TECHNICAL REVIEW

of the

ENVIRONMENTAL IMPACT STATEMENT

for

ELDORADO NUCLEAR LIMITED'S
PROPOSED URANIUM REFINERY

at

HOPE TOWNSHIP

Prepared by

DEPARTMENT OF FISHERIES AND ENVIRONMENT

ONTARIO REGION

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INTRODUCTION

The Federal Environmental Assessment and Review Process requires the Department of Fisheries and Environment (DFE) to review and comment on the adequacy of Environmental Impact Statements (EIS) prepared under that process. The following submission contains the Department of Fisheries and Environment's comments regarding the Eldorado Nuclear Limited Environmental Impact Statement for a proposed uranium hexafluoride refinery in Hope Township. The review was carried out by Departmental personnel from the Ontario Region with assistance from Headquarters staff.

The general objective of the review was to determine the technical merit and accuracy of statements made, conclusions drawn and recommendations presented in the EIS. Matters of significance regarding siting and waste management are emphasized. Comments on conditions that should be adhered to and further studies that should be undertaken if the project proceeds at the Hope Township site are also provided.

Although the EIS contains air and wastewater emission data, DFE has not been provided with a detailed description of the process or detailed information substantiating the emission data. Clearly then, DFE is not able to assess the validity of the emission data without this detailed information. In the review of the EIS, DFE has accepted the statements concerning Project description, including air and water discharges. Comments made during this review are predicated on the presumption that the air and water emissions contained in the EIS are maximum levels. Any variations above these levels, arising from the more detailed design and licensing stages, could affect the observations made in this review.

The Department fully recognizes that Eldorado Nuclear Limited (ENL) will be required to substantiate its claims covering discharge limits and operating procedures during the various licensing processes. DFE will be more than willing to participate with the Atomic Energy Control Board (AECB) in the review of the ENL construction, operation, waste management and post-operational licence applications, as has been done with other matters of a similar nature.

SUMMARY

The Technical Review by the federal Department of Fisheries and the Environment emphasizes matters of significance regarding siting and waste management. Minor technical and editorial deficiencies in the EIS noted during the DFE review are not commented on.

A number of the sections pertaining to "Physical Environment" did not contain sufficient information or data to fully support the determination of impacts and subsequent conclusions. Nevertheless, DFE has attempted to assess the significance of potential impacts on the basis of the given Project Description and air and water dispersion related to the design emission rates.

No significant environmental problems were identified in the material in the "Geology and Hydrogeology", "Aquatic Environment", "Aquatic Biology", or "Radiological Impacts" chapters. Conditions that should be adhered to and further studies that should be undertaken if the project proceeds at the Hope Township site are discussed in the text.

The monitoring programs outlined in Chapter 5 appear reasonable. DFE understands that specific details of these programs will be subject to the review and aproval of regulatory agencies during the various licensing processes. DFE is prepared to participate with AECB in the review of these programs during the assessment of licence applications.

The main environmental concern identified is the potential effect of HF emissions on ambient air quality and vegetation.

From the review it is evident that HF emissions from the existing Port Hope plant have produced known environmental effects. The impacts at the proposed Hope Township site have not been adequately addressed. A more complete discussion of impact under stable atmospheric conditions is necessary. This should be accompanied by a one year on-site meterological program to validate the use of CFB Trenton data.

SUMMARY (Cont'd.)

The significance of the impacts of fluorides on ambient air quality and off-site vegetation is dependent on:

a) the dispersion calculations
b) background fluoride levels
c) design emission rates.

If the dispersion calculations are complete and correct and the background levels of fluorides are relatively low, the predominant concern would be in ENL meeting the design emission rates. New equipment, improved strategy and procedures to be installed by ENL to prevent accidental emissions, to monitor HF and to ensure the normal discharge are below prescribed limits, should be reviewed in detail during the various licensing processes.

Based on the information supplied in the EIS, DFE is unable to conclude that potentially damaging levels of fluoride in vegetation will not occur within the buffer zone.

CHAPTER 2 - PROJECT DESCRIPTION

As discussed in the Introduction, DFE has accepted statements made in the EIS concerning "Project Description" which includes air and wastewater emissions. DFE has, however, a number of technical comments related to the process and waste management sections of the Hope Township EIS. These are outlined below.

DFE concurs with the suggested approach for handling stormwater runoff and wastewater "contaminated" through process upsets. However, as a basic principle, the refinery should be designed to ensure that, within reasonable and practicable limits, concentrated process streams will be isolated within the plant and not be permitted to join the normal waste streams during process upsets and accident situations. The adequacy of the procedures for diverting and treating the wastewater should be reviewed during the plant design approval and licensing stages. The methods of installation and materials to be used for the lined detention lagoons should also be reviewed. DFE recommends that ENL prepare an operating policy for the stormwater detention lagoons which would address a) the bypassing and/or overflowing of the lagoons during severe and sequential storms, and when the lagoons are being used as wastewater treatment facilities b) the monitoring of discharges c) the treatment of specific contaminants, as indicated on P 3-11 d) the analysis, removal and disposal of lagoon sediments.

DFE believes that retrievable storage of solid waste inside ventilated buildings as outlined in Section 2.7 "Solid Waste Management and Radioactive Waste Storage System" is much preferable to inground burial as proposed at Port Granby. However, standard 45 gallon drums are unlikely to withstand the corrosive action of raffinate solids containing 45% sulphate and 14% nitrate for five to ten years. If the integrity of the drums fails after several years, waste materials could become airborne creating a potential hazard from the inhalation of radioactive particles. Since Table 2.7.1 gives a ^{226}Ra specific activity of 800 pCi/g for the raffinate solids whereas the Port Granby EIS stated 2400 pCi/g, there would appear to be a great deal of uncertainty in selecting a value for this important parameter. The higher specific activity could clearly increase the impact of any residue loss from the drums.

CHAPTER 3.1 - GEOLOGY AND HYDROGEOLOGY

There should be little potential for contamination of groundwater, since there is to be no storage of solid wastes by inground burial as proposed at Port Granby and in view of the environmental design considerations, outlined in Section 3.1.6. While the conclusions of the Geology and Hydrogeology section are reasonable, DFE has a number of technical comments pertaining to Chapter 3.1 which should be addressed if the refinery is approved for this site.

From the information contained in Chapter 3.1, it is not possible at this stage to assess the details of the proposed environmental design measures. These measures should be reviewed during the subsequent approval stages for the refinery since any uncontained pollutants reaching the groundwater will be dispersed relatively quickly by the combined groundwater/spring/stream flow system into Lake Ontario.

A formal contingency plan should be available in order to minimize impairment of the streams and Lake Ontario through redirection of contaminated water to treatment lagoons. This plan could be implemented in the event that the groundwater chemical and stream water quality monitoring programs, as outlined in Chapter 5, indicate that a potentially serious groundwater problem exists. Prior to the preparation of the contingency plan, a simulation of a serious spill of hazardous materials may prove beneficial to estimate potential groundwater effects and migration of substances along flow paths.

Section 3.1.3, p. 3-6 describes the ravine bank erosion process. Since the refinery complex is concentrated in close proximity to the ravines, continued or accelerated slumping due to disruption of vegetation cover may be critical to the integrity of the effluent lagoon system, waste storage buildings and rail and road access routes which are all located between the ravines. Slumping activity should be identified in order to delineate poten-

tial risk zones and, if necessary, contingency plans should be prepared. The importance of protecting the ravine systems through restriction of access, as outlined in Section 3.4, should be stressed by ENL during the construction and operation phases of the plant.

CHAPTER 3.2 - AIR ENVIRONMENT

DFE considers that the assessment of the potential impact of air emissions in chapter 3.2, using design emission rates, has used acceptable air quality models to predict short-term and long-term concentrations of emitted contaminants. DFE has, however, not independently checked the dispersion calculations.

Notwithstanding the use of acceptable air quality models, DFE has several comments pertaining to potential impact of air emissions. These comments are outlined below.

Impact of Fluoride Emissions

The major concern in the "Air Environment" Chapter is the potential impact of fluoride emissions. Statements regarding fluoride emissions from the existing Port Hope refinery, such as on P 3-16 "...Fluoride level are generally low except at stations within 1 km of the refinery in a NE direction..." and on P 3-24 "levels of all potential contaminants decrease to acceptable levels within a few hundred metres of the Port Hope refinery", are not supported by the table on P 3-16 nor by Table 3.2.4. The criteria of 40 ug total F/100 cm^2/30 days during growing season months and 80 ug total F/100 cm^2/30 days during non-growing season months, were exceeded on many occasions. All these violations recorded on the table on P 3-16 were beyond 1 km of the Port Hope plant.

The discussion of fluoride content on vegetation in the vicinity of the Port Hope refinery on P 3-16 chapter 3.2 and on P 3-54 chapter 3.4 does not provide a clear statement of survey results. Data pertaining to the types of vegetation surveyed, levels of fluoride content found, the number of times fluoride damage was noted, and the number of years and the frequency within a given year that surveys were undertaken should have been provided. DFE has been informed by the Ontario Ministry of the Environment (MOE) that the 35 ppm standard for forage vegetation and the criterion of 40 ug total F/100cm^2/30 days during growing season months still are being exceeded up to approximately 1.6 km in the NE direction and approximately 750 metres west of the plant.

During a 1976 plant survey, elevated fluoride levels in vegetation were found up to 750 metres from the refinery, with visible fluoride damage occuring up to 400 metres. The emissions of fluorides from the Port Hope refinery have consistently exceeded MOE criteria.

The significance of Port Hope refinery fluoride emissions with respect to the proposed Hope Township refinery will depend a) on whether the Port Hope emissions affect the ambient air quality at the Hope Township site, b) on whether similar fluoride emissions and violations of criteria will occur, and c) on whether the area between the proposed plant and the existing Port Hope plant will be susceptible to the cumulative effects of HF emissions.

Regarding a), Section 3.2.3 does not provide data on ambient fluoride levels at the Hope Township site, although measurements of fluoridation rates using lime candles are presently being undertaken. DFE understands that data for July - October 1978 will be provided by ENL in a Supplementary Report to the Panel. If these measurements indicate low fluoride levels relative to air quality standards and criteria, the effect of Port Hope emissions on the ambient air quality at the Hope Township site should not be significant. High fluoride levels, however, should be included in the prediction of short and long-term concentrations of fluoride levels which arise from the proposed Hope Township refinery emissions.

In relation to b), a comparison of expected fluoride emissions from the proposed Hope Township plant with the existing Port Hope plant has not been provided in the EIS. However ENL have since stated that the normal continuous emission rate of HF, excluding intermittent emissions, varies from 0.125 to 0.250 kg/h from the Port Hope plant. This compares with the design continuous emission rate of 0.035 kg/h from the proposed Hope Township plant. Since the concentrations of emitted contaminants appear to be in compliance with MOE standards using accepted air quality models and assuming low background concentrations of fluorides, the emissions from the new refinery should have little effect on the ambient air quality and off-site vegetation. This assumes that the dispersion calculations are correct and that ENL can meet the design emission rates. New equipment, improved strategy and procedures to be

installed by ENL to prevent accidental emissions, to monitor HF and to ensure that normal discharges are below prescribed limits, should be reviewed in detail during the various licensing processes.

With regard to c), the area between the proposed plant and the existing Port Hope plant could be suceptible to the cumulative effects of HF. This potential, with particular reference to fluoride levels in vegetation, has not been addressed in the EIS. However, as a result of the prevailing wind direction, the majority of the effects of the Port Hope Refinery are found in the NE direction. Assuming improved control of fluoride emissions from the Port Hope refinery, this potential should not be a significant concern. The measurements of fluoride levels at the Hope Township site, as discussed in a) above, will give an indication of the potential for cumulative effects.

Atmospheric Stability

In Section 3.2.2, the wind roses for Wesleyville and Trenton cannot be considered "very similar" since predominant wind directions differ by 45 degrees. The use of Trenton wind data could have implications concerning the validity of atmospheric stability estimates made for the Hope Township site. It should also be noted that the Star program is biased towards neutral stability implying underestimates of both unstable and stable conditions. Therefore, use of the Star program could over estimate the dispersive capability at the Hope site.

Underestimates of the frequency of stable atmospheric conditions will only be important if significant concentrations of contaminants are predicted during these dispersion conditions. Concentration profiles for F stability (extremely stable conditions) are not discussed in sufficient detail on P 3-21. The significance of the

Portelli, R.V., 1976. "A Comparative Study of Experimentally Measured Atmospheric Stability and STAR Program Predictions", presented at the 3rd Symposium on Atmospheric Turbulence, Diffusion, and Air Quality, held at Raleigh, N.C.

frequency of stable atmospheric conditions cannot be estimated until the results of these calculations are provided.

In the fourth paragraph on P 3-25, maximum ground level concentrations resulting from process upsets and credible accidents are discussed for C and D Stabilities. In order to assess more fully potential adverse effects resulting from the process upsets and credible accidents, maximum ground level concentrations should be calculated for extreme stability conditions and during the breakup of these stable conditions.

An on-site meteorological program should be established for at least one year during the construction phase in order to validate the use of CFB Trenton data. This information should be used as input to dispersion models looking at the combined effect of the proposed Wesleyville Generating Station and ENL refinery. This program would be of particular significance if high concentrations of contaminants are predicted during stable atmospheric conditions.

CHAPTER 3.3 - AQUATIC ENVIRONMENT AND CHAPTER 3.4 - AQUATIC BIOLOGY.

Based on the quantity and quality of effluent as outlined in the EIS, there should not be any significant water quality problems in Lake Ontario during normal operating conditions of the plant. In Table 3.3.15 the levels of chromium, zinc and perhaps ammonia in the "normal effluent" may be deleterious to aquatic life in the initial dilution zone near the diffuser ports. Although DFE has not validated the initial dilution calculations, this zone is considered to be extremely small in volume and is unlikely to entrain aquatic species for an appreciable period of time. The impact of the effluent on biological communities is not considered to be significant under normal operating conditions.

In the development of the water monitoring program, a current rose plot (similar to the wind rose plot Fig. 3.2.1) would be useful in establishing the location and frequency of stations. Such a plot would help to determine the frequency of occurence and average duration for each of the coastal flow regimes (steady shore parallel, onshore/-offshore, reversal of currents, calm or stagnant conditions). This would ultimately enable more accurate measurements of the effects of plant operations on Lake Ontario water quality including any effects resulting from any process upset or abnormal operating condition. To develop such a current rose plot, the data base currently available in Ontario Hydro and at the National Water Research Institute should be more than adequate.

The present data base in Chapter 3.4 is inadequate to describe indigenous biological communities in the on-site streams and the open lake around the plant outfall. A more complete sampling program should be undertaken during the pre-operational environmental monitoring program in order to help assess the significance of impact on biological communities arising from uncontrolled upset or non-routine operating conditions.

From the information contained in Section 3.3.4, it is not possible to assess the details of the measures proposed to control site runoff from entering the local creeks during construction. These measures should be

reviewed during the subsequent approval stages since increased sedimentation and rate of runoff could affect the local ravines and biological communities in the on-site streams.

CHAPTER 3.4 - TERRESTRIAL BIOLOGY

Based on the information supplied on P 3-54, DFE is unable to conclude that potentially damaging levels of fluorides to vegetation within the buffer zone will not occur. The predicted average annual ambient air concentration of 0.35 ug/m^3 HF in the vicinity of the ravines is sufficiently close to the 0.5 ug/m^3 (yearly average) recommended level (McCune 1969) for conifer exposure that damage to ravine forests on the site is a distinct possibility.

The frequency with which defoliation from high fluoride levels occurs is a critical factor in measuring potential impact, rather than just leaf loss as described on P. 3-55. For example, defoliation three years in a row during the growing season would be lethal to some conifers. *

Plants may also be injured by simultaneous exposure to various pollutants at very low concentrations. ** The possibility of synergistic effects of SO_2 (arising from the combined Ontario Hydro Wesleyville Generating Station and Hope Township refinery emissions) and HF on vegetation should be considered.

A discussion of the impact of plant emissions on the terrestrial wildlife of the Hope Township site has not been provided. The general discussion on P 3-54 of the effects of fluorides on animals should have been related to long-term ingestion of vegetation with fluoride concentrations greater than 35 ppm, potentially leading to chronic fluorosis, not an intake of acutely toxic amounts. However, since the site is estimated to have a moderately low wildlife potential, the impact of plant emissions on the terrestrial wildlife should not be significant.

* "Responses of Plants to Air Pollution" edited by J.B. Munn and T.T. Kozlowski, Air Pollution Defoliation, Academic Press, 1975.

** E. Mukammel "Review of Present knowledge of Plant Injury by Air Pollution". Reported in World Meteorological Organization Technical Note 147.

CHAPTER 3.5 - RADIOLOGICAL IMPACTS

On page 3-61, mention is made of the new ICRP recommendation on radiological protection (ICRP 26, 1977) but Table 3.5.1 ignores the new ICRP approach to calculating the whole body dose. The ICRP no longer stipulates maximum dose limits for individual tissues but instead, have assigned weighting factors to each organ or tissue based on risk of an effect to the total body. The calculated tissue doses are now to be multiplied by the respective tissue weighting factor and the products summed to give the whole body dose. The EIS is correct in stating ICRP has still maintained the maximum limit for this at 500 mrem per year for an individual member of the public, although a more realistic value is the 5 mrem by AECB to evaluate derived release limits (DRL's) from nuclear facilities.

Since the waste management system for the refinery involves storage of drummed waste rather than ground burial, there should be little impact on the environment from this aspect of the operation, as long as the drums remain intact. The estimated ^{222}Rn loss from the stored drums of raffinate solids will exceed the stack losses after four years operation, but assuming the predicted dilution factors for airborne radionuclides are valid, no significant exposures should occur to individuals offsite above the 5 mrem per year level. It should be noted that high ventilation rates of the waste storage buildings will be required in order to maintain low ^{222}Rn levels for personnel entry to check drum stability.

As all surface water and waste streams possibly contaminated with radionuclides will be treated and analyzed before being released from the site to the lake, there should not be any radioactivity discharged directly to the lake above acceptable levels. However, the procedures to maintain the integrity of the storage lagoons and to finally dispose of the lagoon sediments, should be described.

Airborne uranium would appear to have the greatest radiological impact, but assuming again that the air dilution factors are correct, then individuals at the plant boundary would be protected.

CHAPTER 5 - MONITORING

The conceptual programs outlined in Chapter 5 for pre-operational environmental monitoring, operational compliance monitoring and operational environmental monitoring are generally considered to be a reasonable approach to meet total monitoring requirements. DFE understands that specific details of these programs will be subject to the review and approval of regulatory agencies during Atomic Energy Control Board and various provincial agencies' licensing processes. When the detailed plant design is completed, the Department of Fisheries and the Environment is prepared to participate in the review of these programs during the assessment of licence applications, as has been the practice with other matters before the AECB.

At the present stage of the approval process, a number of comments are pertinent to the conceptual programs:

1. An on-site meterological program should be established for at least one year during the construction phase in order to validate the use of CFB Trenton data. This would include a meterological tower for wind measurements and/or a minisonde program. These data can be used to establish correlations with existing data sets and provide inputs to dispersion models looking at the combined effect of the proposed Wesleyville Generating Station and the ENL refinery. If the detailed information required for the STAR program is not already being collected by Ontario Hydro, it may prove worthwhile for ENL to explore with Ontario Hydro a joint program using the existing tower at the Wesleyville Generating Station.

2. A water quality sampling schedule more frequent than once per month, should be undertaken in the near-shore region and in streams, to more readily detect possible non-routine releases. This schedule should include winter months.

3. Wildlife and aquatic biological surveys should be undertaken to establish the distribution of species within the biological communities for a future operational monitoring program.