Environmental Stewardship Branch
6 Bruce Street
Mount Pearl NF A1N 4T3

February 19, 2009 File No.: 4194-10

Ms. Kim Coady
Canada Newfoundland and Labrador Offshore Petroleum Board
Fifth Floor, TD Place
140 Water Street
St. John's, NF A1C 6H6

Dear Ms. Coady:

RE: Petro Canada Jeanne D'Arc Basin Exploratory Drilling Program EA Report, Offshore NL **EAS 2008-240B**

As requested in your letter of December 30, 2008, Environment Canada has reviewed the EA Report for the Petro-Canada Jeanne d'Arc Basin Exploratory Drilling Program. From the information provided it is understood that the proponent intends to drill an anticipated maximum of 18 exploratory wells at various points in the Jeanne d'Arc Basin over the period 2009-2017.

The following EC comments stem from the department's mandate under the *Migratory Birds Convention Act* (MBCA) Section 36 of the *Fisheries Act* and the *Canadian Environmental Protection Act* (CEPA). Pertinent EC expertise, and related comments, also originates with the *Canadian Wildlife Act,* and the *Species at Risk Act* as well as *Department of the Environment Act.*

Physical Environment

4.2 Climate

The description of the climate and the analysis of the MSC50 dataset is generally very well done, but measured weather and wave data were not used effectively to give a full understanding of the climatology, especially of the extremes. The details were summarized from Appendix 1 (Oceans 2008) of the EA of StatoilHydro's Exploration and Appraisal/Delineation Drilling Program for Offshore Newfoundland, 2008-2016 by LGL, 2008. Most of the recommendations made by this reviewer on the physical environmental conditions and effects of the physical environment of the StatoilHydro's EA were not followed, in the subsequent preparation of this EA for Petro-Canada.

The report makes insufficient use of the more than 10 years nearly-continuous record of weather and wave measurements from platforms in the Northern Grand Banks, contained in industry archives, and in a more limited set in government archives (Fisheries and Oceans, for wave measurements) or university archives (ICOADS: International Comprehensive Ocean Atmosphere Dataset) (Woodruff et al., 1995, Worley et al., 2005).

There is no analysis of frequency and severity of icing accumulation due to freezing spray or to freezing precipitation, even though it is noted as a hazard in Section 7.1 Effects of the Environment on the Project.

Mean wind speed maps for January and July from the Quikscat dataset were presented, which is useful. However it would be of value to present extreme wind speed information from Quikscat as well, both as climatology and as validation of measured and modelled data in recent extreme storms (e.g. see Cardone et al., 2004 and Chelton et al., 2005). The URL for the Quikscat maps is given but a reference should be provided as well. The legend for these maps indicates the wind speeds are in knots, but the captions say that they are in m/s.

There are N. Atlantic maps for monthly mean wind wave height and significant wave height estimates for the months of January and July. The reference is Gulev (1998) but the reference section correctly indicates Gulev and Hasse (1998). The text should indicate that these analyses are based on wave observations from voluntary observing ships, and give some indication of the quality.

There was little description of climate variability or trend in the EA, other than some discussion of trends in tropical cyclones, even though the end of the proposed drilling program extends about 20 years beyond the end of the analyzed climate data. Note that recent work shows increases in 20-yr counts of winter (JFM) cyclones from 1958-77 to 1982-2001 over Newfoundland and eastern Labrador and adjacent waters (Wang et al., 2006a and 2006b). Wang and Swail (2002) found increasing trends in higher percentile modelled wave heights in July to December off Nova Scotia and the Island of Newfoundland. It is recommended that the MSC50 data at a representative point be analyzed for trend and interdecadal variability, and that the results are related to relevant seasonal atmospheric circulation indices such as the North Atlantic Oscillation and the El Nino Southern Oscillation (e.g. see Eichler and Higgins 2006).

4.2.1 Data Sources and 4.2.2 Winds

The chief sources are the MSC50 wind and wave hindcast dataset and the ICOADS dataset composed of observations from ships, platforms, and buoys. As noted in the report, the collection of wind observations in ICOADS is inhomogeneous, coming from ships and platforms with different observing methods and measurement heights. However no attempt was made to homogenize the winds through adjusting to a standard height, using available information about anemometer heights from platforms in the area. It would be helpful to note those platforms which have reported in each region, such as the Eirik Raude in Region 3. There are relatively long weather records in Region 2 from the Hibernia GBS, and the Henry Goodrich and GSF Grand Banks semi-submersibles.

The quality control method for the ICOADS used the standard trimming flags, which are overly restrictive for extreme winds. Their use would exclude valid extreme winds from many storms. For example, the maximum wind speed for February is given as 38.1 m/s (ICOADS, Region 2, Table 4.5) but the Hibernia GBS reported 49.4 m/s and the Henry Goodrich reported 52.5 m/s on 11 February 2003. Examination of the ICOADS reports in this area show many instances of valid extreme winds from the Hibernia GBS and other platforms with trimming flags that would result in their exclusion. Adjusting these platform winds for measurement height would be helpful in a comparison with MSC50 winds.

It is important to adjust wind speeds for measurement height to a standard reference level. Winds measured on platforms at elevations of 80 to 140 m would be up to 25% stronger than equivalent winds at 10m in neutral atmospheric stability conditions. These prevail frequently in the fall and winter months. The difference would be greater in stable conditions which prevail frequently in the late spring and early summer months. The simplest adjustment method uses a log profile formula and assumes neutral stability (e.g. see Cardone et al., 2004 and references therein). More sophisticated methods are available that account for atmospheric stability using the air and sea temperature. One example is the program developed by Walmsley (1988) which also uses of the air temperature measurement height.

While it may be necessary to use the standard or enhanced trimming flags for ships, the platform observations are generally of better quality. It would be of more value to analyze platform weather measurements only, where they are available – particularly in Region 2, rather than have the inhomogeneity and error increased by including observations from passing ships. The influence of the many platform winds, not adjusted for height, in the ICOADS Region 2 monthly mean wind speeds statistics (Table 4.3), show up with values typically about 2 m/s greater than the MSC50 values. Furthermore, analysis of the platform wind measurements required for helicopter operations, available in industry archives, would give valuable information on one or two minute averaging interval values and gusts.

The wave measurements from wave riders near the offshore platforms are available separately from the ICOADS, from Fisheries and Oceans Canada. Combined together in Region 2, for example, these form a nearly continuous record since 1999. These are an important data source but were not mentioned. It is recommended that these data be analyzed and presented.

4.2.3 and 4.2.8 Wind and Wave Extreme Value Analysis

The wave climate is derived entirely from the MSC50, even though there are nearly continuous measurements of significant wave height and peak wave period in this area since 1999, especially for Region 2. There is no comparison of monthly maxima with recent extreme measurements.

The extreme value wind analysis includes tables for one hour, 10 minute, and one minute means. However the 10 minute and one minute means are derived using standard factors from the MSC50 modeled one hour means. It would be of value to analyze 10 minute and one or two minute wind speed measurements collected in support of helicopter operations, to validate and perhaps improve on these adjustment factors.

4.2.5 Precipitation and 4.2.6 Visibility

Similar comments made for the relatively long term wind measurements in Region 2 apply to observations of precipitation and visibility. The climate quality would be better and the estimate of error reduced if platform measurements were analyzed separately from the ship observations.

7.1 Effects of the Environment on the Project, 7.1.1 Physical Environment

This section is very short and general. There were no specifics on typical limiting environmental conditions for each platform type, such as maximum wave crest height for jack-up platforms, or of wave height and period combinations for semi-submersibles. There was no mention of possible seasonal limits on the operation of any of the platform types, in relation to the seasonal frequency of occurrence of important thresholds. This section would be improved if it included description of actions that would be taken for each platform type and mooring system, in the event of a forecast of limiting threshold conditions, and the length of forecast lead time that would be required.

References

Cardone V.J., A.T. Cox, E.L. Harris, E.A. Orelup, M.J. Parsons and H.C. Graber. ***Impact of QuikSCAT Surface Marine Winds on Wave Hindcasting***. 8th International Wind and Wave Workshop, Oahu, Hawaii November 14-19, 2004.

Chelton DB, Freilich MH, Sienkiewicz JM, and Von Ahn, JM, 2005. On the Use of QuikScat Scatterometer Measurements of Surface Winds for Marine Weather Prediction, Monthly Weather Review, volume 134, pp. 2055-2071.

Eichler, T. and Higgins, W. 2006. Climatology and ENSO-Related Variability of North American Extratropical Cyclone Activity, *Journal of Climate,* **19**, pp. 2076-2093.

Swail, V.R., V.J. Cardone, M. Ferguson, D.J. Gummer, E.L. Harris, E.A. Orelup and A.T. Cox, 2006 ***The MSC50 Wind and Wave Reanalysis***. 9th International Wind and Wave Workshop, September 25-29, 2006, Victoria, B.C.

Walmsley, J.L., 1988. On theoretical wind speed and temperature profiles over the sea with applications to data from Sable Island, N.S. *Atmosphere-Ocean,* **26**(2), 202-233.

Wang, X.L. and Swail, V.R., 2002. Trends of Atlantic Wave Extremes as Simulated in a 40-Yr Wave Hindcast Using Kinematically Reanalyzed Wind Fields, Journal of Climate, 15, pp. 1020-1035.

Wang, X.L., Wan, H., and Swail, V.R., 2006a. Observed Changes in Cyclone Activity in Canada and Their Relationships to Major Circulation Regimes. *J. of Climate*. 19, pp. 896-915.

Wang, X.L., Swail, V.R., and Zwiers, F.W., 2006b. Climatology and Changes of Extra-Tropical Cyclone Activity: Comparison of ERA40 with NCEP/NCAR Reanalysis for 1958-2001. *J. Climate*, **19**, 3145-3166 (DOI: 10.1175/JCLI3781.1).

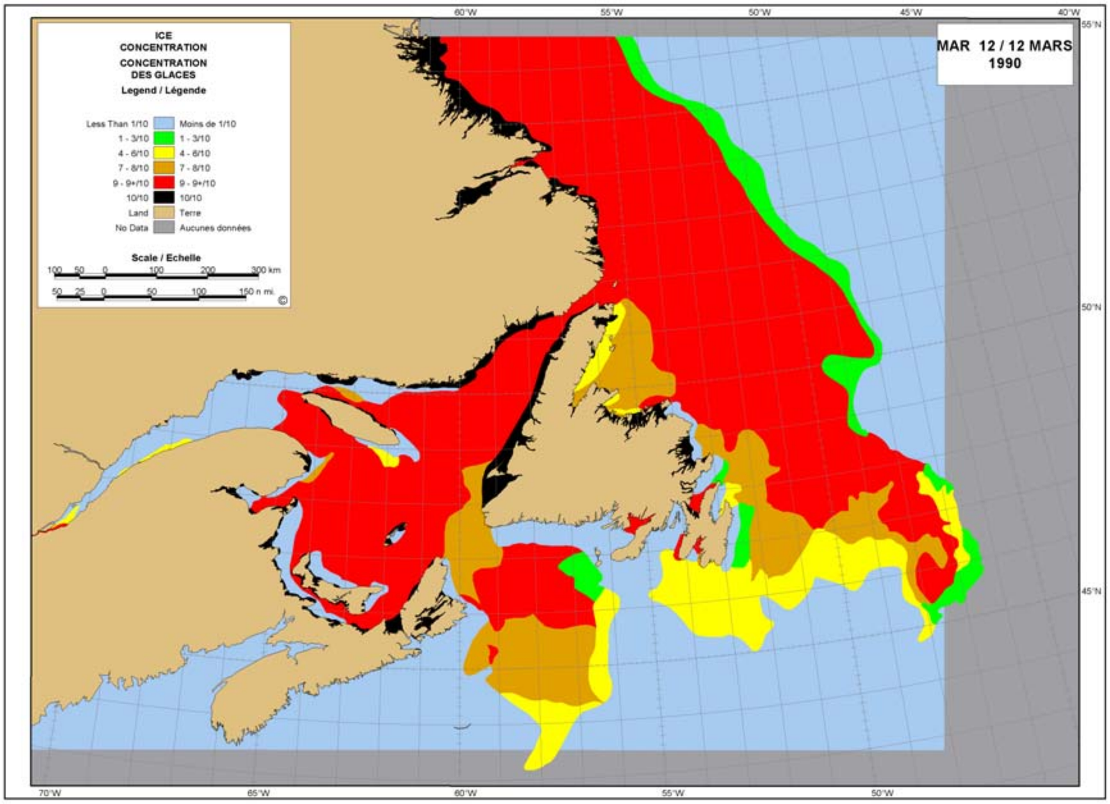
Woodruff, S.D., S.J. Lubker, K. Wolter, S.J. Worley, and J.D. Elms, 1993: Comprehensive Ocean-Atmosphere Data Set (COADS) Release 1a: 1980-92. *Earth System Monitor*, 4, No. 1, 1-8.

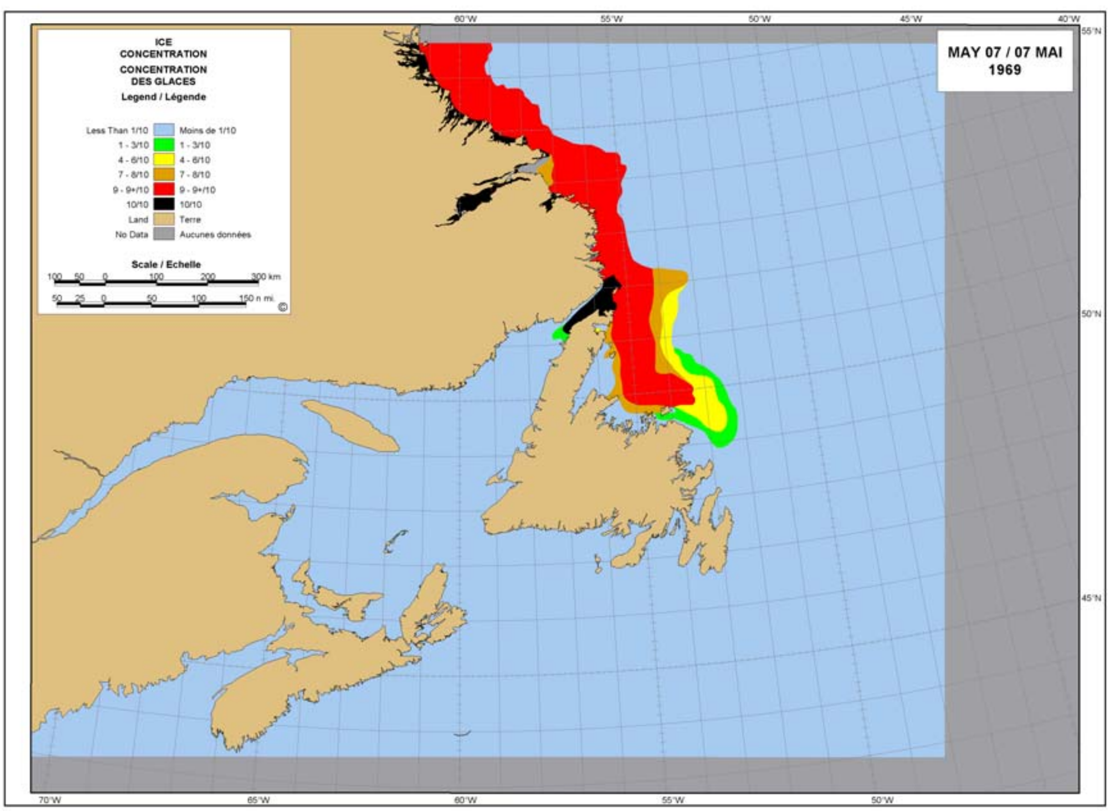
Worley, S.J., S.D., Woodruff, R. W. Reynolds, S. J. Lubker, and N. Lott, 2005: ICOADS Release 2.1 data and products. *Int. J. Climatology (CLIMAR II Special Issue),* **25**, 823-842 (DOI: 10.1002/joc.1166).

Sea Ice and Icebergs

4.4.1 Sea Ice

The proponent may want to add the following figures of record maximum and minimum sea ice extents for the Grand Banks region:


ICE CONCENTRATION
CONCENTRATION DES GLACES
Legend / Légende
Less Than 1/10 Moins de 1/10
1 - 3/10 1 - 3/10
4 - 6/10 4 - 6/10
7 - 8/10 7 - 8/10
9 - 9+/10 9 - 9+/10
10/10 10/10
Land Terre
No Data Aucunes données
Scale / Echelle
100 50 0 100 200 300 km
50 25 0 50 100 150 n mi.
MAR 12 / 12 MARS
1990
60°W
55°W
50°W
45°W
40°W
55°N
50°N
45°N
70°W
65°W

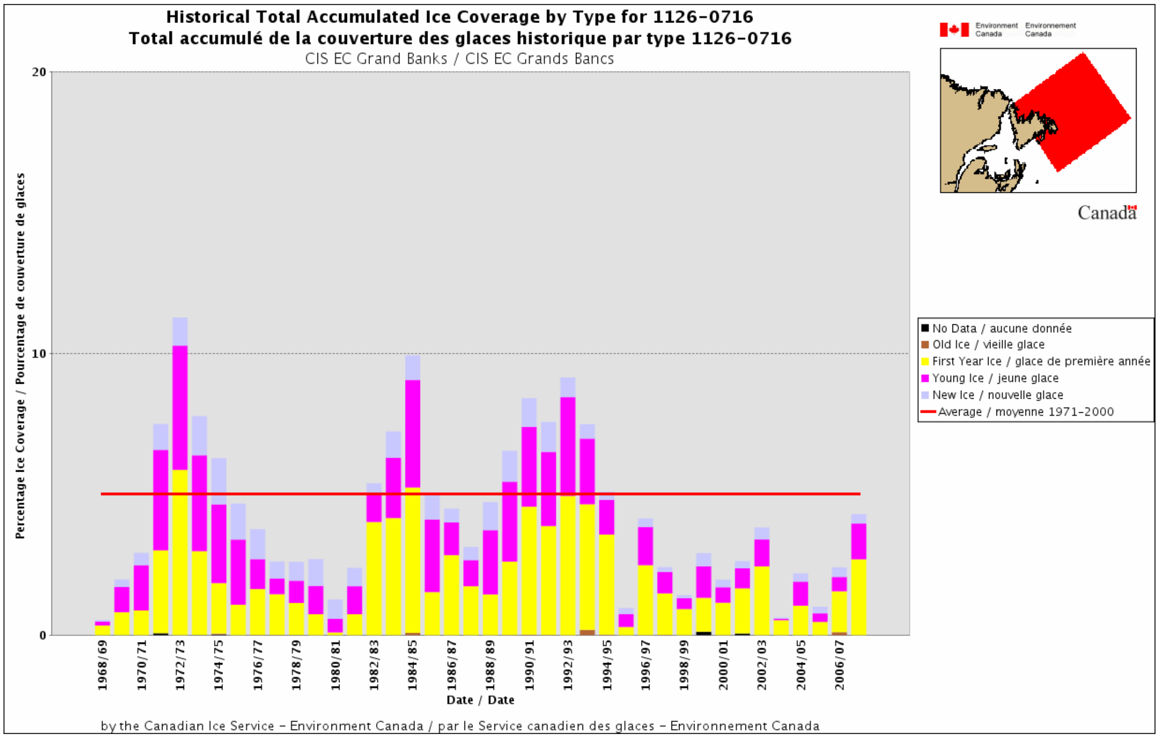

ICE CONCENTRATION
CONCENTRATION DES GLACES
Legend / Légende
Less Than 1/10 Moins de 1/10
1 - 3/10 1 - 3/10
4 - 6/10 4 - 6/10
7 - 8/10 7 - 8/10
9 - 9+/10 9 - 9+/10
10/10 10/10
Land Terre
No Data Aucunes données
Scale / Echelle
100 50 0 100 200 300 km
50 25 0 50 100 150 n mi.
MAY 07 / 07 MAI
1969
60°W
55°W
50°W
45°W
40°W
55°N
50°N
45°N
70°W
65°W

4.4.2 Icebergs

Change word: "This process produces a structure quite different from <u>sea</u> ice."

4.4.2.1 Iceberg distribution

1st para: Note that maximum iceberg years tend to coincide with peak sea ice years because sea ice serves to protect icebergs from wave erosion and melt as they drift southwards from the Labrador Sea to the Grand Banks. In 1984, the year with the highest number of bergs recorded, the average sea ice coverage for the season was above normal (see figure below).



2nd Para: Rephrase for clarity: Icebergs are observed drifting south of 48°N from March through to September, with the highest numbers occurring in July (based on long-term averages of data compiled by PAL from 1989 to 2007).

Also 2nd Para: "… three years have been completely ice free." Which ones?

You may want to include some of the additional iceberg distribution statistics for the last 5 years are shown in the following table.

5-year Iceberg Statistics

based on daily CIS Iceberg charts 2004-2008

year	date icebergs first crossed S of 49N	max S extent latitude (degN)	max S extent date	max E extent longitude (degW)	max E extent date	date iceberg limit perm. retreated N of 49N
2004	Mar-18	42	various times Jun 25 - Jul 26	41	jun 30 - Jul 03	Aug-12
2005	Feb-15	46.5	Apr 24-25	47.5	Mar30-Apr07, May 2-14	Jun-03
2006	Mar 29, Aug 5	48	May 30, Aug 9-12	46.5	aug 8-10	May 31, Aug 13
2007	Mar-02	43	Jul 8-13	45	Jun27-Jul17	Sep-04
2008	Feb-09	41.3	May 29 - Jun 13	42.5	May 16-17	Aug-12

4.2.2 Iceberg Size Distribution

Quantify small, medium and large icebergs: Small icebergs have heights of 5-15m and lengths of 15-60m (where the dimensions refer to the portion above water). Medium icebergs have heights of 16-45m and lengths of 61-120m. Large icebergs have heights of 46-76m and lengths of 121-200m.

4.4.2.4 Iceberg Mass

Add: Ice islands (very large, flat, tabular icebergs) sometimes reach the Grand Banks. Ice island masses can be significantly greater than those of regular icebergs, reaching billions of tonnes. In summer 2008, such an ice island broke off the Petermann Glacier in northwest Greenland and drifted south into Baffin Bay, where it was tagged with a beacon. At the time it was tagged, it was ~8+km long, 20+ km^2, had a draft of 50-55m, and massed 1 billion tonnes. It passed Cape Dyer at the southern end of Baffin Island on January 29, 2009, at which time it measured 5km long and 13.75 km^2. This ice island may reach the Grand Banks in the summer 2009 season. The Petermann ice island can be tracked using the sailwx.info ship tracker. The beacon # is 47557.

7.1.1 Physical Environment

3rd Para: quantify "most of the year": The project area is generally sea ice free from May through to February. The project area is generally iceberg-free from September through to February.

Air Emissions

There are no major concerns with this Petro-Canada drilling project from an air emissions point of view. The GHG emission estimates provided appear reasonable and are in line with recent estimates from other drilling projects. However, it would be useful to provide estimates of CAC emissions from diesel power generation, flaring and well testing. The proponent mentions that GHGs are reported to the CNLOPB as per the OWTG. The OWTG also require reporting of VOC emissions to the CNLOPB so these should also be estimated.

Migratory Birds

5.4.1.1 Seabird Survey Effort in the Study Area

Another source of seabird observation data is Environment Canada's Eastern Canadian Seabirds at Sea (ECSAS) program. This program has conducted over 4000 surveys covering 7800 km of ocean track in the study area since 2006. This would considerably enhance the seabird data presented. This information is available by contacting Dave Fifield at David.Fifield@ec.gc.ca or (709) 772 - 3425 and should be included in future EA's for this area.

5.4.1.2 and Section 5.4.1.4 Seabird Distributions in the Study Area

In both these sections, the authors refer to densities in the two last sentences of the paragraphs. The values presented are not densities, but are merely counts of birds sighted per linear kilometer, or relative abundances and should be indicated as such.

The proponent should be aware that densities could be computed if they moved to using distance sampling methods which also have the added bonus of addressing detectability. A copy of the recommended protocol is attached.

Table 5.12

The categories of Common, Uncommon, Scarce, and Very Scarce should be quantified.

Table 5.15

Under Procellariidae, the p in Storm-Petrels should be capitalized.

7.2.2.4 Residual Effects on Seabirds

This section mentions the release of stranded birds such as Storm-Petrels. It should be noted that the release of stranded birds should be carried out following the standard protocol (CWS & Petro Canada).

7.2.2.4 Cumulative Effects

Increases in the number of drilling platforms have the potential to have cumulative light attraction effects on seabirds. Although there is little data available on the geographical extent of area affected by lights, the potential effect on birds is something that should be mentioned in this section.

I trust that this information will be of assistance in your review of this assessment. If you wish to discuss these comments or have further questions, please do not hesitate to contact me at your convenience.

Yours truly,

Original Signed by Glenn Troke

Glenn Troke
Environmental Assessment Coordinator
Environmental Protection Operations Directorate
ESB/NL

Attachment

cc G. Worthman
S. Zwicker