same tirne, the specific mechanisms of social impact associated with the refinery and relevant to the communities would be identified and described in the context of the baseline analyses of these communities. Finally, an assessment and evaluation of the project's impact on the communities would be provided, and juxtaposed with the projected trends in the absence of the project. Included would be a description and assessment of any measures that could be taken to mitigate the adverse impacts identified.

From the evidence presented at the public meetings and available in the literature, it was clear that a distinctive community exists in the vicinity of the impact area. To the west and north of the site, it comprises the settlements of Martensville, Warman, Osler and related rural areas, uniquely associated and identified with the Mennonite ethnic and religious community; to the east and across the river it is the Hutterite Riverview Colony. The Panel recognizes that the refinery would be located on the fringes of both of these religious communities as well as on the periphery of the urban community of the city of

Saskatoon. Indeed, one of the settlements in the immediate vicinity of the site is recognized as a "half-way house" between the urban setting and the rural Mennonite community. The Panel also is aware that there may be greater diversity, strength and richness in the Mennonite community than has been represented in the presentations of those community members who specifically opposed the Warman refinery.

From the evidence presented, the Panel became aware of a number of site-specific mechanisms of potential social impact, though the limited information at hand precluded a proper assessment of their probable influence. These are:

1. Pacifism as a central tenet of the religious beliefs of the local communities was considered important to the degree that religion is a critical binding force in the communities. The interpretation of pacifism in this case, however, varied between Mennonites and Hutterites, leading the latter to support the proposed project while the former opposed it. The difference was that most Mennonites appearing before the Panel saw the uranium refinery as a nuclear facility, inevitably connected to the production of nuclear weapons, while the Hutterites perceived no such linkage. The extent to which this perception was held throughout the entire Mennonite community should have been established and its significance assessed; people who are opposed to war and prepared to accept nuclear energy for peaceful purposes may be no less faithful than those who have genuine personal fears about its misuse. If many people in that religious community considered the refinery to be linked to nuclear weapons, then an examination should have been made of the extent to which its presence might erode their religious beliefs and thereby adversely affect their community, and what the consequences might be.

2. Environmental stewardship (i.e., passing on to future generations an environment of equal or higher quality than the one received) was stressed as another central tenet of the faith of the local communities. The interpretation of this concept also appeared to allow considerable latitude. That interpretation, the extent and depth to which it occurred locally, and the degree to which it was a binding force in the religious and ethnic community, should have been assessed. Stewardship was frequently cited as a reason for opposition to disposal of radioactive waste and hence the entire project.

3. The effects of increased contact between outsiders and the local community on the continued viability of the religious and ethnic groups needed to be assessed and evaluated in the light of recent social trends. In addition, the degree to which the refinery would infringe upon the social and cultural activities of the ethnic communities should have been examined.

4. Control of local institutions is considered to be an important factor in the maintenance and viability of ethnic enclaves. Some evidence of the existence of local institutions, which are an essential part of religious and ethnic communities, was presented to the Panel. The degree to which the proposed refinery would result in reduced control of these institutions, and attendant deterioration in community viability, should have been assessed.

5. Boundary maintenance is considered to be another important factor in the vitality of ethnic enclaves. While the concept clearly implies stresses and strains, the introduction of a uranium refinery should have been evaluated in terms of its effects upon the transition zone between urban society and the Mennonite religious/ethnic group.

6. Family structure and kinship is considered to be. a further important means by which ethnic and religious communities are modified and maintained. Evidence exists of rapid and recent changes in family structure and kinship contact, induced probably in no small way by the inability of agriculture to support and absorb population increases; in this respect these communities would be responding to many of the same forces that affect rural Saskatchewan generally. The role that a refinery might have in either checking or stimulating these shifts should have been examined.

7. Functional interdependence occasioned by the increasing complexity of modern society limits the ability to maintain homogeneous communities. These interdependencies, observable in a number of ways but perhaps most readily in the changing occupational structure of the labour force in the local corrrnunities, should have been examined with reference to the proposed refinery.

8. Finally, agrarian activities have been stressed as a major underpinning of the Mennonite ethnic groups. The extent to which this is so and the extent that the refinery might encroach upon the activities of the local communities required assessment.

In other words, much information and analysis could have been brought to bear on the extent to which these mechanisms might be stimulated or damped by the presence of a uranium refinery located near the edge of these corrrnunities. This was not done. As a result, the social consequences of proceeding with the refinery project at the Warman site are far from clear. On the one hand the Panel heard opposition based on fundamental beliefs and numerous unknowns regarding the effects that the project might have on the religious and ethnic communities in the vicinity. On the other hand there was support based on evidence that contradicted the concerns and on the substantial socio-economic benefits that the refinery would convey on the larger area. The Panel believes that potential adverse social impacts are too important to permit endorsement of the Warman site without a full, adequately informed assessment of these issues.

3.4.2 Health and Safety

The Panel heard many concerns about the effect of low-level radiation[5] on workers and the public. Low-level radiation was frequently mentioned as a cause of cancer and genetic damage.

In most countries, including Canada, radiation standards are based on the recommendations of the International Commission on Radiological Protection (ICRP). The Maximum Permissible Dose for

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5 Low-level is understood to mean radiation exposure at a rate up to that received from naturally occurring radiation sources, which is in the range of 100 to 150 millirems per year.

It is unfortunate that some of those opposed to this project have chosen to use scare tactics and to misrepresent the parameters of the refinery, and to blow the hazards out of all proportion. If you sat on a barrel of uranium for 365 days, you would receive less radiation than from a simple dental x-ray. The fact that we have in Canada some 45 years experience in handling the materials and tailings, the danger is minimal.

Vic Pizzey

. ..it has been pointed out the radiation levels alreadv existing in Saskatoon are indeed greater than those which will exist should the refinery be built in the Warman area. The point is: do we need to add more risk to that which we can't avoid? Life does have risks, some of which are unavoidable. Background radiation would be one of those. Some risks are deemed necessary. In my view, the proposed refinery is both avoidable and unnecessary.

Nayda Veeman

We are addressing today, and you have been addressing throughout these hearings an extremely important question, and we wish to be blunt and forthright in our presentation. We feel that government policies on nuclear energy, both in Saskatchewan and other geographical and political settings, are playing fast and loose with our lives, our health, and our safety. And, this, of course, says nothing of the consequences to the workers directly involved in these projects, our children, or the health and safety of generations to come.

Larry Katz
Canadian Union of Public Employees

One of the speakers last week expressed the desire to live in Canada without being exposed to radiation. Unfortunately I must inform her that this is impossible. We live in a veritable sea of radiation. Mankind has evolved in this natural radiation background and it still represents the largest source of human radiation exposure. There are three principal components of background radiation - cosmic radiation from outer space, terrestrial radiation from the radioactive elements in the earth's crust, and internal radiation from the radioactive elements within our bodies.

Stan Frost
Eldorado Nuclear Ltd.

radiation workers is 5 000 millirems per year. Since the general public is not subject to regular medical examination or the wearing of radiation dosimeters, an additional safety factor has been provided. The permissible dose level for the public has been lowered by a factor of ten to 500 millirems per year. Health and Welfare Canada and the Atomic Energy Control Board advise that under normal operating conditions, the exposure target to the population should be one percent of the Maximum Permissible Dose recommended by the ICRP, and should not exceed the Maximum Permissible Dose under conditions of plant malfunction. At all times, the dose to the public and the workers should be kept "as low as is readily achievable". Eldorado's past experiences indicated that the exposure of workers has been kept well below regulatory limits.

Eldorado outlined its proposal to protect the health and safety of its employees. Some of the features, relating to radiological protection in particular, were outlined as follows:

- plant personnel would be supplied with clean clothing daily, and showers on leaving work would be mandatory;
- a three-zone contamination control zone would be established to prevent the spread of uranium from operating to non-operating areas;
- regular in-plant air sarnpling for uranium, monitoring for radiation and periodic radon measurements would be conducted;
- employees would be given pre-employment and annual medical examinations;
- employees would wear radiation dosimeters, bioassay samples would be taken regularly and in-vivo counting would be conducted to identify uranium in the lungs;
- radiation exposure records would be maintained and posted for all employees with records forwarded for review to the Radiation Protection Bureau of Health and Welfare Canada, and
- respirators would be provided for work under upset conditions if uranium dust levels exceeded safe limits.

The Panel is satisfied that, with the proposed precautions, low-level radiation from the plant would not represent a significant risk over background levels to the workers or the general public. Nevertheless, due to the controversy over low-level radiation, the Panel believes that a comprehensive employee health monitoring system should be introduced to include post-employment follow-up to aid in the detection of any future health trends.

The adequacy of existing radiological protection standards was questioned. Some contended that there was evidence of serious effects caused by low-level radiation and that such effects may even be enhanced as the dose rate decreases. The Panel recognizes that the on-going scientific discussion on this question will not be resolved quickly. It is not convinced, however, that there is evidence of a direct cause-effect relationship for radiation exposure at dose rates close to those associated with naturally occurring radiation sources. Even if such a relationship were established, it is not easy to comprehend how society could or should respond, particularly with respect to background levels.

Risks to workers from non-radioactive substances (e.g. hydrogen fluoride, fluorine, and anhydrous ammonia) were described as similar to those in many other chemical industries for which much experience and well-established safety procedures exist. The Panel is satisfied that all necessary precautions will be designed into the plant itself, and into

the operational procedures required by the Atomic Energy Control Board, Health and Welfare Canada and the Saskatchewan Department of Labour.

3.4.3 Agriculture and Other Land Use

Discussion on land use focused on: the direct impact of building the refinery on a site with agricultural potential, possible adverse effects of refinery operations on adjoining agricultural activities, the refinery as an industrial intrusion into the larger agricultural area, planning and regulation of land use in the vicinity of the plant, and its compatibility with recreational uses proposed at the eastern edge of the site.

The Panel heard expert testimony indicating that the portion of the site accommodating the refinery operation (16 hectares), now uncultivated, had low capability for agricultural production (Class 5 under the Canada Land Inventory)* It was argued that productivity of a parcel of land depended as much on tenure and management as on soil type. The Panel believes, nonetheless, that the direct impact of the plant on agricultural productivity would be negligible. The remaining 564 hectares of the site, within the buffer zone and mostly unbroken, have somewhat higher capability for cereal crop production (Class 3 and 4). Eldorado proposed to lease the land back to farmers for agricultural use.

Some citizens were concerned that emissions of hydrogen fluoride and uranium might affect forage crops and hence dairy farming in the area. Eldorado presented convincing evidence to show that such emissions would not have significant effects. (See section 3.3.1).

The Saskatchewan Department of Agriculture's presentation indicated that the refinery conformed to the Department's goals on rural development and land use, and that the project would enhance opportunities for non-farm employment in an area characterized by small farms with low incomes. Opponents countered that those Mennonite farmers who were fundamentally opposed to the plant would be unlikely to take work in it.

Concern was expressed that a major industrial intrusion into the agricultural area might lead to additional industrial activity that could raise land values further, reduce the competitiveness of farms and threaten the area's agricultural viability. But few apparent linkages seemed to exist between the refinery and other industries that otherwise might find an adjoining location attractive. It was also noted that an industrial park at Warman would offer alternate sites to light industry.

The Panel notes that the Rural Municipality, with the power to plan for and control land use in the area, does not yet have in place a complete set of planning instruments to cope with non-agricultural growth pressures in the area. The Council has indicated its willingness to rezone the site to permit the refinery use but it has just begun work on a municipal development plan. Should the refinery project proceed, there would be a need to accelerate this planning process and to ensure that the Municipality possessed the capability necessary to deal effectively with any increased urban development that might follow.

The relationship of the refinery to the Cathedral Bluffs recreational activity node was also discussed. This part of the river valley, according to the Meewasin Valley Authority's conceptual master plan, was intended to be a year-round recreational use area. Apparently

designated as high priority for development, it would attract large numbers of people and relieve recreational pressure on environmentally sensitive and presently over-used areas south of Saskatoon. A major component of this node would be the proposed development of a lake, called the Hudson Bay Slough, for active all-seasons recreation. Although Eldorado's property would overlap with the proposed lake, Eldorado indicated that it would permit access to the shore fronting its property. Opponents.contended that the vehicular traffic, noise, unceasing operation and appearance of the refinery would be fundamentally incompatible with the kinds of recreational experiences implied by camping, hiking, canoeing, cross-country skiing and weekend leisure activities generally. Eldorado maintained that its refinery would not interfere with such activities; it also argued that it was in the area first and that the Authority's planning ought to have taken the refinery proposal into account. The power of the Authority to determine whether Eldorado could build on the site which lies within the Authority's buffer-zone[6] was debated. Approval from the Authority might be required, however, for a pumphouse, pipeline and effluent outfall which would be constructed in the control zone. Regrettably the Authority refused to appear at the public meetings, despite the Panel's request and a previous commitment to do so, to answer questions concerning its development plans in relation to Eldorado's proposal. In its absence the Panel must register its doubt that a uranium refinery and the planned recreational uses could co-exist without the former seriously detracting from the latter. Eldorado pointed to a recreational area beside its Port Hope plant but the Panel would question whether it is necessary in Saskatchewan to plan a refinery adjacent to a recreational area.

In summary, the Panel is satisfied that the proposed refinery would have no direct significant effect on agriculture on the site or nearby. The Panel questions, however, whether the refinery and the planned recreational uses immediately adjoining it would be compatible.

3.4.4 Monitoring

A number of people expressed concern that, while considerable emphasis was being placed on vegetation and mammals, little attention was being given to monitoring effects on humans.

A baseline health study was suggested. Eldorado indicated that the health of workers would be monitored before and during their employment at the proposed refinery but questioned the benefits of a baseline health survey of people in the surrounding area. It was argued that procedures for setting safe levels of exposure to low-level radiation were based on the assumption that the population exposed to radiation effects was homogeneous, when in fact some subgroups may be more susceptible to radiation hazards. In this regard it was pointed out that Saskatchewan had one of the highest incidences of allergic disease in Canada. Eldorado, however, cited references which disputed the aryuments that people with allergic conditions were more susceptible to radiation-induced illnesses. While the Panel is not fully

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6 Subsequent to the Panel public meetings, a review of the Meewasin Valley boundaries has been commissioned. This review, amongst other things, is examining a proposal to eliminate the buffer zone in the Rural Municipality of Corman Park.

Esthetically, I see the proposed refinery as a beautiful structure an environmentally controlled facility within the knowledge that we know today, in a rural setting that will be paying some taxes to good old Corman Park and we need a little industrial base once in a while to help agriculture and a plant that will be useful, scientific and productive.

William Wilson

The beauty and heritage of the river bank would be damaged. The Ratepayers of Corman Park -- recently at a meeting they came out opposed to the Meewasin Valley Authority but they are in favour of preserving the beauty and heritage of the river for succeeding generations.

I believe that recreation areas and industrial refineries do not belong in the same immediate area.

Lyle Stucky

convinced that such a relationship exists, it concurs that the differential incidence of certain types of morbidity in the population and its subgroups warrants study. This would permit evaluation of the effects of the refinery at some future time and also allow the identification of possible susceptible subgroups. Such an analysis need not necessarily require medical examinations but rather would comprise a study of existing data sources.

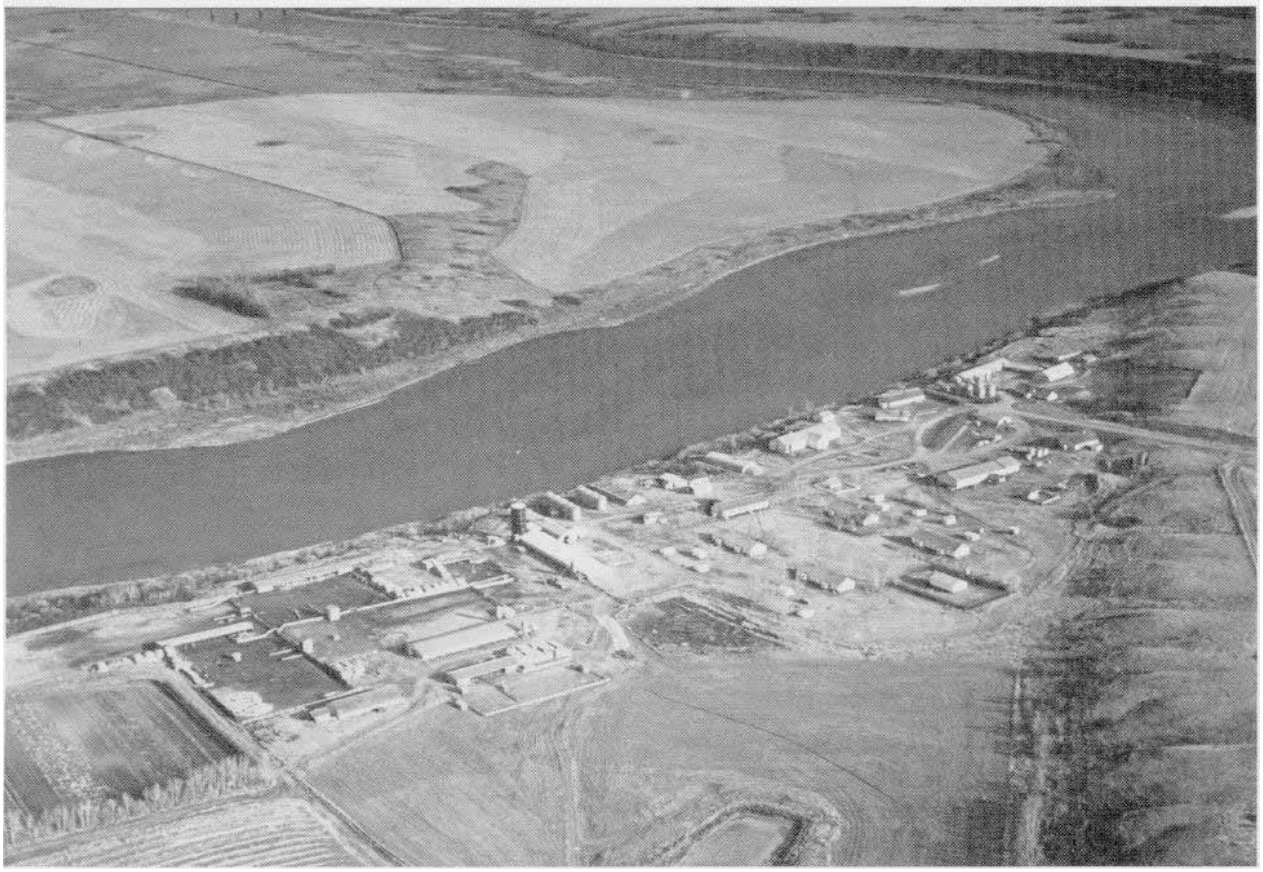
The Public Monitoring Committee proposed by Eldorado would be constituted to monitor any effects the refinery might have on the physical environment. There was no suggestion that the Committee might monitor social impacts. The Panel recognizes that only a few precedents exist for such a program. Nevertheless, considering the uncertainty surrounding the potential social consequences of proceeding with the refinery, the Panel believes that a social impact monitoring program would be required.

The main problem in this regard would be that provincial and federal agencies currently are concerned primarily with the natural environment. In the absence of such input from government agencies, it became the Panel's task to judge the socio-economic merits of this proposal on the basis of conflicting and controversial opinions from those favouring and those opposing the project. The work of the Public Monitoring Committee would be similarly constrained by the lack of social baseline studies and social monitoring data.

The Panel concluded that this is a serious deficiency in the Environmental Assessment and Review Process, and recommends that both the provincial and federal governments consider mechanisms to monitor and assess social impacts. This would allow systematic consideration of social impacts during the review of environmental impacts, assist the Public Monitoring Committee, and afford the human community a level of protection closer to that currently given to the natural environment.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS



RIVERVIEW HUTTERITE COLONY

4.1 INTRODUCTION

In arriving at its conclusions and recommendations the Panel considered a number of general concerns as well as issues that were site specific.

This analysis led to the overall conclusion that the Panel could not endorse the project in the Rural Municipality of Corman Park. near Warman. Saskatchewan.

4.2 RATIONALE FOR CONCLUSIONS AND RECOMMENDATIONS

In this section the Panel outlines its conclusions, the rationale for the conclusions, recommends conditions and certain options. The Panel considers the refinery and plant process and then the proposed location in the Rural Municipality of Corman Park.

4.2.1 Refinery and Plant Process

Conclusion:

The refinery and plant process are generally acceptable provided certain conditions are met.

Reasons:

a) Eldorado demonstrated that it was reasonable to plan for another world scale uranium hexafluoride (UF_6) refinery in Canada; the market would be re-evaluated to determine the economic viability of a new plant before a final decision is made to proceed.
b) A site for the refinery in Saskatchewan is consistent with existing federal and Saskatchewan government policies and compares favourably to other options such as expansion of a new plant in Ontario.
c) Production of UF_6 by the new plant will not be a significant factor in nuclear weapons proliferation.
d) The proposed recycling of raffinate to uranium mills represents a satisfactory solution for a significant quantity of the refinery wastes.
e) Storage of non-recyclable low-level radioactive waste (primarily calcium fluoride) on site is a tolerable practice until disposal methods are developed.
f) Transportation of yellowcake, raffinate, UF_6 and process chemicals imposes risks no greater than for other industrial activities.
g) The refinery can be operated in such a manner as to present no significant health problems.

Recommended Conditions

a) Raffinate should be recycled through the mine/mill circuit. Discussions should be held regarding the recycling program with the mining communities involved.
b) The Atomic Energy Control Board (AECB) should require Eldorado to present a proposal for disposal of non-recyclable low-level radioactive wastes within a specified time. This proposal should be given wide public exposure. Progress towards a solution should also be periodically reported to the AECB and made public.
c) Non-contaminated solid waste should be disposed of at a site owned and controlled by Eldorado.
d) The Public Monitoring Committee proposed by Eldorado should be established with representation from the local community, as soon as a final decision to proceed is made by Eldorado.
e) A baseline health study of the region, compiled from existing health records, should be conducted to properly assess concerns about

long-range health problems that may be associated with refinery operations.

f) Eldorado should implement a comprehensive employee health monitoring system which includes post-employment follow-up to aid in the detection of any future health trends.

g) The comprehensive baseline monitoring program should include additional information on the terrestrial environment, aquatic environment and groundwater in order to allow comparison of future' monitoring results with pre-operational baseline data. This program should be conducted once site selection is finalized and in cooperation with the regulatory agencies. With respect to operational compliance monitoring, once final site layout is approved, plans should be established and approved for groundwater monitoring and spill contingencies. This would require a detailed surficial geology-soils survey in the immediate vicinity of the plant to determine the precise location of observation wells.

4.2.2 The Location in the Rural Municipality of Corman Park

Conclusion:

The site in the Rural Municipality of Corman park is acceptable with respect to the impact on the physical environment, but the Panel was unable to reach a conclusion on the potential impact on the human environment.

Reasons:

1. Concerning the physical environment:

a) Existing technology and proposed mitigation measures are capable of ensuring that there will be no significant impacts by the proposed refinery at the Corman Park site on air quality, groundwater, water quality in the South Saskatchewan River, crops and vegetation and on birds or animals.

b) The direct effect of the project on removing land from agriculture will not be significant.

c) The environmental and occupational health monitoring programs proposed by the proponent and responsible government agencies are a satisfactory basis for regulatory approvals and subsequent detailed implementation.

2. Concerning the human environment:

a) A distinctive community, potentially affected by the project, does exist but the social impacts of the project upon this community have not been properly identified or assessed.

b) These potential impacts on the community surrounding the refinery at Warman are too important to be ignored in reaching a judgement on the overall acceptability of the project.

c) The project may be incompatible with the proposed recreational development at nearby Cathedral Bluffs. The lack of participation by the Meewasin Valley Authority prevented proper assessment and conclusion on this matter.

4.3 RECOMMENDED OPTIONS

The Panel cannot endorse the proposed Warman site due to its concern regarding the potential social impacts on the local community. The Panel recommends that before any decision is made for a refinery site, one of the following three options should be selected:

1. Further information be provided by the proponent with respect to the potential social impacts of the Warman proposal, with subsequent public review. The information considered essential, discussed in Section 3.4.1, should address the following:

a) The extent to which the presence of a nuclear refinery may erode religious beliefs of residents of the community and the likely consequences.
b) Interpretation of the concept of stewardship and the extent and depth to which this concept occurs locally, the degree to which it may serve to bind the community, and the impact of the refinery particularly with respect to radioactive waste disposal.
c) The effects of increased contacts between outsiders and the local community that are occurring in the light of recent social trends, and the effects of a refinery. This should then be related to impacts on social and cultural activities of the ethnic communities.
d) The degree to which the proposed refinery would result in reduced control of local institutions which may be an essential part of the ethnic and religious communities.
e) The effect the refinery may have upon the transition zone which appears to exist between the Saskatoon urban society and the local religious/ethnic group.
f) The role the refinery may play in checking or stimulating changes, underway, in family structures and kinship contacts.
g) The changing occupational structure of the labour force in the local community and the impact the refinery may have.
h) The extent to which agrarian activities are a major underpinning of the local community and how the refinery may encroach upon these activities.

2. One or more alternative sites in Saskatchewan be selected and evaluated with regard to social and environmental impacts and submitted for public review.

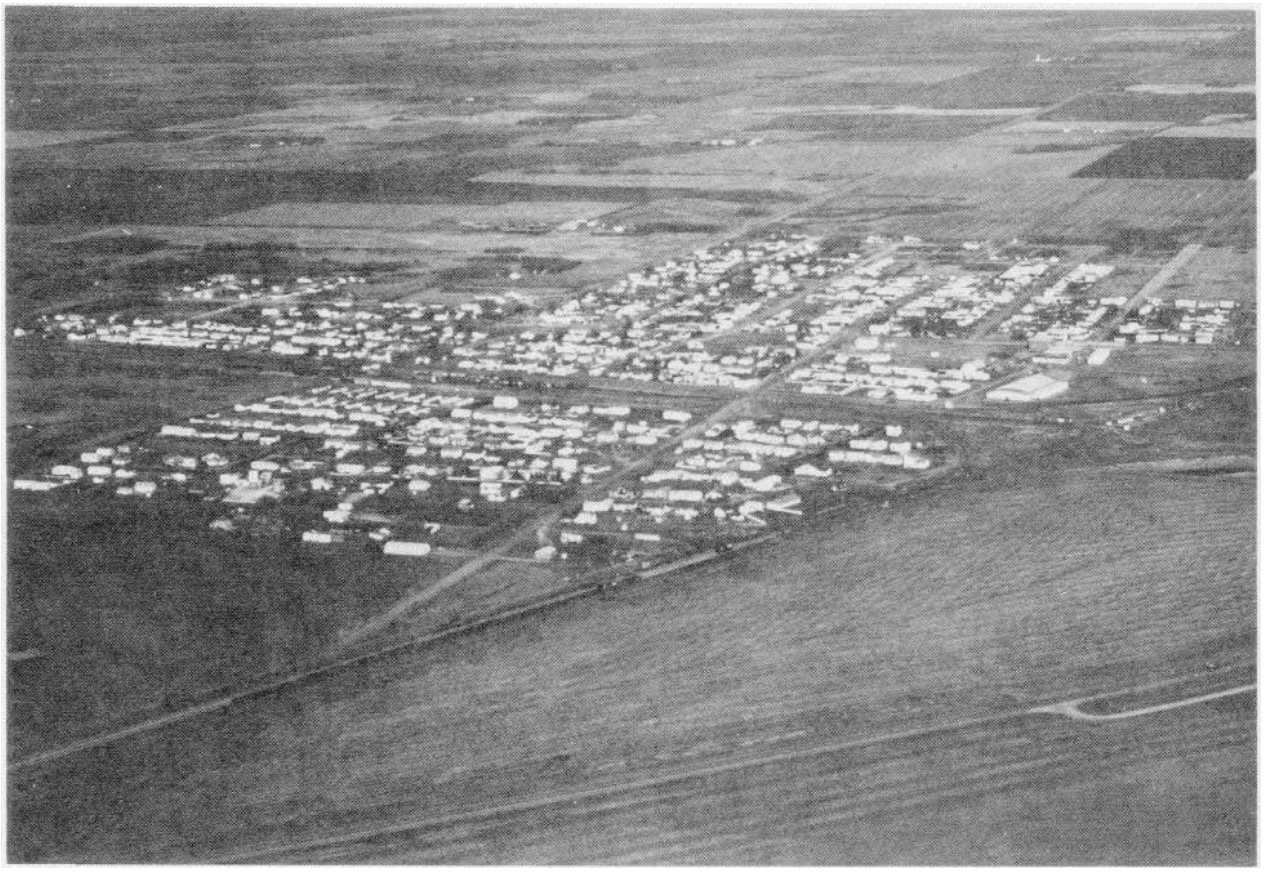
3. One or more sites in Saskatchewan be evaluated and reviewed in comparison or conjunction with the Warman site. This would be a combination of options 1 and 2.

Regardless of the option selected the Panel sees little merit in reconsidering a number of matters raised at the public meetings, for example, the need for the project (other than an update of market information), alternatives to the project, nuclear weapons proliferation, and impacts on uranium mining.

Depending upon the option selected, it is recommended that an updated set of explicit guidelines be issued to indicate those matters necessary to address in a further review.

CHAPTER 5

SUPPLEMENTARY CONCLUSIONS AND RECOMMENDATIONS



TOWN OF WARMAN

In the course of its review, the Panel identified a number of concerns which it wishes to address to governments, rather than to Eldorado. These are outlined as follows:

a) The Panel noted that there is continuing and widespread concern among the Canadian public about the proliferation of nuclear weapons. It believes that the federal government should continue to pursue institutional means to strengthen international safeguards with respect to nuclear weapons and proliferation.

b) In the context of discussions related to the shipment of hazardous materials to and from the proposed refinery, the Panel noted that industrial transportation accidents, and compensation for damages arising as a result of such accidents, are a continuing concern in Canada. The Panel recommends, therefore, that the federal government develop a mechanism to ensure that third parties receive prompt compensation for damages as a result of transportation accidents.

c) There is a need for government regulatory agencies to explain more fully their roles, responsibilities and interrelationships to the public, particularly as the burdens of industrialization become more visible and perceived hazards increase.

d) There is also a need for governrnent agencies to monitor and assess the social impacts of major projects to a degree comparable to the review of environmental impacts.

e) The jurisdiction of regulatory agencies should be clarified with respect to environmental protection and worker protection regulations and requirements in advance of plant operation.

f) The Atomic Energy Control Board, as the agency licensing the refinery, should have control measures available which would be scaled to the degree to which environmental protection regulations had been exceeded.

g) Should the project proceed in the Rural Municipality of Corman Park there would be a need to accelerate Corman Park's planning process to ensure the necessary capability to deal effectively with any increased urban development that might follow.

h) Should the Warman site, or any other site within the jurisdiction of the Meewasin Valley Authority (MVA), be subjected to further assessment and public review, the MVA should be prepared to explain its plans for the area and become fully involved in the public review.

ELDORADO NUCLEAR LTD
ENVIRONMENTAL ASSESSMENT PANEL

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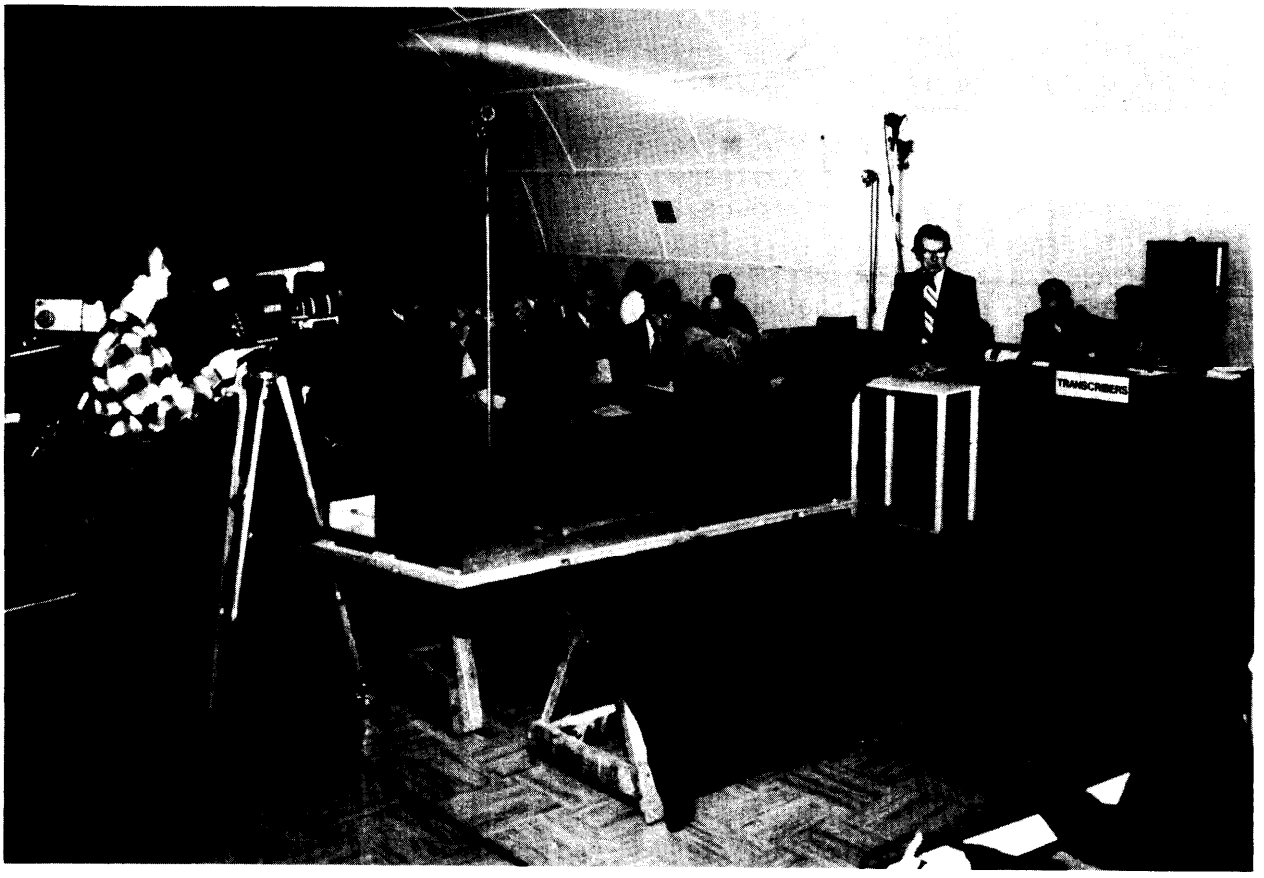
Kim Shikaze

APPENDICES



APPENDIX I — BIOGRAPHY OF PANEL MEMBERS

CHAIRMAN

JOHN S. KLENAVIC, **Federal Environmental Assessment Review Office, Department of the Environment.**

Mr. Klenavic was born in St. Catharines, Ontario and attended schools in Ontario, British Columbia and Manitoba. He graduated from the Royal Military College, Kingston, and Queen's University with a degree in Chemical Engineering (B.Sc.).

He served in the Canadian and British Armies from 1960 to 1968 and subsequently worked as an industrial engineer and quality control chemist in the food processing industry in Toronto. In 1973 he was appointed Acting Director of the Environmental Emergency Branch, Environmental Protection Service of the Federal Department of the Environment. This Branch is concerned with the prevention of, and response to, spills of pollutants into the environment.

Mr. Klenavic joined the Federal Environmental Assessment Review Office in 1977 and was appointed to his present position of Associate Executive Chairman, in mid-1979. He is currently chairman of eight Environmental Assessment Panels.

Mr. Klenavic is a member of the Association of Professional Engineers of Ontario.

MEMBERS

ROBERT GLEN BECK, Department of Economics and Political Science, University of Saskatchewan.

Glen Beck is a Professor of Economics, at the University of Saskatchewan, specializing in health economics - Saskatchewan population, socio-economic impact, and cost-benefit analysis. He received his B.A. degree in economics at the University of Manitoba in 1962.

After obtaining his Ph.D. at the University of Alberta in 1971, he attended the Centre for Social Research, University of Sussex, England, from 1972 to 1973 as a Research Fellow. He also served as a consultant to the Urban Institute in Washington D.C. From 1973 to 1974 Dr. Beck was associate director of the socio-economic sector of the Churchill River Dam Impact Study. From 1975 to 1978, he served as Head of the Departrnent of Economics and Political Science at the University of Saskatchewan. Dr. Beck was also a rnember of the Research Advisory Board of the Saskatchewan Alcoholism Conmission frorn 1976 to 1978. Since 1974, he has undertaken research on utilization of medical services as a National Health Research Scholar for Health and Welfare Canada.

Dr. Beck has published a number of papers and studies on a wide range of socio-economic matters.

REG LANG, Faculty of Environmental Studies, York University, Downsview, Ontario.

Reg Lang was born in Assiniboia, Saskatchewan and attended the University of Saskatchewan. He has been at York University since July 1971, and is a Professor in Environmental Studies, teaching urban-regional and environmental planning, environmental assessment and related subjects. He has extensive experience as a professional planner, engineer, administrator and consultant at all government levels in various parts of Canada. From 1965 to 1971, he was Director of Corrununity Planning, Nova Scotia Department of Municipal Affairs, in charge of a multidisciplinary planning group active throughout the province. Before that, he worked as a planner for

Canada Mortgage and Housing Corporation in Halifax and Ottawa, and as a sewer and water design and construction engineer with the City of Regina Engineer's Department. As a consultant, his recent clients have included Environment Canada, the Royal Commission on Electric Power Planning, the Town of Oakville, the Ontario Planning Act Review Corrunittee, the Regina Rail Relocation Project and the federal Department of Energy, Mines and Resources; he is also active as a voluntary advisor to community groups. His current research activities focus on municipal energy planning and management and social impact assessment.

ALLAN D. OLMSTED, Department of Sociology, University of Calgary.

Allan Olmsted was born in Indian Head, Saskatchewan. He received his B.A. (1963) and M.A. (1964) degrees in sociology from the University of Saskatchewan and his Ph.D. from the University of Washington in 1970. As a research assistant at the University of Saskatchewan, he worked on a study of ethnic intermarriages in Saskatchewan and also co-authored a study of residential population change in six prairie cities. He was a teaching assistant at the University of Washington from 1965 to 1967 and joined the staff of the University of Calgary in 1968 where he is an Associate Professor in Sociology.

His courses include the human ecology, social psychology and human community. Since 1974, he has been a Scientific Associate at the Environmental Sciences Centre, University of Calgary.

Dr. Olmsted has also served as a consultant in the area of social impact. His recent projects include: Influence of Urban Society on a Mountain Ecosystem for the University of Calgary, Sociological Analysis for Jasper National Park - Canadian National Railway Study for Parks Canada, and Social Impact Study, Peace River Power Development, Dunvegan Damsite for J.A. Smith and Associates, Calgary.

DONALD ANDREWS RENNIE, Department of Soil Science, University of Saskatchewan.

Donald Rennie is a Professor and Head of the Department of Soil Science at the University of Saskatchewan and is also Head of the Saskatchewan Institute of Pedology at the University. He joined the department after receiving his B.S.A. degree from the University of Saskatchewan in 1949 and his Ph.D. from the University of Wisconsin in 1952. From 1968 to 1970, he served as Head of the Soils Section, Joint Food and Agriculture Organization/International Atomic Energy Agency Division, in Vienna, Austria.

Dr. Rennie received the American Chemical Society Award in 1968 in recognition of his research on the phosphorous chemistry of soils and fertilizer-phosphorus management practices for cereal grains. He was instrumental in establishing the Saskatchewan Institute of Pedology which integrated federal, provincial, and university programs and activities in soil science. Additional awards he has received include: Fellow, Canadian Society of Soil Science (1971); Fellow, American Society of Agronomy (1972); Fellow, Soil Science Society of America (1976); and Fellow, Agricultural Institute of Canada (1978).

Dr. Rennie's current research programs include the documentation of soil deterioration in Saskatchewan, soil salinity, nitrogen transformation and movement in soils, and dustfall accumulation in soils in the vicinity of potash refineries.

Since 1968, he has been active internationally as a consultant to governrnents

and various international organizations. Dr. Rennie has also published numerous articles in various scientific publications and symposia and written three books.

DAVID P. SCOTT, Freshwater Institute, Fisheries and Oceans Canada, Winnipeg.

Dave Scott graduated from the University of British Columbia with a doctorate in Zoology in 1956. Before joining the Department of Fisheries and Oceans, he worked as an assistant biologist for the Quebec Department of Maritime Fisheries and later as an assistant fisheries biologist for the British Columbia Game Commission.

From 1956 to 1964 Dr. Scott was an associate scientist with the Fisheries Research Board of Canada. He later became a senior scientist with the Board before becoming a research scientist with the Fisheries and Marine Service in 1970. During the period from mid-1961 to mid-1964, Dr. Scott was seconded to the University of Toronto as a research scientist at the Ontario Fisheries Research Laboratory at Maple, and as an honorary lecturer in the Department of Zoology.

Dr. Scott is a working member on the Federal-Provincial Task Force on Strategic Planning for Ontario Fisheries and has been a senior referee for the Journal of the Fisheries Research Board of Canada since 1966 and book review editor since 1975. He is an associate editor for ichthyology with the Canadian Field Naturalist. He is presently Science Advisor for the Western Region of the Department of Fisheries and Oceans. A member of the Region's Management Committee, Dr. Scott is also Chairman of the Region's Publications Review Committee. He also is a member of the Polar Gas Environmental Assessment Panel.

KIM SHIKAZE, Environmental Protection Service, Environment Canada, Toronto.

Kim Shikaze was born in British Columbia, and grew up in southwestern Ontario where he attended high school in Leamington. Mr. Shikaze graduated from the University of Toronto with a Degree in Chemical Engineering in 1959 and obtained a Masters Degree in Sanitary Engineering in 1961.

From 1959 to 1971 he was employed with the Ontario Water Resources Commission (now Ministry of the Environment) involved initially in the Research Branch in the evaluation of pollution control equipment and processes and then in the Industrial Waste Branch involved in many facets of industrial pollution control.

In November 1971, he joined Environment Canada, Environmental Protection Service, in Ottawa. In January 1974 he transferred to the Department's Ontario Regional Office when it was established and became the Director of the Environmental Control Branch in the regional office having a responsibility for all facets of the federal environmental control programs in Ontario. Kim Shikaze is now Acting Regional Director, Environmental Protection Service, Ontario Region.

APPENDIX II — DISCUSSION OF PROCEDURES

During the review of the Eldorado proposal, the Panel heard a number of presentations concerning the Environmental Assessment and Review Process. The Panel offers some observations on a number of issues related to the procedures used in this specific review.

In general, the Environmental Assessment and Review Process attempts to be sufficiently flexible to accommodate a wide range of settings from the highly urban to the very remote. The process must be capable of application to a wide array of projects ranging from nuclear refineries to highways. Thus, the procedures and terms of reference have avoided rigidity and formality to the extent that it is possible. This posture has its costs, of course, for people are inevitably inclined to interpret flexibility as being to their disadvantage as the process enters phases which generate conflicting information. Obviously the more contentious the issue the greater the need for firm ground rules. The Warman public meetings provided many instances for appeal to procedural irregularity, often for what appeared to be strategic reasons. Nevertheless, the Panel believes that a number of questions exist relating to the process which the Federal Environmental Assessment Review Office should evaluate. These are:

1. There may be a need to establish firm rules regarding the roster for presentations to avoid the situation where they become rebuttals of previous speakers. In addition, submissions must be filed with the Panel prior to their oral presentation.
2. There is a need to distinguish technical witnesses from other speakers in terms of the time allocated to them and to the question period.
3. There is a need for distinguishing Panel technical witnesses and for identifying the means by which it is decided to call them and the process by which they are chosen.
4. It may be necessary to conduct two types of meetings; one wherein technical presentations can be made and complex issues pursued and another where the more general presentation may be presented by members of the public.
5. It would seem necessary to clear up a present confusion in the Federal Environmental Assessment Review Office guidelines concerning the nature and amount of public information which is sought. There is some confusion now about whether 'representative' opinion is sought or whether the public meetings are an occasion where one and all may express their views.
6. Some thought should be given to rules of order at public meetings. It is to be hoped that occasions involving slander and libel can be avoided by the exercise of temperance on the part of all participants. In the absence of such rules, the Panel will be deprived of the participation of many unless some protection is offered.
7. The current operational terms of reference, wherein it is indicated that Panels will advise the Minister of all pertinent information needed to make an informed decision, may be too broad and thereby unfair to all concerned. It may be necessary to issue terms of reference for specific public meetings at some stage in the process, if a more restrictive general set to cover all situations cannot be developed.
8. It may be helpful to develop a means by which groups may obtain intervenor status and thereby be accorded more

opportunity for participation in the question periods.

9. It may be necessary to address early in the review the identification of major issues by means of public involvement in the preparation of guidelines for an Environmental Impact Statement in order that it may contain a sound data base for public dialogue during the Panel public meetings to review the final project. The Panel notes that public input to guidelines is now the normal practice but that the 1976 guidelines for this project were not subjected to public review.

APPENDIX III — APPEARANCES BEFORE THE PANEL

Dr. Don Acton
Agriculture Canada

Doug Adams

Dr. Alan Anderson

Russ Anderson
Saskatoon Real Estate Board

Derek Arnold

Rick Ast
Regina Group for a
Non-Nuclear Society

Gordon Bailey

Wally Baldwin
Saskatchewan Department of
Agriculture

Linda Batty

Terry Beebe
Saskatoon Citizens for a
Non-Nuclear Society

Heather Blair

Ron Bocking

Herman Boerma
Saskatoon Environmental Society

Garry Boldt
Warman and District Concerned
Citizens Group

Kathy Boldt

Bob Bond
North Saskatoon Businessmens
Association

Bob Boulden
Environment Canada

Anne Boulton

Daphne Boyer
Saskatchewan Working Women

Paul Brady

Ben Buhler

Diane Buhler

Jake Buhler
Warman and District Concerned
Citizens Group

Louise Buhler
Warman and District Concerned
Citizens Group

Maria Buhler and her interpreter

Ruth Buhler

Wilf Buhler

Carl Burton
Saskatchewan Environment

Richard Butler

Cynthia Campbell
Regina Group for a
Non-Nuclear Society

Bob Carleton

Cam Casswell
Saskatchewan Department of
Agriculture

Gerry Catcher

Don Chandler
Beak Consultants Ltd.

Laure Chapman
Member of the Church in Society Committee, St. Thomas Wesley United Church, Saskatoon

Laurel Chelsom

John Chernevski

Dr. John Cherry

Rev. Colin Clay
Chaplain at the University of Saskatchewan

Ken Couchener

Rod Cousineau

Vi Coutu

Theresa Coutu

Nancy Coutu

Ken Coutu

Brian Curran
Environment Canada

Roy Currie

Ron Dakers
Eldorado Nuclear Limited

Mrs. Stan Day

Ian Daykin
Mayor, Town of Martensville

Wilfred Denis

Susan Dennis

Peter Deranger

Susan Deranger
Save the North Program

Joe Didyk
Atomic Energy Control Board

Angela Djao

Murray Dobbin
Saskatoon Citizens for a Non-Nuclear Society

Tena Doe11

Leonard Doe11
Warman and District Concerned Citizens Group

Murray Doe11

Walter Doepker

Father Paul Donlevy

Dennis Dorgan

Mary Douglas
Member of the Church in Society Committee
St. Thomas Wesley United Church, Saskatoon

Dr. Leo Driedger

Karen Driedger

Irvin Driedger

Rene Dubois

Rob Dumont
Canadian University Service Overseas

Dr. Colin Dunn
Saskatchewan Environment

Gerry Dyck

Dr. Gordon Edwards
Canadian Coalition for Nuclear Responsibility

Paul Enns
Osler Mennonite Church

Edgar Epp

David Fairlie

Bob Fink
Saskatoon Citizens for a
Non-Nuclear Society

Larry Fiss

Laura Foley

Michel Fortier
Saskatoon Catholic
Pastoral Council

Perry Foster

Don Fox

Gerry Fraser

Wilf Friesen

Ivan Fricsen
Chairperson of Ploughshares
Study Group

Dorothy Friesen
Warrnan and District Concerned
Citizens Group

Art Friesen

Tena Friesen

Leo Fritz
United Brotherhood of Carpenters
and Joiners of America, Local 1805

Joe Froese

William Froese

Peter Froese

Rev. Rudy Froese
Pastor, Martensville Mennonite Church

Maria Froese-Loewen

Stan Frost
Eldorado Nuclear Limited

Ken Funk

Louise Gagné

Martin Garber-Conrad

Marie-Josée Gautrais

Judy Gayton

Marc Genuist
Etudiants pour une
Société Non-nucléaire

Monique Genuist

Gus Gerecke
North Saskatchewan Building and
Construction Trades Council

Dan Giesbrecht

Erdman Giesbrecht

Marc Gimby

Donald Glazier
Councillor Rural Municipality of
Corman Park

Marcel de la Gorgendière
Saskatoon Board of Trade

John Graham

Dr. David Green

Sister Pauline Greenizan
Chaplain at the Newman Centre
and St. Thomas More College,
University of Saskatchewan

Nadia Greschuk

Dr. G.E. Grisak
Technical Witness

Dennis Gruending
Social Action Committee,
Catholic Archdiocese of Regina

Ken Gryschuk

Cornie Guenther

Elmer Guenther

George Guenther
Warman and District Informed
Citizens Group

Don Guenther

Joe Gunn
Social Action Committee, Catholic
Archdiocese of Regina

Wayne Gust

John Guy
Chaplain of the University of
Calgary

Albert Haas
Warman and District Concerned
Citizens Group

Maureen Hain

Pipa Hall

Joan Halmo

Alice Hamon

Bill Harding

Dr. James Harding

Don Harms

Jack Harris

Merv Harrison
Church in Society Committee of the
Saskatoon Presbytery of the United Church

Frank Hartman
Saskatoon Industrial Development
Board

Vivian Heinl

Elmer Henderson

Mark Henderson

Esther Highfield

Ernie Hildebrand
Warman and District Concerned Citizens
Group

Judy Hildebrand

Ronda Hildebrand

Ken Hirsch

Deborah Hopkins
Saskatoon Citizens for a
Non-Nuclear Society

Jennie Hornosty

Judy Horwood

Bill Howard
Saskatchewan Environment

Nancy Howse

Robert Howse

Frank Hueston
Eldorado Nuclear Limited

Nadine Hunt
Saskatchewan Federation of Labour

Gordon Jangula

Don Jesse
Saskatchewan Department of Industry and Commerce

David Johnson

Brenda Johnson

Marguerite Jollife

Larry Katz
Canadian Union of Public Employees

Ralph Katzman
Member of the Legislative Assembly of Saskatchewan

Richard Kellow
Saskatchewan Environment

Dave Kessler
Mayor, Town of Warman

John Klassen

John Kleiner

John Paul Kleiner
Central Canada Synod of the Lutheran Church in America

Fred Knelman

Rev. Mark Koenker

Daniel Kuhlen

Dr. W.O. Kupsch

Tom Lackie
City of Saskatoon
Environmental Advisory Council

Dr. Krishan Lal

Tex Lamb

Paul Lapointe

Dr. Richard Laskin

David Lawrence

Dr. Iain Le May

Andy Le Blanc

Pierre Leblanc

Larry Lechner
Saskatchewan Environment

Dale Leitch
Saskatchewan Municipal Affairs

Anna Liccardi
Saskatoon Citizens for a Non-Nuclear Society

Laurie Lindstrom

Anne Linn
Member of the Church in Society Committee
St. Thomas Wesley United Church, Saskatoon

David Linn

Barry Lipton

Beth Lischeron

Doug Livingston
Saskatoon Citizens for a Non-Nuclear Society

Reg Loeppky

Harold Loewen

Dr. Phillip Loftus
Community Health Services Association (Saskatoon)

Peter Loptson

Bill Lough
University Students for Nuclear Responsibility

Dr. Don Lush
Beak Consultants Limited

Roger MacDonald
Saskatchewan Environment

Pat MacKay

Rock Mackie

Ken MacTaggart

David Malcolm
City of Saskatoon Environmental Advisory Council

John Mar
Environment Canada

John Marchildon
President of the Operative Plasterers and Cement Masons, Local 442

Paul Marianovits

Dr. John Markham

Henry Martens

Judith Martin

Ronald Mattey
Labour Canada

Nadage McConnell
Saskatoon Citizens for a Non-Nuclear Society

Rick McCormick
Saskatoon Citizens for a Non-Nuclear Society

Bruce McDonald
Saskatchewan Department of Agriculture

Jack McDonald

Ormond McKague

Linda McKenzie

Linda McLaughlin

Hank Merlin
Department of Energy, Mines & Resources

Dr. Julius Metrakos

Dorothy Meyerhof
Department of National Health and Welfare

Frank Molnar

Bob Moody

Helen Moon

Freda Moosehunter
Saskatoon Native Women

Betty Morgan

Dennis Morgan

Ken Morrison
University Students for Nuclear Responsibility

Lorraine Moulding
Saskatoon Citizens for a Non-Nuclear Society

Larry Mullen

Don Mullord
Steep Hill Food Co-op

Michael Murphy

Marty Murray
Saskatchewan Mining Development Corporation

Paul Murray

Don Nordquist

Greg Nova1

Mr. Offet
Saskatchewan Economic
Development Corporation

Ivan Olynyk

Robert O'Halloran
Chaplain at Newman Centre and at
St. Thomas More College, University
of Saskatchewan

Carol Pardoe
Community Health Services Association
(Saskatoon)

Jim Penna

Dan Penna

Marion Penna

Rosalie Penner

John Perret

Brenda Peters

Fred Peters
Mennonite Central Committee

Marlene Peters

Ellery Peters

Grace Pine

Dr. Piper
Saskatchewan Department of Health

Vic Pizzey

Dr. Irene Poelzer

John Pollock
Diocesan Pastoral Council of
St. Peter's Abbacy

Michael Pomedli

Rev. Alan Porter

Peter Prebble
Member of the Legislative Assembly,
Saskatchewan

Reverend John D. Reddekopp
Bergthaler Mennonite Congregation

John S. Reddekopp
Councillor, Town of Osler

Don Reddekopp

Sylvia Regnier

Robert Regnier

Bill Reid

Irving Reid

Kevin Rempel

Kim Rempel

Gertrude Rempel

Sam Rempel
Warman and District Concerned
Citizens Group

Rev. Bill Richards

Andy Roake
Eldorado Nuclear Limited

James Robbins

Herb Robertson

Frances Robson

Mychaylo Rohatynsky

Ian Roundthwaite

Dr. Stan Rowe

Sylvia Roy

Agnes Ruest

Dr. O. J. C. Runnalls
Technical Witness

Penny Sanger

Joan Sass

Ian Savage

Lloyd Sawatzky

Loretta Sawatzky

Lynn Scheidle

Dale Schmeichel
Saskatchewan Mining Development Corporation

Don Schmidt

Dorothy Schmidt

Rita Schmidt

Dr. David Schroeder
Technical Witness

Barbara Scott

Robert Seaton

Dr. Peter Shargool
Saskatoon Environmental Society

Lin Shepard

Maisie Shiell
Regina Group for a Non-Nuclear Society

Jim Slimon
Saskatoon Board of Trade

Ann Smart
Saskatoon Citizens for a Non-Nuclear Society

Adele Smillie
Saskatoon Citizens for a Non-Nuclear Society

Ben G. Smillie

Jim Smith

Rnold Smith

David Smythe
Atomic Energy Control Board

Sister Gertrude Sopracolle
Canadian Catholic Organization for Development and Peace

Bill Stadnyk

Reverend Stahl
Riverview Hutterite Colony

Wayne Stanbrook
Northwest Economic Development Council

Melanie Steele
University Students for Nuclear Responsibility

Bonnie Stephenson

Terry Stevens
United Steelworkers of America

Violet Stoesz

Dr. George Strnad

Lyle Stucky

Jack Suderman

Don Sugden
Saskatoon Citizens for a Non-Nuclear Society

Mr. Sully
Saskatchewan Municipal Affairs

Diane Sundstrom
Saskatoon Citizens for a Non-Nuclear Society

Keith Sutherland

Al Taylor

Sister Teresita

Richard Thatcher
Saskatoon Citizens for a Non-nuclear Society

Stuart Thiessen
National Farmers Union

Daryl Thompson
Canadian University Services Overseas

Ron Thornpson
Rural Municipality of Corman Park

Jim Tooke

Ernest Tootoosis

Bill Turnbull
Saskatoon Board of Trade

Catherine Ulmer

Jeannie Van Pinxten

Nayda Veeman
Saskatchewan Council for International Co-operation

Tom Viglasky
Atomic Energy Control Board

Dr. Sigfried Wall

Phil Wasson

Rose Wasylenka
Mayor of Uranium City

Dr. Leonard H. Weinstein

Dave Weir

Rev. Jim Weisgerber

Jake Wiebe

Nettie Wiebe

Isaac Wiebe

Frieda Wiebe

Beryl Wignes
Member of the Church in Society Committee
St. Thomas Wesley United Church

Bob Wilcox

Gail Wilcox

William Wilson

Larry Yakimoski

Art Zacharias

Abbis Zaidi
Environment Canada

Ed Zerr

APPENDIX IV — BACKGROUND DOCUMENTATION

Selected Documentation Submitted to the Panel[1]

A Dosage Response Curve for the One Rad Range: Adult Risks from Diagnostic Radiation
Irwin D.J. Bross, Marcella Ball
Steven Falen,
AJPH, February 1979.

A Race Against Time
Interim Report on Nuclear Power in Ontario by the Royal Commission on Electric Power Planning,
September 1978, excerpts.

Adult Leukemia Following Diagnostic X-Rays?
John D. Boice, Charles E. Land,
AJPH, February 1979.

Borehole Logs for the Warman Site, Eldorado Nuclear Ltd.
D. Gevaert, 12 April 1977.

Cancer and Environment: Higginson Speaks Out
Science, Vol. 205, 28 September 1979.

Charge Filed with County of Northumberland, Ontario, Against Eldorado Nuclear Ltd., Regarding Discharge of Material to Lake Ontario,
January 17, 1980.

Comment on "Radiation Exposures of Hanford Workers Dying from Cancer and Other Causes"
Ethel Gilbert, Sidney Marks.
Letter to the Editors, Health Physics,
Vol. 37, May 1979.

Eldorado Nuclear Limited - Proposed Uranium Refinery Near Warman, Saskatchewan
Saskatchewan Environment
January 23, 1980.

Environmental Impact Statement for a Uranium Refinery in Corman Park R.M., Saskatchewan,
Eldorado Nuclear Ltd., July 1979.

Environmental Impact Statement for a Uranium Refinery in Corman Park R.M., Saskatchewan, Appendices,
Eldorado Nuclear Ltd., July 1979.

Environmental Impact Statement for a Uranium Refinery in Corman Park R.M., Saskatchewan
Public Involvement Supplement, Eldorado Nuclear Ltd., September 1979.

Estimating Lung Cancer
Gordon Edwards, March 1978.

Excerpts from Report to the President by the Interagency Review Group on Nuclear Waste Management
October 1978.

Excerpts from Saskatoon City Council Minutes Dealing with the Proposed Uranium Hexafluoride Refinery at Warman
Saskatoon City Council, January 1980.

Excerpts from The Atomic Establishment
Peter Metzger (PhD), 1972.

Excerpts from the Report of the Environmental Assessment Panel on the Proposed Eldorado Urani um Refinery at Port Granby Ontario
May 1978.

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1 In addition to the documentation listed in this Appendix, many written submissions, letters and petitions were also received from government agencies, Eldorado Nuclear Ltd., members of the public and various groups and organizations. Most of these have been reproduced in the document entitled: "Presentations to the Environmental Assessment Panel, Eldorado Uranium Refinery Review, R.M. of Corman Park, Saskatchewan."

Geologic Disposal of High-Level Radioactive Wastes - Earth Science Perspective
U.S. Geological Survey Circular No. 779, 1978.

Geology of the Warman Region Phase 2
E.A. Christiansen Consulting Ltd.
February 10, 1978.

Geology of the Warman Site and its Relationship to the Saskatoon Low Collapse Structure
E.A. Christiansen Consulting Ltd.
November 26, 1979.

Health Dangers of the Nuclear Fuel Chain and Low-Level Ionizing Radiation
A Bibliography/Literature Review
British Columbia Medical Association
Health Planning Council
Environmental Health Committee
Robert F. Woollard, M.D.,
Eric R. Young, BSc, M.D., May 1979.

Health Effects of Radon-222 from Uranium Mining
Robert Pohl, Search Vol. 7, No. 8, August 1976.

Letters from Dr. Victor Archer, M.D., Medical Director of the U.S. National Institute for Occupational Safety and Health, to Gordon Edwards (Jan 3/77) and to Frank Palmy (Feb 2/79).

Link Between Refinery and Fallout - Cumulative Risk
Star-Phoenix, July 26, 1977.

Low Energy Passive Solar Housing
University of Saskatchewan
October 1979.

Low-Level Radiation: A Review of Current Estimates of Hazards to Human Populations
D.K. Myers, Atomic Energy of Canada Ltd., December 1977.

Management and Control of Radioactive Wastes from Uranium Milling Operations
R.H. Kennedy et al, International Conference on Nuclear Power and Its Fuel Cycle, Salzburg, Austria, May 1977.

Map of Known World Deposits of Uranium.

Measurable Health Effects of Diagnostic X-Ray Exposure
Rosalie Bertell, Ph.D., July 11, 1978.

NRC Regulation of the Uranium Milling Industry: Problems and Prospects
Victor Gilinski, May 2, 1978.

Nuclear Dilemma
Business Week, December 25, 1978.

Nuclear Energy - Saskatchewan and the Third World
Board of the Saskatchewan Council for International Co-operation, 1976.

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Transcript of testimony of Gordon Edwards to the Select Committee on Ontario Hydro Affairs
October 12, 1978.

Nuclear Wastes: What, Me Worry?
Gordon Edwards, February 1978.

Nuclear Weapons and Nuclear Reactors
D.A. Meneley, August, 1977.

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Bill Harding, Regina Group for a Non-Nuclear Society, 1979.

Oil in Abundance
Jude Wanniski, Harpers, October 1979.

Phase II Saskatchewan Site Evaluation Study for Eldorado Nuclear Ltd. Uranium Refinery
The Cambrian Group, August 1979.

Proof of Dr. Alice Stewart's Evidence for Windscale Enquiry
Alice Mary Stewart.

Qualifications of Beak Consultants Limited Relevant to Socio Economic and Public Participation Programs
Beak Consultants Limited.

Radiation Protection
G. Hoyt Whipple, August 1979.

Reanalysis of Data Relating to the Hanford Study of the Cancer Risks of Radiation Workers
George W. Kneale, M.A.
Alice M. Stewart, M.D.
Thomas F. Mancuso, M.D.
March 13-17, 1978.

Record Linkage and Identification of Long-term Environmental Hazards,
E.D. Acheson, Proc. R. Soc. Land. , B 205, 165-178, 1979.

Regulations Under the Air Pollution Control Act
Environment Saskatchewan.

Reports to the U.S. Congress
Comptroller General of the United States, Washington, D.C., 1916-11.

Safeguards - Non-Proliferation Treaty - Nuclear Suppliers Guidelines
Atomic Energy Control Board, January 1980.

Saskatchewan Economic Review
Saskatchewan Bureau of Statistics
October 1979.

Saskatchewan Site Evaluation Study for Eldorado Nuclear Ltd. Uranium Refinery,
The Cambrian Group, October 1975.

Saskatoon
City of Saskatoon, Industrial Development Office, March 1979.

Status of. ..Waste Disposal: Overview and Summary
California Energy Resources Conservation and Development Commission, January 11, 1978.

Stratigraphic Test Drilling of the Proposed Eldorado Nuclear Refinery Site, Warman, Saskatchewan
Ground-Water Consultants Group
March 1977.

The Air Pollution Control Act
Province of Saskatchewan.

The Amount of Hereditory Disease in Human Populations
Benjamin K. Trimble and John H. Doughty, Am. Hum. Genet., Lond., 1974.

The Clean Air Act - Compilation of Regulations and Guidelines
Environment Canada, November 1977.

The Department of Environment Act
Province of Saskatchewan.

The Ethical Implications of Energy Production and Use
Adopted by the Governing Board of the National Council of the Churches of Christ in the U.S.A., May 11, 1979.

The Ground Water Conservation Act,
Province of Saskatchewan.

The Health Hazards of Not Going Nuclear,
Leo Yaffe, Chemistry in Canada, December 1979.

The Incidence of Genetic Disease and the Impact on Man of an Altered Mutation Rate
Benjamin K. Trimble and Martha E. Smith, Canadian Journal of Genetics of Cytology, September 1977.

The Litter Control Act
Province of Saskatchewan

The Medical Effects of Radiation,
Helen Caldicott, Image, April 1978.

The Meewasin Valley Project,
Raymond Moriyama Architects and Planners

The Nuclear Option
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APPENDIX V — ACKNOWLEDGEMENTS

The Panel wishes to express its thanks to all those who participated in the review of the proposal to construct a uranium refinery in the Rural Municipality of Corman Park, near Warman, Saskatchewan.

The Panel received invaluable assistance from representatives of many federal and provincial government agencies who participated as technical reviewers of the Environmental Impact Statement and as participants in the public meetings.

The Panel would like to thank representatives of radio, television and newspapers who disseminated information about the project and provided extensive coverage during the public meetings.

The Panel would also like to thank its staff for assisting them in the review and the completion of the report.

Finally, the Panel offers its sincere thanks to the many individuals and groups who spent considerable time and effort in preparing briefs for and presenting them to the Panel.