2007 Annual Report
Offshore Environmental Effects Monitoring Program
ExxonMobil Canada Properties - Sable Offshore Energy Project

Submitted to:

ExxonMobil Canada Properties Inc.
Sable Offshore Energy Project
1701 Hollis Street
Halifax, NS B3J 3K8

Submitted by:

32 Troop Avenue, Unit 301
Dartmouth, NS B3B 1Z1
(902) 468-2848

58 Parkedge Crescent
Dartmouth, Nova Scotia B2V 2V2
(902) 441-0626

On behalf of:

130 Eileen Stubbs Avenue
Suite 1 South
Dartmouth, Nova Scotia
B3B 2C4

Date of Submission: September 2008
AMEC Reference: TN07100510

TABLE OF CONTENTS

LIST OF TABLES

PAGE

LIST OF FIGURES

PAGE

LIST OF ATTACHMENTS

PAGE

EXECUTIVE SUMMARY

AMEC Earth & Environmental and Hurley Environment Ltd., on behalf of Accent Engineering Consultants Inc., are submitting the results of the 2007 Environmental Effects Monitoring (EEM) program for the Sable Offshore Energy Project (SOEP) to ExxonMobil Canada Properties (EMCP).

The SOEP offshore EEM program has focused on the effects of drilling and production activities at Tier 1 sites (i.e. Venture, Thebaud, North Triumph) since 1997. With the majority of the development drilling completed and the start-up of operations at Tier 1 sites by 2000, EEM surveys undertaken in 2001 to 2003 focused on the effects on sediments and bottom fauna of exposure to intermittent discharges of muds/cuttings during drilling and continuous produced water discharges during operations. The 2005 program addressed start-up activities at Tier 2 sites (Alma in 2003 and South Venture in 2004) whilst considering lessons learned from the Tier I EEM Program and information presented at the 2003 Offshore Environmental Effects Monitoring Workshop held at the Bedford Institute of Oceanography which called for greater emphasis on monitoring fish health effects. There were no drilling or construction activities at SOEP offshore facilities during 2007 rather steady-state production operations only.

The 2007 SOEP offshore EEM program builds on the results and lessons learned to date, in particular from the 2006 EEM program, and recommendations made by the CNSOPB EEM Review Committee which includes representatives of Fisheries and Oceans Canada, Environment Canada, and the Canadian Environmental Assessment Agency.

The SOEP offshore EEM program was designed to address relevant predictions made during the SOEP Environmental Assessment (EA) process. The EEM components were based on valued ecosystem components (VECs) identified during the EA process and components identified by Sable Offshore Environmental Effects Monitoring Advisory Group (SEEMAG) and the EEM study team. The SOEP offshore EEM is intended to be 'adaptive', efficient and meaningful. Therefore, the monitoring plan is adjusted annually by dropping or adding monitoring components or sampling sites with the prior approval of the CNSOPB EEM Review Committee based on the latest monitoring results and scientific information or to address new Project activities. Following review of the 2006 results and consultations with the CNSOPB EEM Review Committee, produced water chemistry, air quality, seabird monitoring, beached seabird surveys, mussel body burden, sediment chemistry, sediment toxicity, and thermal discharge monitoring were monitored in 2007.

A subsea inspection program was planned for 2007. The scope of the planned program was similar to previous years and included inspections by ROV at the base of the Thebaud jackets and along the pipeline route. The video records from these surveys were to be examined as part of the EEM program. The 2007 inspection program commenced in July. However, the supply / support vessel needed as a base to launch the ROV and house the associated crew experienced mechanical difficulties early in the program. The vessel was unavailable for approximately three months while repairs were carried out. Attempts were made to source a replacement support vessel, but none were readily available. Once the vessel was returned to service, the scope of the subsea survey was adjusted to focus on priority areas of the pipeline that could be inspected in the limited weather window that remained. As a result the inspection data available for EEM purposes was not of sufficient detail and quality to meet the intended EEM program scope. A full survey of the pipeline and base of the Thebaud jacket is planned for 2008 and this activity will be included in the 2008 EEM plans.

The ExxonMobil Offshore EEM Team worked cooperatively with government agencies during 2007 notably DFO COOGER and the Canadian Wildlife Service.

Key findings of the 2007 program were:

Produced Water Chemistry and Toxicity (Section 2)

- Barium, boron, iron, strontium, and ammonia levels at Venture are the highest observed of the platform sites monitored in 2006 and 2007. The concentrations of the same elements at South Venture and Thebaud show an increasing trend from 2005 to 2007 sample times. At Alma, values are stable between the two years and are much lower than for the other platforms.

- Total Petroleum Hydrocarbon concentrations for all samples/platform locations were below the OWTG limits for oil in water.

- The 2007 bioassay results using three-spined stickleback and sea urchin fertilization for PW from Thebaud, Venture, South Venture and Alma can be interpreted as being acutely toxic based on regulations for other industries.

- There was no difference in activity of the EROD enzyme between treated and untreated cod suggesting that exposure to the 4% level of PW does not result in activation of this enzyme system.

- The discharge rates of PW at SOEP platforms, which are considerably less than at other existing or proposed East Coast offshore facilities, combined with the higher tidal energy on Sable Island compared to the Grand Banks means that PW constituents will likely to be diluted to background levels within a few metres of the mouth of the discharge caisson.

Air Quality (Section 3)

- There appears to be recent air quality data available from EC for the Sable Air Quality Monitoring Station. This data will be incorporated in the scope of the 2008 program.

- Most observations from the Thebaud platform were that the flare plume was typically either clear or very light gray. There appeared to be a general improvement in flare plume colour towards the latter half of the year.

Seabird Monitoring (Section 4)

- Based on the limited seasonal dataset collected in 2007, there is insufficient information to state conclusively whether the SOEP platforms attract seabirds based on analysis of transect data. Interpretation of seabird observation data in the vicinity of the SOEP platforms is complicated by the nearby presence of Sable Island, which supports colonies of many bird species.

- Several predominantly land-based birds likely died of trauma caused by collisions with superstructures on the Thebaud platform (October 10) and on a DFO research vessel (October 7).

- Application was made for a "Migratory Bird Damage Permit" to scare and kill Great Black-back Gulls and Herring Gulls on the Alma Platform.

Beached Seabird Observations (Section 5)

- During 2007, the corpses of 776 beached gannets, tubenoses, gulls and alcids were collected on Sable Island. Alcids comprised 65.1% of total birds recovered.

- For all species combined, the oiling rate for birds coded for oil (i.e. with >50% of body intact) was 3.8%. The highest rate for a seabird group, 7.1%, was observed in alcids.

- The oiling rate observed in 2007 was the lowest recorded since 2000.

- Of the 3 samples collected and analysed, none contained light or mid-range distillate fuels, or condensates that would be typical of oils produced on offshore gas facilities such as SOEP processing platforms off Sable Island. The contamination source for the single sample containing fuel oil could have been one of any offshore operations in the region, including fishing and military vessels, freighters and container ships, and offshore energy vessels and facilities.

- Although only 3 samples were collected in 2007, the results of generic identification of these oils are consistent with results of samples collected during 2000 to 2006, which indicated that crude oil discharges were likely responsible for a large proportion of pelagic tar and oiled seabirds observed on Sable Island.

Mussel Body Burden (Section 6)

- The concentrations of aliphatic hydrocarbons in both the control and test samples were lower than those of the most recent previous survey (2005).

- The aliphatic hydrocarbon profile reported is typical of that produced by naturally occurring phytoplankton.

Sediment Chemistry (Section 7)

- All sediment samples tested in 2007 resulted in non-detect mercury values which is consistent with earlier data at the same locations near Thebaud and Gully reference sites.

- Barium concentrations at the 2007 Thebaud sites are relatively unchanged from the 2005 values – slightly higher than baseline values only at 250 and 500 'downstream' of Thebaud wellhead platform. The barium concentrations recorded at the Gully reference sites fall within the range of background or baseline levels.

- Total Petroleum Hydrocarbons concentrations were below the current analytical detection limit at all 2007 sampling locations near Thebaud and the Gully reference sites.

Sediment Toxicity (Section 8)

- No toxic responses (amphipod mortality of 30% or greater) were observed in 2007 using the amphipod, *Eohaustorius estuarius*, at any of the far-field Gully reference or nearfield Thebaud platform sampling sites.

- Toxic responses in sediments collected at the sampling site nearest this platform (i.e., T-250m) in the years immediately following drilling (1999-2002) appear to have stabilized at the baseline level (<10% in 1998) since the fall of 2003 from a high of 81% in the spring of 1999.

- In earlier years, sediment toxicity (as a measure by amphipod survival) appeared to be related to the concentration of TPH rather than the concentration of Barium.

Thermal Discharge Monitoring – Thebaud Compression Platform (Section 9)

- Verification of persistence and spatial distribution of excess temperature above ambient seawater resulting from discharge of seawater cooling medium from the Thebaud Compression Platform could not be determined due to the loss of the near-field thermistor moorings.

1.0 INTRODUCTION

1.1 OVERVIEW

AMEC Earth & Environmental and Hurley Environment Ltd., on behalf of Accent Engineering Consultants Inc., are submitting the results of the 2007 Environmental Effects Monitoring (EEM) program for the Sable Offshore Energy Project (SOEP) to ExxonMobil Canada Properties (EMCP).

The SOEP offshore EEM program has focused on the effects of drilling and production activities at Tier 1 sites (i.e. Venture, Thebaud, North Triumph) since 1997. With the majority of the development drilling completed and the start-up of operations at Tier 1 sites by 2000, EEM surveys undertaken in 2001 to 2003 focused on the effects on sediments and bottom fauna of exposure to intermittent discharges of muds/cuttings during drilling and continuous produced water discharges during operations. The 2005 program addressed start-up activities at Tier 2 sites (Alma in 2003 and South Venture in 2004) whilst considering lessons learned from the Tier I EEM Program and information presented at the 2003 Offshore Environmental Effects Monitoring Workshop held at the Bedford Institute of Oceanography which called for greater emphasis on monitoring fish health effects. There were no drilling or construction activities at SOEP offshore facilities during 2007 rather steady-state production operations only.

The 2007 SOEP offshore EEM program builds on the results and lessons learned to date, in particular from the 2006 EEM program, and recommendations made by the CNSOPB EEM Review Committee which includes representatives of Fisheries and Oceans Canada, Environment Canada, and the Canadian Environmental Assessment Agency.

1.2 BACKGROUND

The SOEP offshore EEM program was designed to address relevant predictions made during the SOEP Environmental Assessment (EA) process (refer to Table 1-1). The EEM components were based on valued ecosystem components (VECs) identified during the EA process and components identified by Sable Offshore Environmental Effects Monitoring Advisory Group (SEEMAG) and the EEM study team. The SOEP offshore EEM is intended to be 'adaptive', efficient and meaningful. Therefore, the monitoring plan is adjusted annually by dropping or adding monitoring components or sampling sites with the prior approval of the CNSOPB EEM Review Committee based on the latest monitoring results and scientific information or to address new Project activities. Based on these criteria, the applicability of specific EA predictions and EEM components to the 2007 program are addressed in Tables 1-1 and 1-2. Finally, a summary of findings from the 2007 EEM program and a suggested plan for the 2008 EEM program in given in Table 1-2.

A subsea inspection program was planned for 2007. The scope of the planned program was similar to previous years and included inspections by ROV at the base of the Thebaud jackets and along the pipeline route. The video records from these surveys were to be examined as part of the EEM program. The 2007 inspection program commenced in July. However, the supply / support vessel needed as a base to launch the ROV and house the associated crew experienced mechanical difficulties early in the program. The vessel was unavailable for approximately three months while repairs were carried out. Attempts were made to source a replacement support vessel, but none were readily available. Once the vessel was returned to service, the scope of the subsea survey was adjusted to focus on priority areas of the pipeline that could be inspected in the limited weather window that remained. As a result the inspection data available for EEM purposes was not of sufficient detail and quality to meet the intended

EEM program scope. A full survey of the pipeline and base of the Thebaud jacket is planned for 2008 and this activity will be included in the 2008 EEM plans.

1.3 OBJECTIVES AND GOALS

The SOEP EEM program is undertaken with the following primary objectives:

- To verify predictions made during the EA process;
- To evaluate the effectiveness of mitigation and identify the need for improved or altered mitigation;
- To provide an early warning of undesirable change in the environment; and
- To inform the CNSOPB, other key regulatory authorities, and stakeholders.

1.4 THE EEM TEAM

Figure 1-1 shows the organization of the offshore EEM Team led by AMEC Earth & Environmental and Hurley Environment Ltd. Several firms were contracted to carry out specific assignments related to their specific area of expertise. Special thanks are extended to government agencies participating in the 2007 program. DFO COOGER (Ken Lee and Brent Law) provided sediment samples near the Thebaud platform and the Gully MPA for chemical and toxicity analyzes. DFO (Les Burridge) also carried out PW chemistry and acute and sublethal toxicity analyses on a sample of Thebaud PW provided by the client. The Canadian Wildlife Service (Carina Gjerdrum) offered considerable assistance with seabird monitoring and data analysis.

1.5 FIELD TRIPS

Supply vessels were used to carry CWS seabird observers between the shorebase and offshore facilities (refer to chapter on seabird monitoring). CWS also provided reference seabird data collected by their observers on a vessel of opportunity (i.e. CCG vessel Hudson). During September, four moorings supporting temperature loggers were deployed at Thebaud for the purpose of collecting time series temperature data in support of the Compression Platform cooling water discharge thermal plume monitoring program (refer to chapter on thermal discharge monitoring). During August, the CCG vessel, Hudson, was used by DFO COOGER researchers to collect sediment samples near Thebaud and the Gully MPA (refer to Chapters 7 - Sediment Chemistry and 8 – Sediment Toxicity) and to receive produced water samples from the platform for chemical analysis and toxicity testing (refer to Chapter 2 – Produced Water).

1.6 REFERENCE MAP

A reference map (Figure 1-2) showing the location of the SOEP offshore facilities and pipelines and one-page summaries providing overviews of special environmental areas (i.e., Sable Island (Figure 1-3) and the Gully MPA (Figure 1-4) are also included in the report.

1.7 REPORT ORGANIZATION

This report consists of an assemblage of component study reports relating to specific EEM requirements. Each component study report was prepared using a concise and standard format to facilitate information summarization and readability. To the extent possible, references were

provided for detailed methodological or analytical procedures. Detailed results were generally attached at the back of the respective component study report.

Table 1-1 EA Predictions and Relevant EEM Components

EA Prediction [1]	Relevant EEM Component	Applicability to 2007 EEM Program
"The loss of fishing opportunity that would result from exclusion of fishing vessels from around offshore facilities is insignificant in comparison to the overall fishing area available."	See note in adjacent column.	Offshore commercial fisheries interests formally agreed not to seek compensation for 500 m safety zones around SOEP facilities. Thus, loss of fishing opportunity has never been a component of the SOEP EEM program, However, observers supplied by the fishing industry have been placed on various offshore vessels and platforms for extensive periods to increase fishing industry awareness of offshore gas operations and collect marine mammal and seabird data.
"Underwater noise from construction activities or from platform operations will not be above ambient noise levels in the Gully."	Underwater Noise and Marine Mammals	N/A – Noise associated with SOEP drilling and production activities has been shown to have minor contribution to the overall noise field and estimated to be well below the prolonged noise threshold level known to induce behavioral responses in marine mammals and sea turtles even at the monitoring station closest to the platform (i.e., 250m). No drilling or pile driving activities were carried out at SOEP platforms during 2007. Thus, underwater noise was not a component of the 2007 SOEP EEM program.
"Due to the localized occurrence of fouling, the overall impact on the communities in the vicinity of production structures is not expected to be significant."[2]	Benthic Habitat and Fish Density	Marine growth on platform jacket legs is dominated by the blue mussel, a species which is not commonly found in natural concentrations on Sable Island Bank. Also, refer to Table 1-2.

[1] Unless otherwise noted, the predictions apply only to routine construction and operations activities (i.e., not accidental events) as stated in the Executive Summary of the SOEP – EIS Vol. 3.
[2] As stated in Section 5.2.1.6 of the SOEP – EIS Vol. 3.

EA Prediction [1]	Relevant EEM Component	Applicability to 2007 EEM Program
"The discharge of cuttings contaminated with oil-based drilling muds will not lead to significant biological impacts on commercial fish or shellfish species."	Benthic Habitat and Fish Density Sediment Chemistry and Toxicity Fish Health	Oil-based drilling muds (e.g, diesel, LTMO) were never used for drilling SOEP wells. The vast majority of wells were drilled with a combination of water-based muds (WBM) and synthetic-based muds (SBM). There is no regulated discharge limit for WBM; the vast majority of SBM drill waste was skipped to shore for treatment and disposal (i.e., not ocean discharged). No toxic responses to sediment indicator species have been shown at the nearest sampling station to the platform (i.e. 250m) since the fall of 2003. Overall health of Atlantic cod using a variety of bioindicators, captured directly under the Thebaud platform in 2005 was similar to fish from a far-field reference site. Also refer to Table 1-2 and relevant chapters in this report.
"The potential for tainting of scallops (or other bottom-living organisms) by hydrocarbons beyond the fishing exclusion zone is low."	Scallop Taint and Body Burden	There are no scallop beds in the immediate vicinity of any SOEP platform. Testing to date on scallops from Sable Island Bank has shown tissue hydrocarbons to be biogenic in origin and taste panels have noted no off-flavours or odours associated with hydrocarbon taint. Thus, scallop taint and body burden were not a component of the 2007 EEM program.
"Impacts of effluent discharges (e.g. produced water) were considered to have no significant impacts on the marine environment."	Produced Water Chemistry and Toxicity Mussel Body Burden	The principal conclusion coming out of the recent International Conference on Produced Water held in St. Johns, Newfoundland was that produced water effects do not extend beyond the immediate mixing zone of the discharge, thus effects at the population level are highly unlikely. Hydrocarbons in mussels collected from platform jacket legs have been shown to be of biogenic origin (i.e., derived from phytoplankton). Also refer to Table 1-2 and relevant chapters in this report.

EA Prediction [1]	Relevant EEM Component	Applicability to 2007 EEM Program
"Air emissions were considered to have no significant impacts on the marine environment."	Air Quality on Sable Flare Plume measurements at Thebaud	Air quality monitoring in 2003/4 on Sable Island has shown that air shed contaminants are principally derived from the continental mainland. It remains unknown if whether emissions from SOEP offshore platforms can be detected on the island. Also refer to Table 1-2 and relevant chapters in this report.
"Lights [from work lights and gas flares] may attract migrant bird species, especially in fog and/or low cloud and rain."[3]	Seabird Vessel Transects	Observations over several years by full-time independent observers stationed on Thebaud, the only SOEP platform with a flare, have shown that seabirds are not particularly attracted to this platform under any weather condition including fog, and/or low cloud and rain. Occasionally, some land birds have taken refuge or stranded and died on the platform, presumably after flying off course from their normal migration routes, typically during a severe storm. Alma is the only unmanned SOEP platform that has attracted large numbers of seabirds, in particular black-back and herring gulls to the extent of becoming a safety issue for helicopter operations. Also, refer to Table 1-2 and relevant chapters in this report. Based on the limited seasonal dataset collected in 2007, there is insufficient information to state conclusively whether the SOEP platforms attract seabirds based on analysis of transect data. Interpretation of seabird observation data in the vicinity of the SOEP platforms is complicated by the nearby presence of Sable Island, which supports colonies of many bird species.

[3] As stated in Section 5.2.1.9 of the SOEP – EIS Vol. 3.

EA Prediction [1]	Relevant EEM Component	Applicability to 2007 EEM Program
"Because of the importance of Sable Island and the Gully, special attention will be paid to these areas in the development of monitoring."[4]	Air Quality on Sable Oiled seabird surveys on Sable Island Underwater Noise and Marine Mammals Sediment Chemistry and Toxicity	Concentrations of drill waste chemical indicators (Ba, TPH, Hg) in sediment sampled at least once annually at several stations near the Gully since 1997 have been found to be within the range of background or baseline levels and in many cases below the analytical detection limit. Noise from drilling and production activities at Venture, the platform closest to the Gully, has been shown to be a minor component of the background noise field even at the monitoring closest known to the platform (i.e., 250m). For additional discussion on noise see comment above under the 'underwater noise' component. SOEP has supported beached bird surveys on Sable Island by the resident biologist since 2000. The oiling rate, which is largely related to crude oil discharges (i.e., unrelated to SOEP offshore gas operations) was the lowest on record in 2007 and has been on a downward trend since 2000. Also, refer to Table 1-2 and relevant chapters in this report.

[4] As stated in Section 7.4 of the SOEP – EIS Vol. 3.

Table 1-2: Summary of Findings

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
Thebaud	Benthic & Fish Habitat	Fish Density (ROV videotape analysis)	– Examine video from scour survey – Estimate average fish density of commercial fish species. – Comparative analysis with previous observations where feasible. – [Note: If Atlantic cod, compare with 2006 observations]	– ROV survey video coverage of platform was limited due to mechanical difficulties and subsequent availability of the survey vessel (see Section 1.2 above) and restricted by poor visibility.	– Examine video from scour survey – Estimate average fish density of commercial fish species. – Comparative analysis with previous observations where feasible. – [Note: If Atlantic cod, compare with 2006 observations]
		Cuttings Pile Analysis (ROV videotape analysis)	– Examine video from scour survey at wellhead platform	– ROV survey video coverage of platform was limited due to mechanical difficulties and subsequent availability of the survey vessel (see Section 1.2 above) and restricted by poor visibility.	– Examine video from scour survey at wellhead platform to confirm previous finding that cuttings pile is no longer present.
	Sediment	Toxicity (amphipod only) at 250, 500, & 1000m from platform along predominant current axis	– No plans to collect/analyze further sediment samples; Explore opportunities with COOGER to acquire samples/data during DFO research survey planned for August 2007	– DFO collected and analyzed samples taken at 250, 500 & 1000 m from platform – As per results since 2003, no toxic responses (based on amphipod survival) at any nearfield sampling site	– Discontinue
		Chemistry (Barium, TPH, Strontium, Ammonium, and Sulphides) at 250, 500, & 1000m from platform along predominant current axis	– No plans to collect/ analyze further sediment samples; Explore opportunities with COOGER to acquire samples/ data during DFO research survey planned for August 2007	– DFO collected and analyzed samples taken at 250, 500 & 1000 m from platform – Barium concentration clearly above baseline only at 250m stn. – TPH and Hg concentrations were below analytical detection limits	– Discontinue

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
Thebaud	Shellfish	Taint and body burden for mussels (jacket scraping) {Reference samples for each species to be sourced from commercial seafood outlets}	– Analyze body burden only: consistent with previous programs. – Ensure jacket leg selected for scraping is situated 'downstream' of PW discharge caisson.	– Mussel scraping taken from jacket leg 'downstream' of PW discharge caisson. – Total aliphatic hydrocarbons (TAH) lower than most recent (2005) previous mussel body burden sample from platform; hydrocarbon profile indicates TAHs are biogenic in origin (produced from naturally occurring phytoplankton) and not from petroleum hydrocarbons.	– Analyze body burden only: consistent with previous programs. – Ensure jacket leg selected for scraping is situated 'downstream' of PW discharge caisson.
	Seabirds	Observations recorded on supply vessel transects from shorebase to platform (&between platforms) and along selected reference transects.	– Invite CWS offshore seabird specialist (or designate) to participate in transect survey(s)	– Based on the limited seasonal dataset collected in 2007, there is insufficient information to state conclusively whether the SOEP platforms attract seabirds based on analysis of transect data. Interpretation of seabird observation data in the vicinity of the SOEP platforms is complicated by the nearby presence of Sable Island, which supports colonies of many bird species. – Several predominantly land-based birds likely died of trauma caused by collisions with superstructures on the Thebaud platform (October 10) and on a DFO research vessel (October 7). – Application was made for a “Migratory Bird Damage Permit” to scare and kill Great Black-back Gulls and Herring Gulls on the Alma Platform.	– Continue supply vessel transect surveys. – If feasible, station seabird specialist aboard Standby vessel at Thebaud to make day/night observations of possible seabird mortality due to flare. – Continue to consult with CWS re Alma platform/bird interactions.
	Air Quality	Visual observations of the Flare Plume from platform.	– Record flare plume status (using EC supplied smoke chart) along with concurrent weather conditions on the platform.	– Flare plume was typically either clear or very light gray (#1 or #2 on NSDOEL Smoke Chart). There appeared to be a general improvement in flare plume colour towards the latter part of the year. – See Section 3 of this report.	– Record flare plume status (using EC supplied smoke chart) along with concurrent weather conditions on the platform.

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
Main Subsea Pipeline to shore	Fish Habitat	Fish Density (ROV videotape analysis along exposed sections of pipeline)	– Entire subsea pipeline from Thebaud to shore planned to be surveyed in 2007. – Examine pipeline inspection videos from same sections of the pipeline as analyzed in 2005 to enable comparison of snow crab densities. – Identify general sediment type from video imagery.	– ROV survey video coverage of platform was limited due to mechanical difficulties and subsequent availability of the survey vessel (see Section 1.2 above) and restricted by poor visibility.	– Entire subsea pipeline from Thebaud to shore planned to be surveyed in 2008. – Examine pipeline inspection videos from same sections of the pipeline as analyzed in 2005 to enable comparison of snow crab densities. – Identify general sediment type from video imagery.
Gully MPA Boundary	Sediment	Toxicity (amphipod only)	– No plans to collect/analyze further sediment samples; Explore opportunities with COOGER to acquire samples/data during DFO research survey planned for August 2007.	– DFO collected and analyzed samples taken at 4 Gully MPA reference sites. – No toxic responses (based on amphipod survival) were observed.	– Discontinue
		Chemistry (Barium, TPH, Strontium, Ammonium, and Sulphides)	– No plans to collect/analyze further sediment samples; Explore opportunities with COOGER to acquire samples/data during DFO research survey planned for August 2007.	– DFO collected and analyzed samples taken at 4 Gully MPA reference sites. – Barium concentrations were within range of background or baseline levels. – TPH and Hg concentrations were below analytical detection limits.	– Discontinue
Sable Island	Air Quality	Analysis of continuous monitoring data which includes nitrogen oxides, sulphur dioxide, particulate matter (total and fine) polyaromatic hydrocarbons, and volatile organic compounds.	– Summarize data analyzed in conjunction with Environment Canada [EC Contact: Michael Hingston]. – Compare air quality measurements on Sable Island with systematic flare plume measurements at Thebaud to assess potential interactions.	- Awaiting data from EC for further analysis and reporting (M. Hingston, EC. pers.comm.) Preliminary analysis to date by EC (see poster by Waugh et al. in Section 3 of this report) indicates that all pollutant (i.e., SO2, NOx) concentrations measured on Sable Island are at much lower levels than in Halifax with the exception of PM2.5 which is believed to be high on Sable Island due to sea-salt aerosols.	– Summarize data analyzed in conjunction with Environment Canada [EC Contact: Michael Hingston]. – Compare air quality measurements on Sable Island with systematic flare plume measurements at Thebaud to assess potential interactions.

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
	Seabirds	Monthly Oiled Bird Surveys (summarization of monthly surveys-collected over a 2-3 day period - and inclusion in annual EEM report).	– Coordinate with Zoe Lucas, Independent biologist and resident of Sable Island.	– The oiling rate (2.3%) in 2007 was the lowest on record since 2000. – Of the three samples collected and analyzed, none contained light or mid-range distillate fuels or condensates that would be typical of oils produced on SOEP facilities.	– Coordinate with Zoe Lucas, independent biologist and resident of Sable Island. – Use CWS methodology for determining oiling rate.
Thebaud	Fish Health	MFO, gross pathology and histopathology for fish (at platform).	– Summarize fish health indices obtained from 2007 DFO bottom trawl groundfish survey for selected sampling station(s) on Sable Island Bank. – Delineate and characterize thermal plume from compression platform. – Investigate possible attraction of fish to thermal plume.	- DFO could not provide fish health data since there were no bottom trawl sampling tows in close proximity to any of the SOEP offshore platforms in 2007 (M. Showell, DFO, pers.comm.). - Verification of persistence and spatial distribution of excess temperature above ambient seawater resulting from discharge of seawater cooling medium from the Thebaud Compression Platform could not be determined due to the loss of the near-field thermistor moorings.	- Collaborate with DFO COOGER to characterize PW plume using chemical and microbial tracers.

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
Thebaud, Venture, South Venture and Alma	Produced Water	Toxicity analysis as per OWTG (2002)	– OWTG expectation – Continue use of same bioassay species [Confirmed with Ken Doe, EC]. – Discuss possible synergies re PW sampling/analysis with Ken Lee, DFO.	- PW at all SOEP platform locations can be interpreted as being toxic based on 2007 bioassay test LC50 results using two fish species - three-spined stickleback (6.25 -33%) and Atlantic cod (3.24-5.29 %), Microtox (0.53-13%), and sea urchin fertilization (0.11-6.11%). - However, the relatively low PW discharge rate compared with other east coast offshore facilities combined with the higher tidal energy on Sable Island compared to the Grand Banks means that PW constituents are likely to be diluted to background levels within a few metres of the mouth of the discharge caisson. - The observed mortality levels were possibly caused by polyaromatic hydrocarbons (K. Doe, and P. Jackman, EC, pers. comm.) even though measured TPH levels were below the regulatory limits and phenol concentrations were below concentrations known to be lethal to fish (L. Burridge, DFO, pers.comm.). High salinity levels - up to 210 ppt undoubtedly contributed to the toxicity of some samples. -There was no difference in activity of the EROD enzyme between treated and untreated cod suggesting that exposure to the 4% level of PW does not result in activation of this enzyme system (L. Burridge, DFO, pers.comm.).	– OWTG expectation – Continue use of same bioassay species [Confirmed with Ken Doe, EC]

Location	Environmental Component	Type of Monitoring/Analysis	Plan for 2007	2007 Findings	Plan for 2008
Thebaud, Venture, South Venture and Alma	Produced Water	Chemistry analysis as per OWTG (2002)	– OWTG expectation	– Total Petroleum Hydrocarbon concentrations for all samples/platform locations were below the OWTG limits of 30 mg/L (30 days) and 60 mg/L (24-hour) for oil in water. – Barium, boron, iron, strontium, and ammonia levels at Venture are the highest observed of the platform sites monitored in 2006 and 2007. The concentrations of the same elements at South Venture and Thebaud show an increasing trend from 2005 to 2007 sample times. At Alma, values are stable between the two years and are much lower than for the other platforms.	– OWTG expectation

Figure 1-1: EEM Team

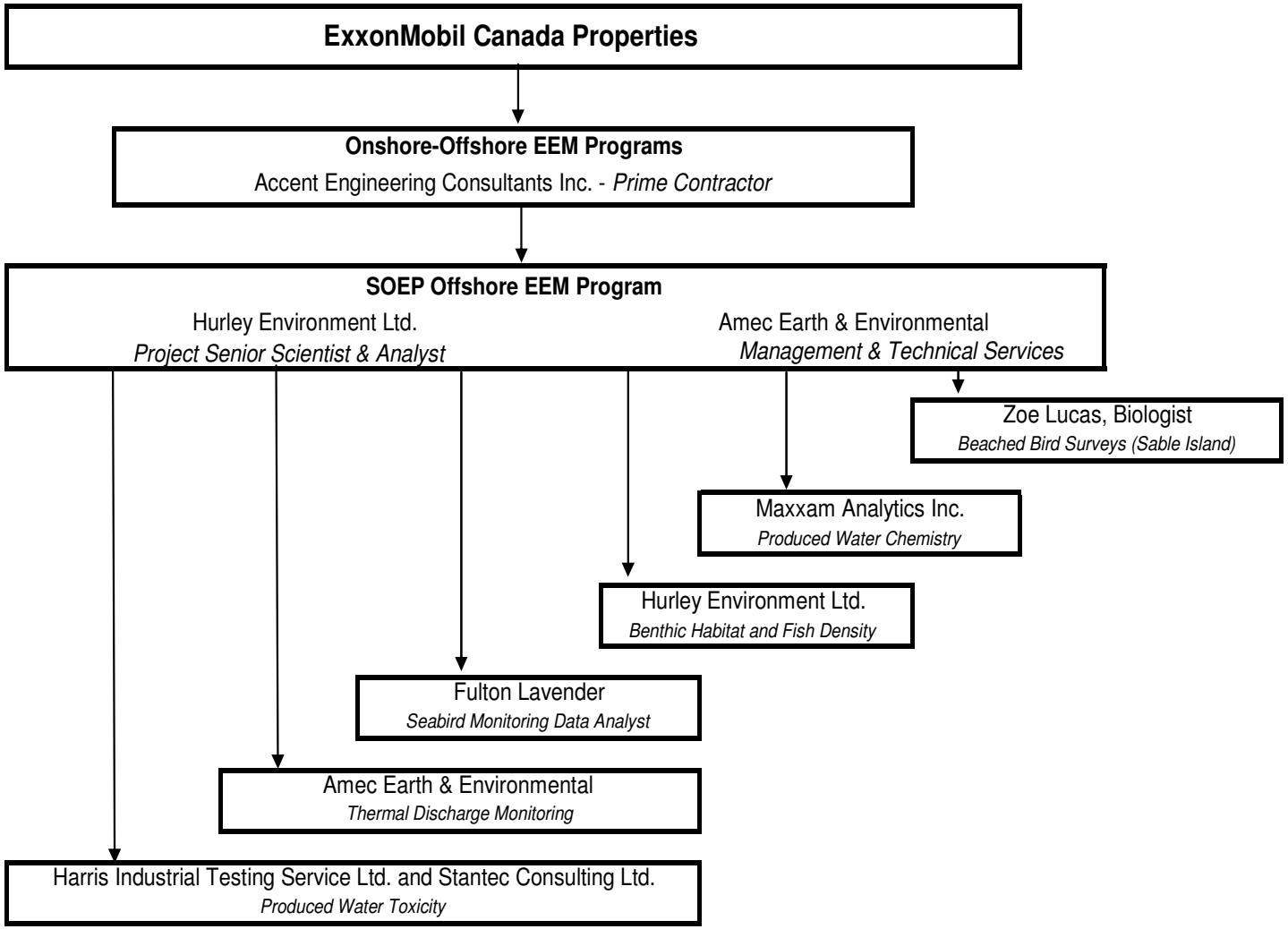


Figure 1-2 SOEP Offshore Facilities and Pipelines Reference Map

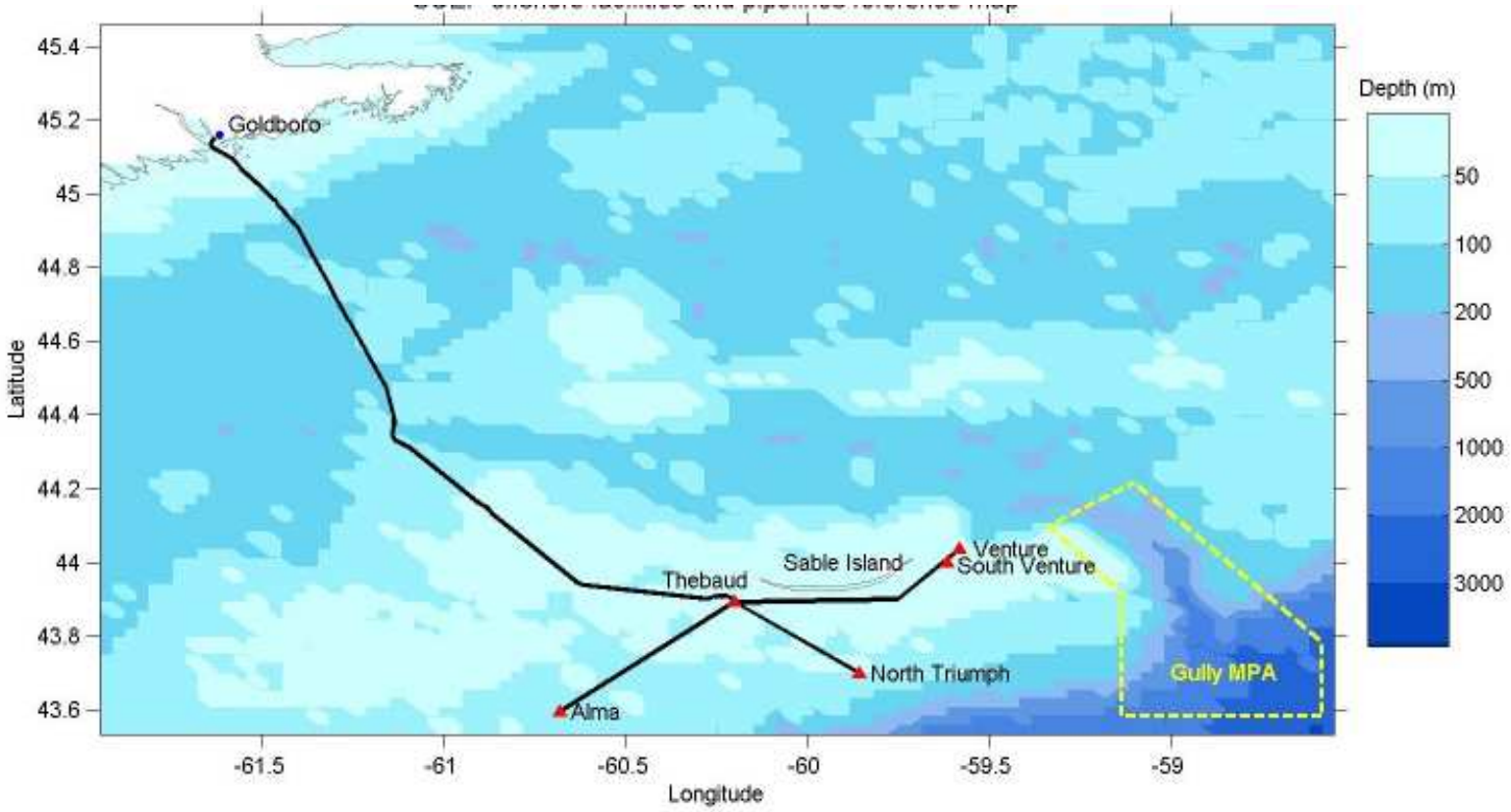


Figure 1-3 Sable Island

SABLE ISLAND

Location
160 km SE of Canso, NS

Dimensions
42 km x 1.5 km (3400 ha)

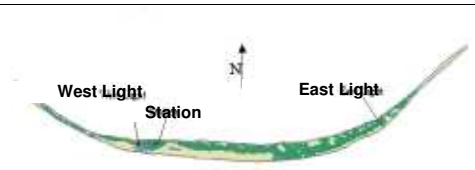
Administration
1 Migration bird sanctuary administered by Canadian Wildlife Service
2 Access regulated by Canadian Coast Guard (Sable Island regulations)

Physiography
3 Beaches, sand dunes, inland fields of grass and heath, and freshwater ponds
4 Constantly re-shaped by winds, currents, waves and tides

Climate
5 Temperate oceanic, milder than mainland
6 -5 to +5°C in winter, peak at 25°C in summer
7 Average wind ~ 20 knots, mainly NW
8 Windiest place, least sunshine, most fog in NS

Station
1. Collection of weather data and atmospheric research
2. Maintenance of aids to navigation
3. Scientific research
4. Support services for offshore energy industry

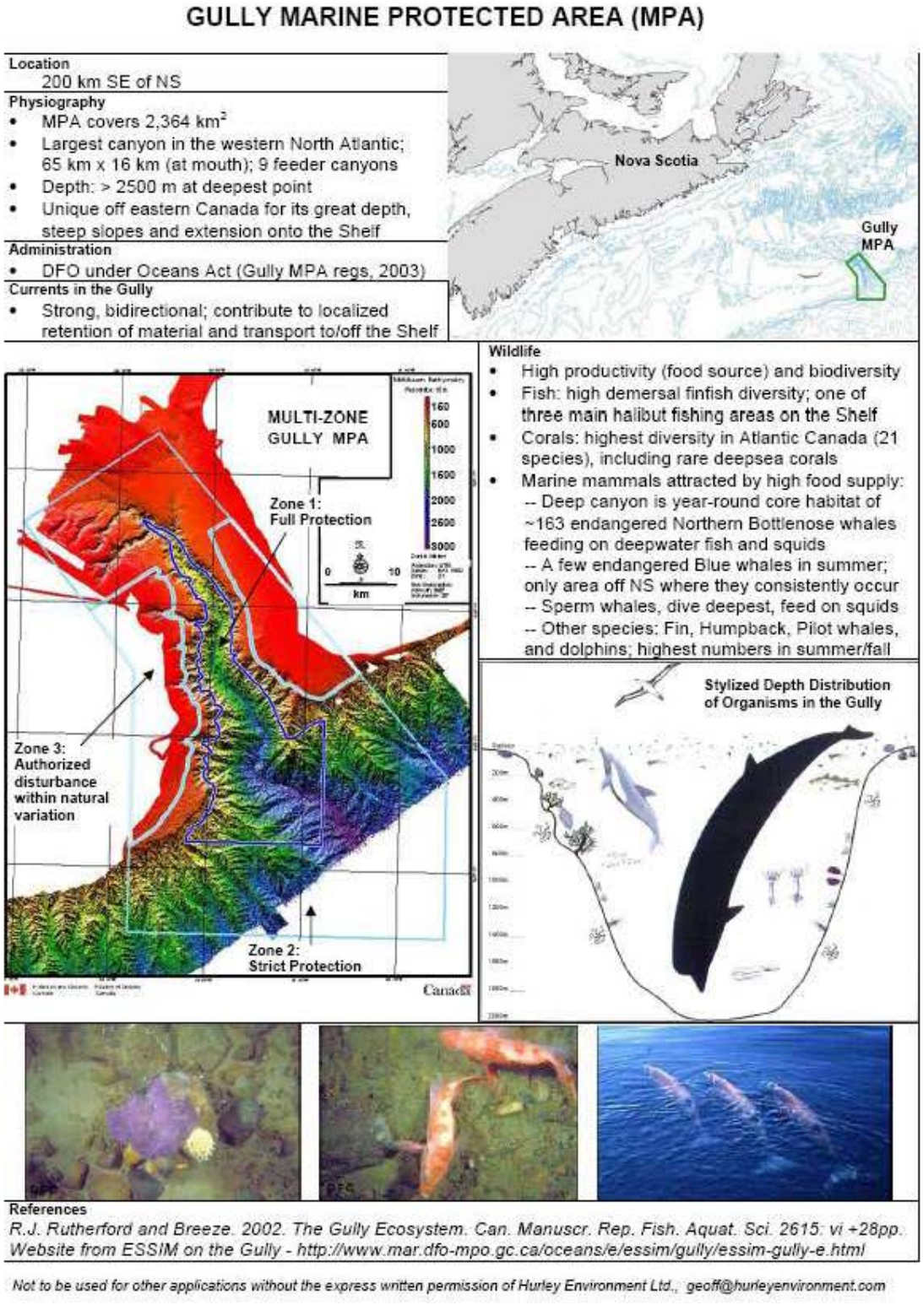
Vegetation
5. 40% of land surface vegetated mainly by sandwort, marram-forb, marram-sparse grassland, marram-fescue, shrub heath, cranberry heath, pond edge herbaceous plant communities
6. Only 1 tree (small pine) surviving from a planting
7. 175 plant species, including 6 species rare in NS



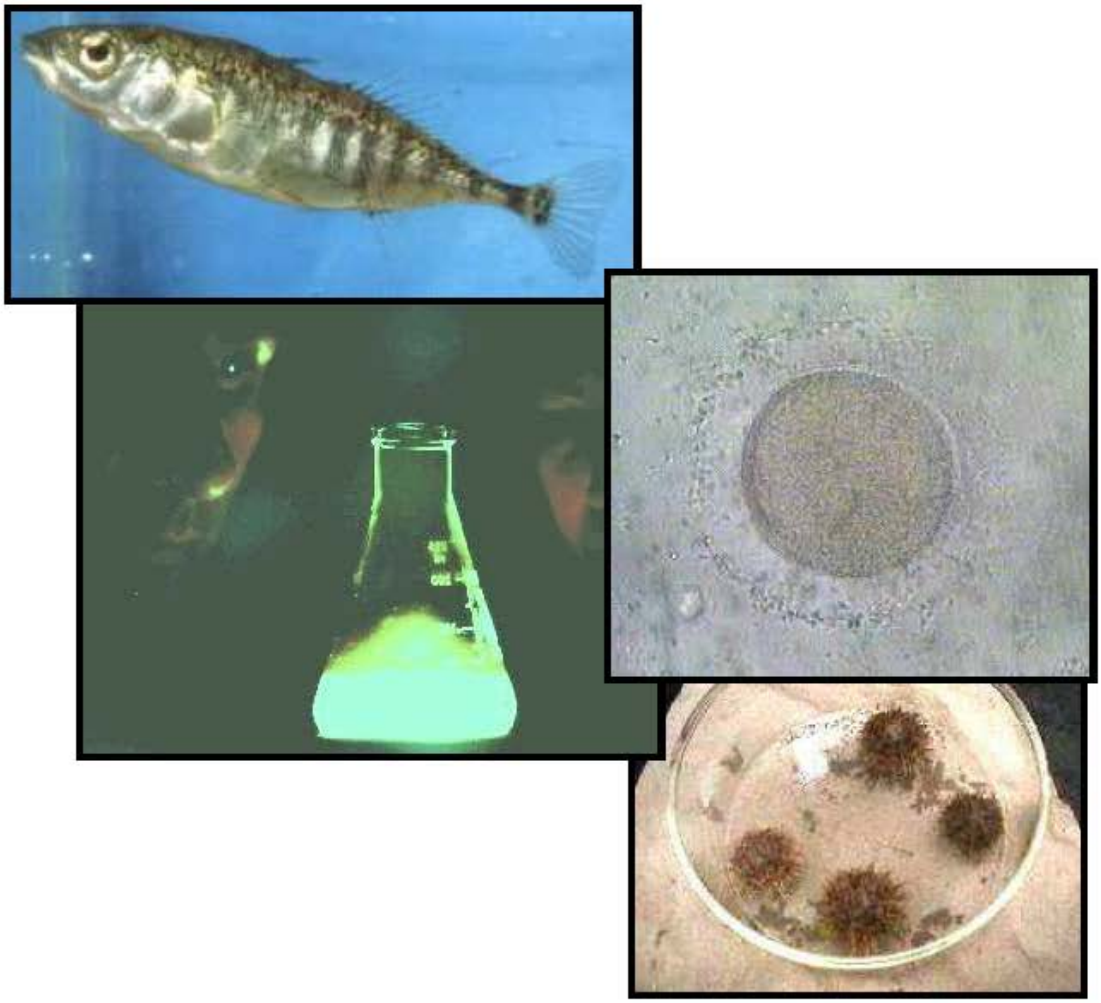
Wildlife
9 Birds -- 330 species sighted including breeding birds, migrating birds, and waterfowl
-- 14 nesting species: Ipswich Savannah sparrow (special concern) nesting exclusively on the island (early June-early August); Common and Arctic terns with very small numbers of the endangered Roseate tern (May-July); Leach's Storm petrel; gulls; shorebirds and ducks
10 Seals -- Grey seals (largest breeding population in the world, late December to early February) and Harbour seals (late May to early June), both year-round residents
-- Several hundred juvenile Harp and Hooded seals and one or two Ringed seals come ashore for a few hours or days during winter and early spring
11 Wild horses: 200-350 animals, descendants of domestic horses brought to the island during the late 1700s
12 Invertebrates: 600 species including 3 moths, 1 beetle, 1 nematode, 1 freshwater sponge that are endemic

References
Breeze, H., D.G. Fenton, R.J. Rutherford and M.A. Silva. 2002. The Scotian Shelf: An Ecological Overview for Ocean Planning. Canadian Technical Report of Fisheries and Aquatic Sciences 2393.
Sable Island Green Horse Society Website - http://www.greenhorsesociety.com

Figure 1-4 Gully Marine Protected Area (MPA)



2.0 PRODUCED WATER CHEMISTRY AND TOXICITY



2.1 BACKGROUND

The Offshore Waste Treatment Guidelines (OWTG) [7] specify that the composition and toxicity of produced water from each production installation be analyzed and the results submitted to the Chief Conservation Officer on an approved schedule.

Analysis of produced water (PW) composition is to be carried out twice yearly for the following parameters: aluminum, antimony, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, magnesium, molybdenum, nickel, phosphorus, selenium, silver, strontium, thorium, tin, uranium, vanadium, zinc, mercury, ammonia nitrogen, sulphur, and Total Petroleum Hydrocarbons.

Annual aquatic toxicity testing is to include the Sea Urchin Fertilization test and at least two other bioassay tests (e.g., early life stage of fish, bacteria, algal species, etc.) satisfactory to the Chief Conservation Officer. The tests should be conducted contemporaneously with one of the twice-yearly chemical characterization tests. Besides the Sea Urchin Fertilization test, Dr. Ken Doe of the Environment Canada Toxicology Laboratory in Moncton, NB has also recommended the Threespine Stickleback test as an indicator of fish toxicity and the Microtox test as an indicator of toxicity at the cellular level.

For 2007, PW samples were collected from the Thebaud production platform and the satellite platforms: Alma, South Venture and Venture. PW from North Triumph platform was routed to the Thebaud platform for treatment and discharge. The PW samples underwent chemical analysis, and toxicity analysis using Microtox, Sea Urchin Fertilization, and Threespine Stickleback tests.

A PW sample was also gathered by Department of Fisheries and Oceans Canada (DFO) at Thebaud on August 13, 2007. The sample was tested for acute fish toxicity using Atlantic cod, and for EROD (ethoxyresorufin-O-deethylase) activity, which is an indicator of exposure to PAHs. The lethality tests were run onboard Hudson (Aug. 14-15, 2007), and at Saint Andrews Biological Station (SABS) (Oct 2007).

Background on Threespine Stickleback test

The acute lethality test with seawater-acclimated Threespine Stickleback *(Gastreostreus acculeatus)* (TSS) has been used by Environment Canada and several Canadian laboratories concerned with evaluating the potential toxic effects of effluents discharged into estuarine or marine environments [4].

Background on Microtox test

The basic technology of the Microtox Test System is based upon the use of luminescent bacteria, specifically the strain *Vibrio fisheri* NRRL B-11177, to measure toxicity from environmental samples. When properly grown, luminescent bacteria produce light as a byproduct of their cellular respiration. Cell respiration is fundamental to cellular metabolism and all associated life processes. Bacterial bioluminescence is tied directly to cell respiration, and any inhibition of cellular activity (toxicity) results in a decreased rate of respiration and a corresponding decrease in the rate of luminescence. The more toxic the sample, the greater the percent light loss from the test suspension of luminescent bacteria. Bacterial bioluminescence has proved to be a convenient measure of cellular metabolism

and consequently, a reliable sensor for measuring the presence of toxic chemicals in aquatic samples. Strain 11177 was originally chosen for the acute and chronic tests because it displayed a high sensitivity to a broad range of chemicals.

Background on Sea Urchin Fertilization test

The Sea Urchin Fertilization test is a common marine bioassay used for routine environmental monitoring, investigative evaluations, and/or regulatory testing of effluents and sediment pore waters.

2.2 GOAL

To examine the potential aquatic toxicity of produced water from the Thebaud and the satellite platforms using indicator species and to perform chemical characterization tests as per the OWTG [7].

2.3 OBJECTIVES

- Analyze produced water collected at the Thebaud and the satellite platform locations for aquatic LC50 toxicity testing and chemical composition.
- Compare results with monitoring data at the same locations.
- Utilize data in developing a strategy for future monitoring.

2.4 2007 SAMPLING

Note: Produced water samples, which were supplied by ExxonMobil, were collected and analyzed following procedures supplied by Maxxam Analytics Inc. as outlined in Attachment 2-1.

Collection Date(s):	Thebaud: Jan. 11/07 Aug. 13/07 Nov. 26/07 Dec. 9/07	Venture: Oct. 7/07 Nov. 20/07	S. Venture: Dec. 15/07	Alma: Jan. 19/08
Platform:	Thebaud, Venture, South Venture, Alma			
Type of Sample::	Produced water			
Test Sample Locations:	Taken directly from the discharge caisson (prior to going overboard).			
Reference Sample Locations:	None			

Sample Preparation:	Sample Bottles were provided by Maxxam Analytics Ltd. as follows (see Attachment 2-1): • Thorium – 50ml plastic with nitric acid preservative • BTEX/TPH – 3 x 40ml amber vials preserved with copper sulphate and 2 x 250ml glass bottles • Metals (dilute and shoot) - 50ml plastic with nitric acid preservative • Metals (seawater) – 2x500ml plastic acid rinsed bottles • Mercury – 100 ml amber glass preserved with potassium dichromate in 17% nitric acid • Ammonia – 100ml amber glass with sulphuric acid preservative • Total Phosphorous – 100 ml amber glass with sulphuric acid preservative • Nitrogen – 100ml amber glass with sulphuric acid preservative Amec E&E supplied an HDPE container for the Harris Industrial Testing Service Ltd. sample.
Sampling QA/QC:	• Each bottle (supplied by the Maxxam laboratory to ensure the integrity of the samples) was filled to the top but not to overflowing (i.e. no headspace) to ensure no loss of preservative and kept cold until shipping to the lab (not frozen). • Samples were stored in sealed cooler with a frozen gel pack to keep samples cool. They were shipped to shore by helicopter following sample collection. The samples were then delivered to Maxxam Analytics Inc. for chemical testing. • For toxicity testing, the samples were placed in the HDPE container on the Thebaud Platform. The samples were shipped to shore by helicopter following sample collection. They were collected by Harris Industrial Testing from the heliport. Subsamples were extracted from each, and then shipped to the subcontractors for toxicity testing.

The following describes the sampling details for the sample taken by DFO at Thebaud platform:

Contractor: Dr. Ken Lee & Dr. Les Burridge,
Fisheries and Oceans Canada

Collection Date(s):	Aug. 13, 2007
Platform:	Hudson
Type of Sample::	Produced water
Test Sample Locations:	Thebaud platform
Reference Sample Locations:	None
Sample Preparation:	Bulk samples in acid washed nalgene jerry cans (10 L). Containers were sealed on arrival on board Hudson and stored at ~4℃.
Sampling QA/QC:	• Each container (supplied by BIO staff) was filled to the top but not to overflowing (i.e. no headspace) to ensure no loss of sample and minimal exposure to air and kept cold until shipping to the lab (not frozen). • Samples were stored in cooler on board ship and were transferred to St. Andrews Biological Station.

Atlantic cod for the DFO fish toxicity tests were obtained from the St. Andrews Biological Station cod genome project. The cod ranged in length from 8-12.2 cm (mean = 9.9 cm) for the Hudson test – no weights collected aboard ship. In lab studies the fish were 11.6 – 18.1 cm (mean =14.4) and weighed from 12 to 58 g (mean=27g)

In addition to lethality tests an experiment was conducted on board the Hudson in which juvenile cod were exposed to a sub-lethal concentration of PW from the Thebaud site. Cod were held in 4% PW for up to 72 hours. Periodically (T=6, 12, 24, 48 and 72 h) 5 fish were sacrificed and tissues collected, flash frozen in liquid nitrogen and held for biochemical analysis. The exposure solutions were changed daily and dissolved oxygen concentrations were maintained at >75% throughout the exposure. Gills, muscle, liver, and blood (plasma) was collected from these fish. All liver tissues have been analysed for ethoxyresorufin-O-deethylase (EROD) activity. Activity of this enzyme is considered an indicator of exposure to PAHs.

2.5 ANALYSES

Contractors:

1. Harris Industrial Testing Service Ltd. (Threespine Stickleback for all platforms)
2. AquaTox Testing & Consulting Inc. (Microtox and Sea Urchin Fertilization for all platforms)
3. Stantec (Microtox and Sea Urchin Fertilization for Thebaud platform only)
4. Maxxam Analytics Inc. (Chemical Parameters for all platforms)
5. Department of Fisheries and Oceans (Acute lethality test and EROD induction on cod using Thebaud PW sample from Aug. 13/07)

2.5.1 Parameters Analyzed

Parameters	Analysis Method
Cellular metabolism	Microtox Test [3]
Egg fertilization	Sea Urchin Fertilization Test [1]
Acute fish toxicity	Threespine Stickleback (TSS) [4]
BTEX/TPH (BTEX =Benzene, toluene, ethylbenzene, xylenes TPH = total petroleum hydrocarbons)	VPH (Volatile petroleum hydrocarbons) by Combi-Pal and TEH (total extractable hydrocarbons) by Gas chromatography - flame ionization detector (GC-FID)
Chemical Characterization	Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
Sulphur and Magnesium	Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)
Mercury	Cold Vapour Atomic Absorption
Ammonia-N	Colorimetric Test
Phosphorous	Colorimetric Test
Nitrogen	Total Kjeldahl Nitrogen Test
Acute fish toxicity of PW to Atlantic cod[5]	Juvenile cod (*Gadus morhua*). 24 hr static exposure in 2 L glass jars on board Hudson. Aerated. Mortality recorded at 1, 3, 6, 12 and 24 hr. Juvenile cod (*Gadus morhua*). 24 hr static exposure 25 L glass aquaria at St. Andrews Biological Station Aerated. Mortality recorded at 1, 3, 6, 12 and 24 hr. LC50 determined.
EROD induction in Atlantic cod livers[6]	Juvenile cod (*Gadus morhua*) exposued for 72 hr to 4% Thebaud PW. Daily water changes, water aerated. Fish sampled periodically, sacrificed, livers removed and stored at -80°C until analysed for EROD activity in livers.

[5] Atlantic cod for the DFO fish toxicity tests were obtained from the St. Andrews Biological Station cod genome project. The cod ranged in length from 8-12.2 cm (mean = 9.9 cm) for the Hudson test – no weights collected aboard ship. With respect to the SABS test, the fish were 11.6 – 18.1 cm (mean =14.4) and weighed from 12 to 58 g (mean=27g)

[6] Gills, muscle, and blood (plasma) was also collected from these fish. These tissue samples are being held at -80 C; however, there are no plans to analyse these samples in the near future (L. Burridge, [1]).

2.5.2 QA/QC

The QA/QC procedures for the each laboratory involved with the various testing included the use of duplicates, method blanks, surrogates, spikes and certified reference materials where applicable. For further details on QA/QC procedures refer to Attachment 2-1.

2.6 RESULTS

Table 2-1 summarizes the results of the chemical analysis of the produced water samples taken at Thebaud, Venture, South Venture, and Alma platforms. The Total Petroleum Hydrocarbon (TPH) concentrations for the five samples ranged from Not Detected (<5 mg/L) to 14 mg/L.

Table 2-2 summarizes the results of toxicity testing of the most recent samples of produced water collected from the three platforms.

Detailed laboratory reports are included as Attachments 2-3 (Fish Toxicity), 2-4 (Microtox), and 2-5 (Sea Urchin Fertilization).

LC50 for the DFO toxicity tests was determined using Toxstats software. The Spearman-Karber method was deemed the most appropriate calculation. Three LC50 estimates were: 5.29%, 4.12% and 3.24% Thebaud PW mixed with ambient salt water. The average LC50 is 4.22% (SD=1.02). No control fish died. The results are summarized in Table 2-3 to Table 2-5.

DFO analyzed the PW for phenols in the water used to expose the cod for the 72 hours. The results of these tests are shown in Table 2-6. None of the compounds are present in concentrations that are reported to be lethal to fish. The bulk of the published work with cod and alkylphenols deals with sub-lethal responses.

2.7 SUMMARY AND CONCLUSIONS

- Figure 2-1 is a plot of the PW chemical parameters (barium, boron, iron, strontium, ammonia, TPH) with the highest observed concentration values from 2005 to 2007 data. Barium, boron, iron, strontium, and ammonia levels at Venture are the highest observed of the platform sites monitored in 2006 and 2007. The concentrations of the same elements at South Venture and Thebaud show an increasing trend from 2005 to 2007 sample times. At Alma, values are stable between the two years and are much lower than for the other platforms.

- Total Petroleum Hydrocarbon concentrations for all samples/platform locations were below the OWTG limits [7] of 30 mg/L (30 days) and 60 mg/L (24-hour) for oil in water.

- Comparison of the 2007 toxicity results with earlier data are plotted in Figure 2-2. There appears to be a slightly increasing trend in toxicity data from 2005 to 2007 for TSS and Sea Urchin at Venture and Thebaud. Toxicity values at South Venture and Alma approximate those at Thebaud and Venture for 2006 and 2007. Microtox values at Thebaud remain relatively stable from 2005-2007, whereas the 2007 value at Venture indicates a decrease in toxicity from 2006. No historic microtox data is available at Alma and South Venture to enable comparisons with 2007 data.

- Although there is no pass/fail concentration criterion stipulated by the OWTG (2002) [7] for TSS, the 2007 results can be interpreted as being toxic based on regulations for other industries, such as pulp and paper, which consider any effluent with greater than 50% mortality at 100% concentration to be a failure [6]. Dr. J. Sprague of the University of Guelph [8], a recognized expert in fish toxicology, classifies as "practically non-toxic" any value above 10,000 mg/L or 1 percent for fish.

- There are no pass/fail criteria for the Microtox and Sea Urchin Fertilization tests. The results for these tests at all platform locations fall within the range of results for most produced water samples that have been tested in Environment Canada's Toxicology Laboratory (Moncton, NB). The observed mortality levels were possibly caused by polyaromatic hydrocarbons (K. Doe [6], and P. Jackman [5], Environment Canada, pers. comm.) even though measured TPH levels (Section 2.6) were below the regulatory limits and phenol concentrations (Table 2-6) were below concentrations known to be lethal to fish (L. Burridge, DFO, pers.comm.). High salinity levels - up to 210 ppt (Attachment 2-3) undoubtedly contributed to the toxicity of some samples.

- There was no difference in activity of the EROD enzyme between treated and untreated cod suggesting that exposure to the 4% level of PW does not result in activation of this enzyme system (L. Burridge, [1]).

- Further, the discharge rates of PW at SOEP platforms are considerably less than at other existing or proposed East Coast offshore facilities. To illustrate, the 2007 average discharge rate for SOEP platforms was .007m3/sec compared with discharges at Hibernia (.22m3/sec), the past CoPan project (.21m3/sec), or the recently-approved Deep Panuke project (.07m3/sec). The lower discharge rate combined with the higher tidal energy on Sable Island compared to the Grand Banks means that PW constituents will likely to be diluted to background levels within a few metres of the mouth of the discharge caisson.

2.8 REFERENCES

[1] Burridge, Les, 2008. DFO, pers. Comm.

[2] Environment Canada, Dec. 1992 with Nov 1997 amendments. Biological Test Method: Fertilization Assay using Echinoids (Sea Urchins and Sand Dollars) EPS/1/RM/27. Environmental Protection, Ottawa, ON. 97 pp.

[3] Environment Canada, 1992. Biological Test Method: Toxicity Test using Luminescent Bacteria (*Photobacterium phosphoreum*), EPS/1/RM/24 Environmental Protection, Ottawa, ON. 83 pp.

[4] Environment Canada, 1990. Biological Test Method: Acute Lethality Test using Threespine Stickleback. EPS/1/RM/10 Environmental Protection, Ottawa, ON

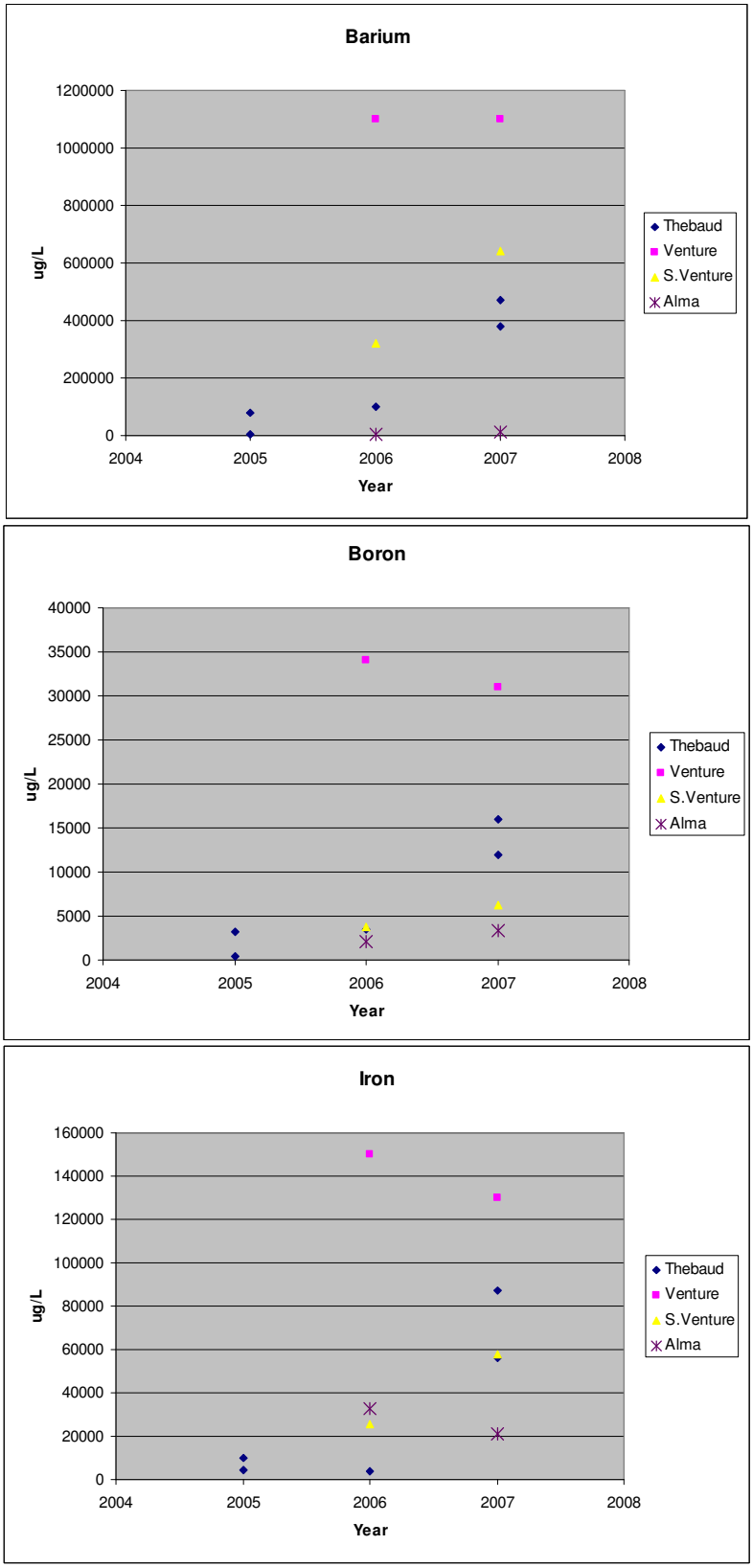
[5] Environment Canada, Jackman, Paula, 2005. Email Communication.

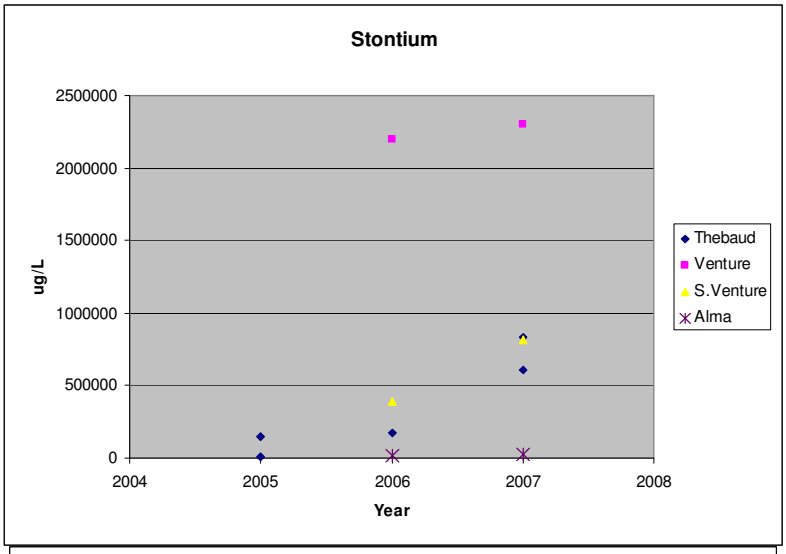
[6] Harris, Gary, 2007. In conversation with Ken Doe of Environment Canada

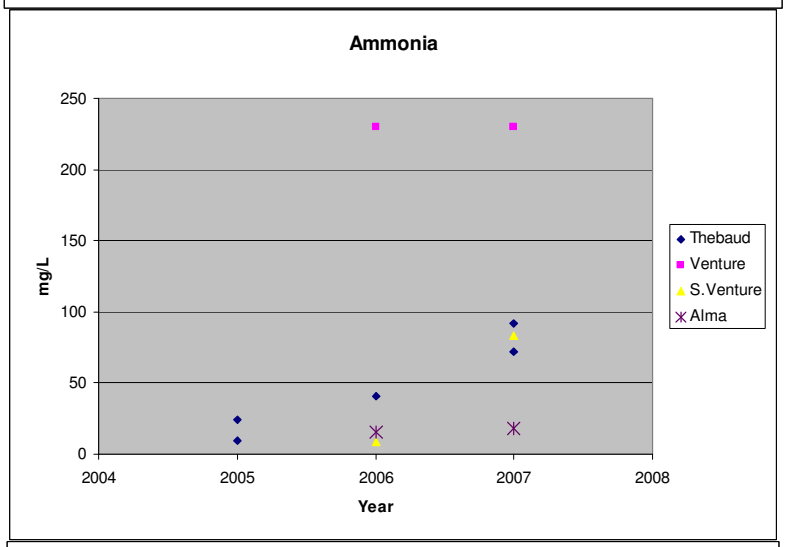
[7] National Energy Board, Canada-Newfoundland Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, August 2002. Offshore Waste Treatment Guidelines.

[8] Sprague, J.B., 1973. The ABC's of Pollutant Bioassay Using Fish, Biological Methods for the Assessment of Water Quality, ASTM STP 528, American Society for Testing and Materials, pp 6 – 30.

Figure 2-1 Comparison of historic PW chemistry samples.




Stontium
2500000
2000000
1500000
1000000
500000
0
ug/L
2004
2005
2006
2007
2008
Year
Thebaud
Venture
S.Venture
Alma


Ammonia
250
200
150
100
50
0
mg/L
2004
2005
2006
2007
2008
Year
Thebaud
Venture
S.Venture
Alma

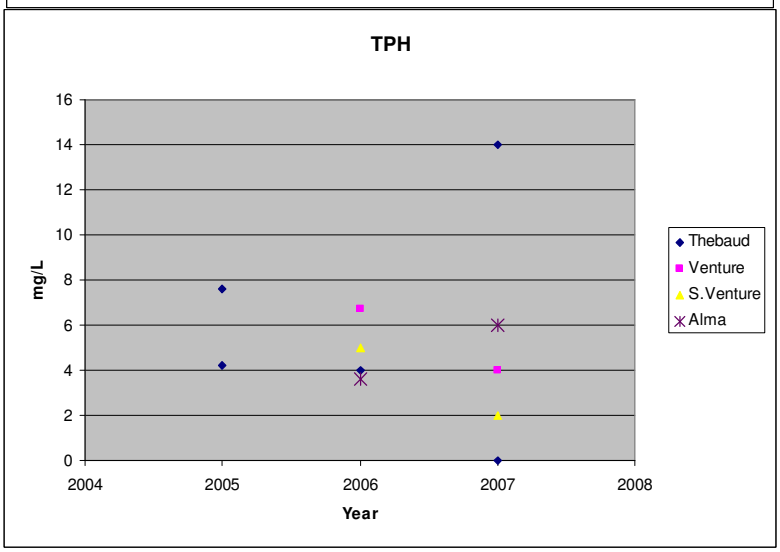

TPH
16
14
12
10
8
6
4
2
0
mg/L
2004
2005
2006
2007
2008
Year
Thebaud
Venture
S.Venture
Alma

Figure 2-2 Comparison of toxicities at SOEP platforms.

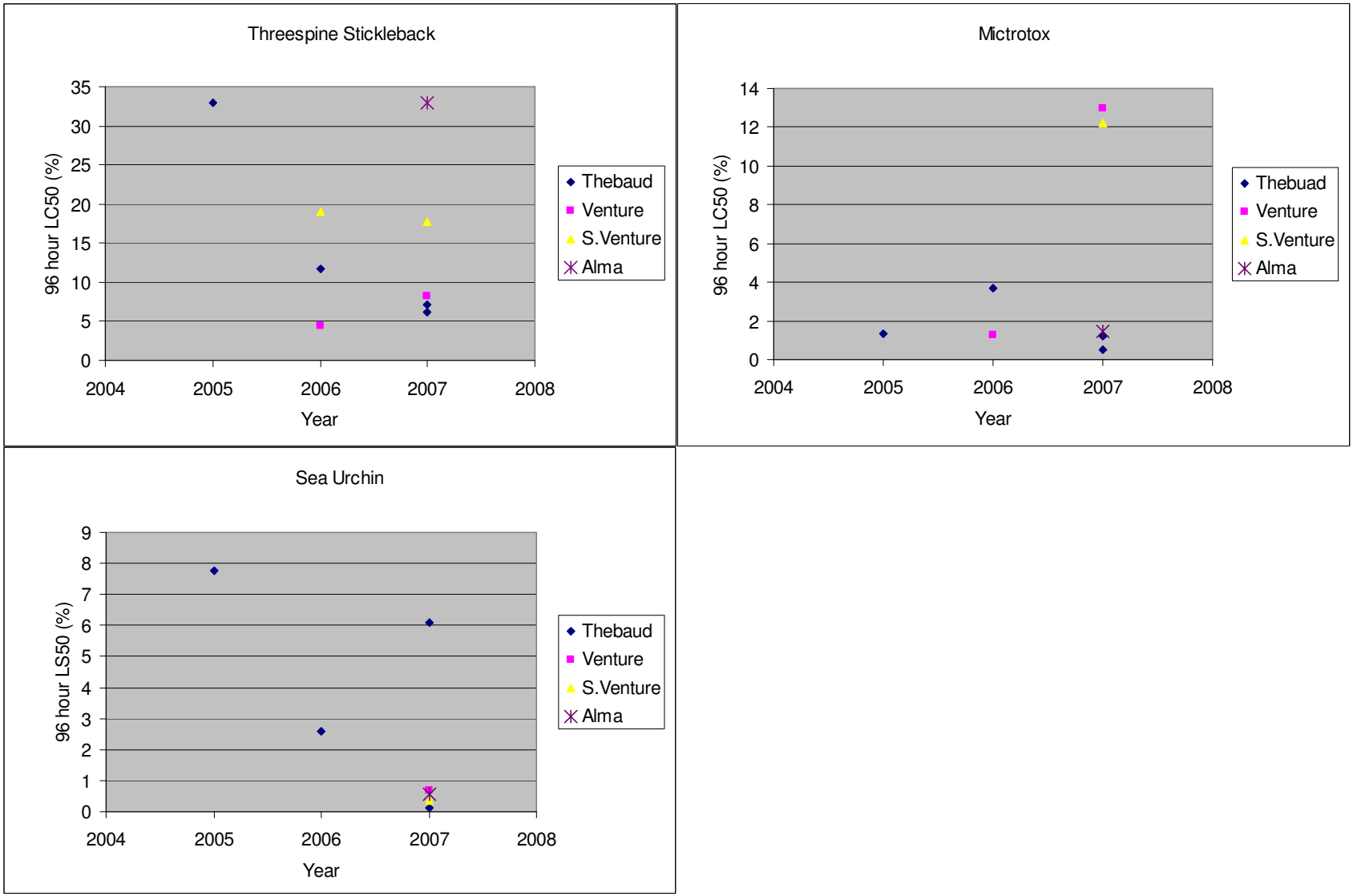


Table 2-1 Chemical Composition of Produced Water[7]

Sampling Date			20 Nov.'07	26 Nov '07	09 Dec '07	16 Dec '07	21 Jan'08
Chemical Parameters as per OWTG (2002)	**Units**	**Reportable Detectability Limits**	**VENTURE**	**THEBAUD**	**THEBAUD**	**SOUTH VENTURE**	**ALMA**
Thorium	ug/L	200	<200	<100	<100	<50	<1
Mercury	ug/L	0.04	<0.04	<0.01	**0.01**	<0.01	**0.02**
Aluminum	ug/L	10000	<10,000	<1000	<1000	<1000	<100
Antimony	ug/L	2000	<2000	<200	<200	<200	<20
Arsenic	ug/L	2000	**0.5**	**0.1**	**0.3**	**0.2**	<0.1
Barium	ug/L	5000	**1,100,000**	**380,000**	**470,000**	**640,000**	**11,000**
Boron	ug/L	5000	**31,000**	**12,000**	**16,000**	**6200**	**3300**
Cadmium	ug/L	0.1	**0.8**	**0.2**	**0.2**	<0.1	<0.1
Chromium	ug/L	0.5	**1.5**	**1.0**	**7.0**	**0.7**	**2.1**
Cobalt	ug/L	0.1	**0.9**	**0.4**	**0.3**	**0.4**	**2.7**
Copper	ug/L	0.1	**1.4**	**1.4**	**0.7**	**0.5**	**0.6**
Iron	ug/L	5000	**130,000**	**56,000**	**87,000**	**58,000**	**21,000**
Manganese	ug/L	200	**29,000**	**5400**	**7700**	**5300**	**206**
Lead	ug/L	500	**34.2**	**8.6**	**6.0**	**1.3**	**0.5**
Molybdenum	ug/L	2000	<2000	<200	<200	<200	<20
Nickel	ug/L	0.5	**2.5**	**5.9**	**8.2**	**6.3**	**23.3**
Selenium	ug/L	5000	<5000	<500	<500	<500	<50
Strontium	ug/L	5000	**2,300,000**	**610,000**	**830,000**	**820,000**	**30,000**
Sulphur	mg/L	5	**150**	--	--	**48**	**1.4**
Tin	ug/L	2000	<2000	<200	<200	<200	<20
Uranium	ug/L	100	<100	<10	<10	<10	<1
Vanadium	ug/L	2000	<2000	<200	<200	<200	<20
Zinc	ug/L	1	**290**	**440**	**1400**	**30**	**5**
TPH	mg/L	1	**4**	<5	**14**	**2**	**6**
Ammonia-N[8]	mg/L	10	**230**	**72**	**92**	**83**	**18**
Nitrogen	mg/L	10	**200**	**70**	**66**	**78**	**20**
Phosphorus	mg/L	0.04	**0.11**	**0.06**	**0.07**	**0.06**	**0.02**

[7] The PW sample taken at Thebaud on Aug. 13/07 was clear and clean. The PW sample from Nov. 26/07 was pale yellow in colour with a large amount of iron precipitate. The PW sample from Venture was rusty red in colour with a film on the surfacer. The PW sample from South Venture was orange in colour and opaque. The PW sample from Alma was clear and colourless, with an iron-like precipitate after aeration. All samples had a strong petroleum odor.

[8] Ammonia is reported as ammonia-N. This is done so that all nitrogen sources are reported as concentration of N and are then added to compare to total N. Therefore ammonia-N should always be less than total nitrogen-N.

Table 2-2 Toxicity of Produced Water

Toxicity Test	96 Hour LC50/IC50 Value (95% confidence limits in brackets)			
	Thebaud	**Venture**	**S. Venture**	**Alma**
Threespine Stickleback Fish Toxicity	*Aug 13/07:* **<6.25% (--%)** *Nov 26/07:* **7.11% (6.55-7.71%)**	*Oct 7/07:* **8.25% (7.23-9.41%)**	*Dec 15/07:* **17.8% (12.5-25%)**	*Jan 19/08:* **33.0% (28.9-37.6%)**
Microtox	*Aug 13/07:* **0.53% (0.49-0.58%)** *Nov 26/07:* **1.19% (0.98-1.44%)**	*Oct 7/07:* **13.0% (12.8-13.1%)**	*Dec 15/07:* **12.2% (10.1-14.7%)**	*Jan 19/08:* **1.44% (1.27-1.64%)**
Sea Urchin Fertilization	*Aug 13/07:* **6.1% (5.7-6.4%)** *Nov 26/07:* **0.11% (0.07-0.14%)**	*Oct 7/07:* **0.69% (0.47-1.00%)**	*Dec 15/07:* **0.37% (0.15-0.51%)**	*Jan 19/08:* **0.54% (0.38-0.70%)**

[Note: LC50 is the medial lethal concentration, i.e., the concentration of material in the water that is estimated to be lethal to 50% of the test organisms.]

Table 2-3 Hudson Lethality Test August 14-15, 2007

Concentration	Mortality at 24 h (n=5 per test)
0	0
10%	5
7%	5
4%	0
2%	0
1%	0

LC50 = 5.29 %

Table 2-4 SABS Lethality Test #1 Oct 17-18, 2007

Concentration	Mortality at 24 h (n=5 per test)
0	0
10%	5
6%	5
3.6%	3
1.8%	0

LC50 = 3.24%

Table 2-5 SABS Lethality Test #2 Oct 22-23, 2007

Concentration	Mortality at 24 h (n=5 per test)
0	0
10%	5
6%	5
3.6%	1
1.8%	0

LC50 = 4.12%

Table 2-6 Phenols Present in Thebaud PW

Sample ID	Thebaud 4% PW T=0hr	Thebaud 4% PW T=72hr
Units	**ng·ml-1**	**ng·ml-1**
phenol	2171.21	527.46
o-cresol	57.53	30.12
m & p-cresol	**563.40**	**276.78**
2,6-dimethylphenol	**95.19**	**42.25**
2-ethylphenol	**180.37**	**99.05**
2,4 and 2,5-dimethylphenol	**379.52**	**206.22**
3 and 4-ethylphenol	**261.61**	**162.68**
2,3-dimethylphenol	**37.58**	**23.63**
2-isoproplyphenol	48.06	24.40
2-proplyphenol	29.64	16.54
3 and 4-isopropylphenol	114.65	69.36
2-sec-butylphenol	12.15	**8.12**
3 and 4-tert butylphenol	37.61	24.25
4-sec-butylphenol	19.48	**15.51**
4-isopropyl-3-methylphenol	**10.19**	**9.79**
4-nonylphenol	n.d.	n.d.
∑ Phenols ($ng \cdot ml^{-1}$)	**4018**	**1536**

Attachment 2-1 Produced Water Sampling and Analysis Procedures

Maxxam Analytics Inc.

***Collection of Produced Water**:*

The samples that are collected directly from the discharge pipe should be sampled into the bottles supplied by the laboratory to ensure the integrity of the samples.

Produced Water / Filtration of Produced Water / Sub-Sampling Procedures / Salinity, pH, Oxygen

N/A to laboratory

Nutrients

The nutrient samples that are taken for ExxonMobil are to be analysed for Ammonia and Total Phosphorous and should be sampled in 100 ml amber glass bottles that contain a sulphuric acid preservative supplied by Maxxam Analytics. Fill the bottle but not to overflowing and keep cold until shipping to the lab (not frozen).

TKN – 100 ml amber bottle preserved with sulphuric acid

Inorganics (SPM)

N/A to laboratory

Metals

The following are the bottles needed for metals analysis:

Seawater metals – 2x500ml acid washed plastic bottles. The samples are preserved at the lab, once preserved hold time is 6 months.

Dilute and Shoot Metals – 1x50ml plastic vial (field filtered if required by field protocol) preserved with nitric acid dropper (can be supplied by lab)

Thorium - 1x50ml plastic vial (field filtered if required by field protocol) preserved with nitric acid dropper (can be supplied by lab)

Mercury – 100 ml amber bottle preserved with Potassium Dichromate in 17% Nitric Acid supplied by the lab. Fill the bottle but not to overflowing and keep cold (not frozen).

Organics

The bottles required for BTEX/TPH are 2x250ml glass plus 3x40ml amber vials that contain a copper sulphate preservative. The holding time is 7 days from date sampled. The vials must be filled to the top and contain no headspace being careful not to fill to overflowing to ensure no loss of preservative.

Methods and method summaries of analysis are available upon request.

Quality Control

Blank samples can be supplied by the client to run as samples within the laboratory. They will be treated the same as all other samples.

Field and Trip blanks can be supplied to the client upon request and can be run as actual samples.

Maxxam Analytics follows a very stringent QA/QC Program with the analysis of duplicates, method blanks, surrogates, spikes and certified reference materials where applicable.

General Info on Sampling / Preparing to go to the field / Locating Site Stations / Field Notes / Observations

N/A to laboratory

Sampling Equipment Containers

The following is what the Produced Water for ExxonMobil has been analysed for in the past as well as bottles required:

Thorium – 50ml plastic with nitric acid preservative
BTEX/TPH – 3 x 40ml amber vials preserved with copper sulphate and 2 x 250ml glass bottles
Metals (dilute and shoot) - 50ml plastic with nitric acid preservative
Metals (seawater) – 2x500ml plastic acid rinsed bottles
Mercury – 100 ml amber glass preserved with potassium dichromate in 17% nitric acid
Ammonia – 100ml amber glass with sulphuric acid preservative
Total Phosphorous – 100 ml amber glass with sulphuric acid preservative
TKN – 100ml amber glass with sulphuric acid preservative

Sampling Collection Methods

N/A to laboratory

Preservation / Holding Times

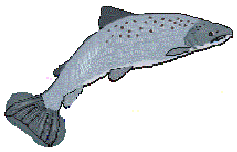
BTEX/TPH – 7 days keep cold at 4C
Metals – 6 months after they are preserved – should be to the lab within 7 days
Mercury – 28 days with preservative
Ammonia – 28 days with preservative
TP – 28 days with preservative
TKN - 28 days with preservative

Analytical Methods

BTEX/TPH – Atlantic PIRI Guidelines – we run VPH (Volatile petroleum hydrocarbons) by Combi-Pal and TEH (total extractable hydrocarbons) by GC-FID and then the Modified TPH is calculated.
Metals – ICP-MS
Mercury – Cold Vapour Atomic Absorption
Ammonia – Konelab
Total Phosphorous – Colorimetric
TKN – subcontracted to Maxxam Mississauga

Other Considerations

N/A to laboratory



HARRIS INDUSTRIAL TESTING SERVICE LTD.
1320 Ashdale Rd. Site 13 Box 8 RR #1 Mt. Uniacke
Nova Scotia B0N 1Z0
Phone: 902 757-0232 Fax: 902 757-0973
E-mail: hits@ns.sympatico.ca

Geoff Hurley
Hurley Environment Ltd.
58 Parkedge Crescent
Dartmouth NS
B2V 2V2

Dear Geoff:

I received the results from the Echinoid Fertilization test yesterday.

The results of the three tests: Threespine stickleback (TSS), Microtox and Echinoid fertilization, indicate that the Thebaud produced water is toxic.

As noted in the individual reports, the produced water was clear and clean with a salinity of 30 ppt and had a strong petroleum odour.

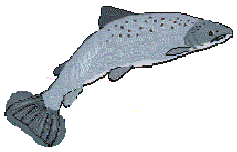
The TSS test, with an LC50 value of < 6.25%, was observed to have turned a rusty red colour in all concentrations during the test. A minimum volume of 20 litres was requested but only 10 litres were received. A one litre subsample of this produced water was required for the Microtox and Echinoid fertilization, leaving only nine litres for the LC_{50} test. A previous sample of Thebaud produced water (Jan. 07) resulted in an LC50 value of 11.7%. As with this latest sample, it was clear and clean with a strong petroleum odour and turned rusty red during the test. "The Offshore Waste Treatment Guidelines" August 2002 do not have a pass/fail criteria however most effluent discharge regulations stipulate that if an effluent has greater than 50% mortality at 100% concentration, it fails.

The Microtox results with an IC50 result of 0.53% (0.49 – 0.58) is more toxic than the previous Microtox test of 3.68% (3.61 – 3.76). Again the Guidelines do not stipulate a pass/fail number.

The Echinoid fertiliazation IC25 result of 6.1% (5.7 – 6.4) is less toxic than the previous Thebaud sample with an IC25 of 2.58% (2.09 – 3.32). Again no pass/fail criterium is available.

The results of these three tests indicate that the Thebaud produced water sampled on August 13 2007 is toxic. The cause of the toxicity is most likely high petroleum levels. If chemical analysis was performed on the sample, it will probably indicate this to be the case.

Best regards,
Gary Harris



HARRIS INDUSTRIAL TESTING SERVICE LTD.
1320 Ashdale Rd. Site 13 Box 8 RR #1 Mt. Uniacke
Nova Scotia B0N 1Z0
Phone: 902 757-0232 Fax: 902 757-0973
E-mail: hits@ns.sympatico.ca

Amec Earth & Environmental
Aubrey Beaver
32 Troop Ave. Unit 301
Dartmouth N.S. B3B 1Z1

Re: Thebaud Produced Water Summary

Dear Aubrey:

The following is a discussion of the results of the three tests (Nov. 27 07): Threespine stickleback (TSS), Microtox and Echinoid fertilization.

As noted in the individual reports, the produced water was pale yellow in colour with a large amount of iron precipitate, a salinity of 82 ppt and a petroleum odour.

The TSS test results gave an LC_{50} value of 7.11% (6.55 – 7.71). Previous samples of Thebaud produced water (Jan. 11 and Aug. 13 2007) resulted in LC_{50} values of 11.7% (9.41 – 14.5) and < 6.25% respectively. All had strong petroleum odours.

"The Offshore Waste Treatment Guidelines" August 2002 do not have a pass/fail criteria however most effluent discharge regulations stipulate that if an effluent has greater than 50% mortality at 100% concentration, it fails.

The Microtox test results gave an IC_{50} value of 1.19% (0.98 – 1.44). The Guidelines do not stipulate a pass/fail number. Previous Microtox tests (Jan. and Aug. 2007), gave IC_{50} values of 3.68% (3.61 – 3.76) and 0.53% (0.49 – 0.58) respectively.

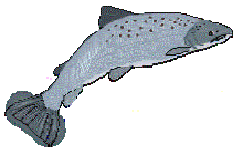
The Echinoid fertilization IC_{25} result was 0.11% (0.07 – 0.14). Previous Echinoid fertilization tests (Jan. and Aug. 2007), gave IC_{25} values of 2.58% (2.09 – 3.32) and 6.1% (5.7 – 6.4) respectively.

The results of these three tests indicate that the Thebaud produced water sampled on November 27 2007 is toxic. The cause of the toxicity is most likely high petroleum levels. Chemical analyses performed on the sample, would probably indicate this to be the case.

Table 1: Summary of Thebaud Produced Water Toxicity Results of Samples Taken in 2007

Date	Threespine stickleback	Microtox	Echinoid Fertilization	Salinity ppt (100% conc.)
Jan. 11 07	11.7% (9.41 – 14.5)	3.68% (3.61 – 3.76)	2.58% (2.09 – 3.32)	30
Aug. 13 07	< 6.25%	0.53% (0.49 – 0.58)	6.1% (5.7 – 6.4)	20
Nov. 27 07	7.11% (6.55 – 7.71)	1.19% (0.98 – 1.44)	0.11% (0.07 – 0.14)	82

Best regards,
Gary Harris



HARRIS INDUSTRIAL TESTING SERVICE LTD.
1320 Ashdale Rd. Site 13 Box 8 RR #1 Mt. Uniacke
Nova Scotia B0N 1Z0
Phone: 902 757-0232 Fax: 902 757-0973
E-mail: hits@ns.sympatico.ca

Megan Tuttle
Exxon Mobil
1701 Hollis St.
Halifax NS
B3J 3M8

Nov. 06 2007

Dear Megan:

I received the results from the Echinoid Fertilization and the final report for the Microtox tests yesterday. The following is a discussion of all of the results.

The results of the three tests: Threespine stickleback (TSS), Microtox and Echinoid fertilization, indicate that the Venture produced water is toxic.

As noted in the individual reports, the produced water was rusty red in colour with a film on the surface, a salinity of 210 ppt and a petroleum odour.

The TSS test gave an LC_{50} value of 8.25%. A previous sample of Venture produced water (Nov. 06) resulted in an LC50 value of 4.4%. Both samples had very high salinities, however in the previous test salinity was not the cause of toxicity as the sample was still lethal at normal salinities. This Venture sample was not toxic once normal salinity values were reached through dilution.

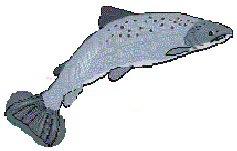
"The Offshore Waste Treatment Guidelines" August 2002 do not have a pass/fail criteria however most effluent discharge regulations stipulate that if an effluent has greater than 50% mortality at 100% concentration, it fails.

The Microtox test gave an IC_{50} of 13% (12.8 – 13.1). The Guidelines do not stipulate a pass/fail number.

The Echinoid fertiliazation test gave an IC_{25} result of 0.69% (0.47 – 1.00). There is no pass/fail criterium available.

The results of these three tests indicate that the Venture produced water sampled on Oct. 2007 is toxic. The cause of the toxicity is most likely high petroleum levels. Chemical analysis, if performed on the sample, would probably indicate this to be the case.

Best regards,
Gary Harris



HARRIS INDUSTRIAL TESTING SERVICE LTD.
1320 Ashdale Rd. Site 13 Box 8 RR #1 Mt. Uniacke
Nova Scotia B0N 1Z0
Phone: 902 757-0232 Fax: 902 757-0973
E-mail: hits@ns.sympatico.ca

Jan. 28 2008

Megan Tuttle
Exxon Mobil
1701 Hollis St.
Halifax NS
B3J 3M8

Re: South Venture Produced Water Summary

Dear Megan:

The following is a discussion of the results of the three tests (Dec. 15 2007) conducted on South Venture Produced Water using: Threespine stickleback (TSS), Microtox and Echinoid fertilization.

As noted in the individual reports, the produced water was orange in colour and opaque, with a salinity of 89 ppt and a petroleum odour.

The TSS test results gave an LC_{50} value of **17.8%** (12.5 – 25%). A previous sample of South Venture produced water (July 07 06) resulted in an LC50 value of **19%** (15.3 – 23.6%).

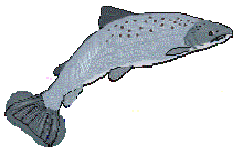
"The Offshore Waste Treatment Guidelines" August 2002 do not have a pass/fail criteria however most effluent discharge regulations stipulate that if an effluent has greater than 50% mortality at 100% concentration, it fails.

The Microtox test gave an IC_{50} value of **12.2%** (10.1 – 14.7). The Guidelines do not stipulate a pass/fail number.

The Echinoid fertiliazation IC_{25} test result was **0.37%** (0.15 – 0.51). The Guidelines do not stipulate a pass/fail number.

The results of these three tests indicate that the South Venture produced water sampled on Dec. 15 2007 is toxic. The cause of the toxicity is most likely high petroleum levels. Chemical analysis, if performed on the sample, would probably indicate this to be the case.

Best regards,
Gary Harris



HARRIS INDUSTRIAL TESTING SERVICE LTD.
1320 Ashdale Rd. Site 13 Box 8 RR #1 Mt. Uniacke
Nova Scotia B0N 1Z0
Phone: 902 757-0232 Fax: 902 757-0973
E-mail: hits@ns.sympatico.ca

Feb. 20 2008

Megan Tuttle
Exxon Mobil
1701 Hollis St.
Halifax NS
B3J 3M8

Re: Alma Produced Water Summary

Dear Megan:

The following is a discussion of the results of the three tests conducted on Alma Produced Water using: Threespine stickleback (TSS), Microtox and Echinoid fertilization.

As noted in the individual reports, the produced water was clear and colourless with an iron-like precipitate after aeration and a petroleum odour.

The TSS test results gave an LC_{50} value of **33.08%** (28.9 – 37.6%). The sample had a low salinity of 6 ppt, but this would not be a factor as TSS is a euryhaline organism able to tolerate wide ranges of salinity.

"The Offshore Waste Treatment Guidelines" August 2002 do not have a pass/fail criteria however most effluent discharge regulations stipulate that if an effluent has greater than 50% mortality at 100% concentration, it fails.

The Microtox test gave an IC_{50} value of **1.44%** (1.27 – 1.64). The Guidelines do not stipulate a pass/fail number.

The Echinoid fertiliazation IC_{25} test result was **0.54%** (0.38 – 0.70). The Guidelines do not stipulate a pass/fail number.

The results of these three tests indicate that the Alma produced water sampled on Jan. 19 2008 is toxic. The cause of the toxicity is most likely high petroleum levels. Chemical analysis, if performed on the sample, would probably indicate this to be the case.

Best regards,
Gary Harris

Attachment 2-3 Fish Toxicity Report – Thebaud Aug. 13, 2007

FISH TOXICITY REPORT (LC_{50})

Client: Amec Earth & Environmental	Test Facility: Harris Industrial Testing Service Ltd.
Address: 32 Troop Ave. Unit 301 Dartmouth, N.S. B3B 1Z1	Location: 1320 Ashdale Rd., South Rawdon, RR#1 Mt. Uniacke Nova Scotia, Canada B0N 1Z0 Tel: 902 757-0232
Contact: Aubrey Beaver	Fax: 902 757-0973 E-mail: HITS@ns.sympatico.ca
This laboratory is accredited by the Canadian Association for Environmental Analytical Laboratories *The test included in this report is within the scope of this accreditation*	

Sample/Location	Thebaud Platform Produced Water		Lab ID. #	7-336
Sampling Method	Not supplied	Sample Homogenized: No	Sampler	Not supplied by client
Date/Time Collected	Aug. 13 2007 -- Hrs		Received	Aug. 14 2007
Date/Time Started	Aug. 15 2007 1520 Hrs		Completed	Aug. 19 2007 1520 Hrs
Sample Description:	Clear and clean, strong petroleum odour.			

Test Information - Pre-test Parameters (100%)

Reference Method: EPS 1/RM/10 July 1990 Type: LC_{50} Lab Method ID: Tox 9B	Mandatory 30 minute pre-aeration: Rate: 6.5 ± 1 ml/min/L Time: 1450 hrs D.O.: 7.6 mg/L Continued: ___ min. @ ___ hrs Total: 30 min. D.O. 7.6 mg/L Cont'd throughout test by airstone	Number of fish per vessel: Test: 10 Control: 10
Test Organism: Threespine stickleback		Loading Density: 0.5 g/L Mean wet weight: 0.25 g ± 0.05 g SD Range: 0.18 g - 0.32 g
Pre-test Temperature: 16.0 °C Pre-test D.O.: 5.9 mg/L Pre-test pH: 5.8 pH Adjusted: No	Trout Batch #: 18 Stock Tank Mortality: 0 % 1 – 5 days prior to test	Mean fork length: 27.8 mm ± 0.79 mm SD Range: 26 mm - 29 mm
Conductivity: -- µS/cm Salinity of Sample: 20 ppt Control: 30 ppt	Test Volume: 5 L Depth: 9.0 cm Replicate solutions: No	Photoperiod: 16L/8D Lux: 100 - 500 Test Duration: 96 hours Static Dilution Water: Seawater
Analyst(s): G. Harris		Temperature: 15 ± 1°C

Test Parameters

Initial (0 Hrs)					Final (96 Hrs)			Test Results		
Conc. %	Temp. °C	D.O. mg/L	pH	Sal. ppt	Temp. °C	D.O. mg/L	pH	# Dead	# Stressed	Comments
100	15.0	7.6	6.0	20	15.0	8.2	7.1	**10/10**		All equilibrium loss within minutes. All dead @ 18.5 hrs.
50	15.0	8.6	7.2	25	15.0	8.5	7.6	**10/10**		All dead @ 18.5 hrs.
25	15.0	8.5	7.4	28	15.0	8.7	8.0	**10/10**		All dead @ 18.5 hrs.
12.5	15.0	8.1	7.8	30	15.0	8.3	8.1	**10/10**		All dead @ 18.5 hrs.
6.25	15.0	8.1	8.0	30	15.0	8.4	8.1	**10/10**		Total eq. loss @ 18.5 hrs. All dead @ 20 hrs.
Ctl	15.0	8.1	8.2	30	15.0	8.5	8.2	**0/10**		

96 Hour LC_{50} Value = < 6.25 % 95% Confidence Limits: -- % - ___ % Statistical Method: --

Reference Toxicant Data for Phenol: Batch # 18	Date: Aug. 13 – 17 2007	96 Hour LC_{50}: 19.0 mg/L
95% Conf. Limits: 16.6 – 21.6 mg/L	Historical Phenol Mean: 17.0 mg/L	Warning Limits ± 2 SD: 13.1 – 22.1 mg/L

Comments: Colour change overnight to rusty red, most observable in the highest conc.

Transcribed by: *C. Harris* x *A. Huybers* ___ *G. Harris* ___

Authorized by: *G.Harris* ___ *A. Huybers* x Date: *Aug. 20 2007*

Form No. 5B Version No. 2 Revised: Aug. 20 2007

Fish Toxicity Report – Thebaud Nov. 26, 2007

FISH TOXICITY REPORT (LC_{50})

Client:	Amec Earth & Environmental	Test Facility:	Harris Industrial Testing Service Ltd.
Address:	32 Troop Ave. Unit 301	Location:	1320 Ashdale Rd. Site 13 Box 8 South Rawdon
	Dartmouth, N.S. B3B 1Z1		RR #1 Mt. Uniacke Nova Scotia Canada B0N 1Z0
Contact:	Aubrey Beaver		Ph : 902 757-0232 Fax: 902 757-0973 hits@ns.sympatico.ca

SAMPLE DATA

Sample/Location:	Thebaud Platform Produced Water – Nov 07	Lab ID. #	7-496
Sampling Method:	Grab Sample Homogenized: No	Sampler:	Ron Sweet
Date/Time Collected:	Nov. 26 2007 1400 Hrs	Received:	Nov. 27 2007
Date/Time Started:	Nov. 28 2007 1115 Hrs	Completed:	Dec. 02 2007 1115 Hrs
Sample Description:	Pale yellow in colour and clear, with petroleum odour.		

TEST INFORMATION and PRE-TEST PARAMETERS (100%)

Reference. Method:
EPS EPS 1/RM/10 July 1990
Type: LC_{50} Tox 9B
Test Organism: Threespine stickleback

Pre-test Temperature: 15.5 °C
Pre-test D.O.: 7.1 mg/L
Pre-test pH: 6.3 Adjusted: No

Conductivity of Sample:
102,900 µS/cm
Salinity of Sample: 82 ppt
Salinity of Control: 30 ppt

Analyst(s): A. Huybers & G. Harris

Mandatory 30 minute pre-aeration:
Rate: 6.5 ± 1 ml/min/L
Time: 1045 hrs D.O.: *7.1 mg/L
Continued: ____ min. @ _____ hrs
Cont'd throughout test by airstone

TEST CONDITIONS

TSS Batch #: 18
Mortality: 1.5 % over 7 days prior to test

Test Volume: 10 L Depth: 17.7 cm
Replicate solutions: No
Number of fish per vessel: 10

TEST CONDITIONS (Continued)

Loading Density: 0.35 g/L

Mean wet weight:
0.35 g ± 0.14 g SD
Range: 0.22 g - 0.67 g

Mean fork length:
36.0 mm ± 3.46 mm SD
Range: 32 mm - 43 mm

Photoperiod: 16L/8D Lux: 100 - 500
Static Test - Duration: 96 hours
Control/Dilution Water: Seawater
Temperature: 15 ± 1°C

TEST PARAMETERS / RESULTS

	Initial (0 Hrs)				Final (96 Hrs)					
Conc %	Temp °C	D.O mg/L	pH	Salin. ppt	Temp °C	D.O mg/L	pH	**Number Dead**	**Number Stressed**	Comments
100	15.5	*7.1	6.4	83	15.0	*6.9	6.7	**10/10**		All dead @ 1.75 hrs.
50	15.0	*7.8	7.1	56	14.5	*7.0	7.0	**10/10**		All eq. loss @ 1.75 hrs. All dead @ 24 hrs.
25.0	14.5	*7.8	7.4	45	14.5	*7.4	7.2	**10/10**		All eq. loss @ 1.75 hrs. All dead @ 24 hrs.
12.5	14.5	7.8	7.6	36	14.5	7.1	7.6	**10/10**		Some with eq. loss @ 1.75 hrs. All dead @ 24 hrs.
6.25	15.0	8.3	7.8	32	14.0	7.4	7.9	**1/10**		1/10 dead @ 24 hrs.
Ctl.	14.5	8.4	8.2	30	14.0	7.9	8.2	**0/10**		

96 HOUR LC_{50} RESULTS

LC_{50} Value: 7.11 %
95% Confidence Limits: 6.55 % - 7.71 %
Statistical Method: Speraman Karber - Toxstats

REFERENCE TOXICANT DATA:

Batch: 18
Reference Substance: Phenol
Test Date: Nov. 28 – Dec. 02 2007
96 Hour LC_{50} for Phenol: 17.7 mg/L
95% C.L.: 12.5 – 25.0 mg/L
Historical Phenol Mean: 17.1 mg/L
Warning Limits ± 2 SD: 13.3 – 22.0 mg/L

Comments: * The D.O. meter was set to the **maximum** salinity setting of 40 ppt. As salinity increases, D.O. measurements decrease. Reported measurements are higher than the true measurements. We were unable to measure actual D.O.s due to the limitations of the instrument. Concs. 25, 12.5, 6.25 % turned bright yellow after pre-aeration and all concs. had orange coloured precipitate at termination.

Transcribed by: *C. Harris* x *A. Huybers* _____ *G. Harris* _____

Authorized by: *G.Harris* _____ *A. Huybers* x Date: *Dec. 03 2007*

Accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL).
The test included in this report is within the scope of this accreditation.

Fish Toxicity Report – Venture Oct. 7, 2007

FISH TOXICITY REPORT (LC_{50})

Client:	Exxon Mobil Canada	Test Facility:	Harris Industrial Testing Service Ltd.
Address:	Founders Square	Location:	1320 Ashdale Rd. Site 13 Box 8 South Rawdon
	Halifax, N.S.		RR #1 Mt.Uniacke Nova Scotia Canada B0N 1Z0
Contact:	Megan Tuttle		Ph : 902 757-0232 Fax: 902 757-0973 hits@ns.sympatico.ca

SAMPLE DATA

Sample/Location:	Venture Platform Produced Water	Lab ID. #	7-407
Sampling Method:	Grab Sample Homogenized: Yes	Sampler:	R. Beaton
Date/Time Collected:	Oct. 07 2007 1630 & 1640 Hrs	Received:	Oct. 08 2007
Date/Time Started:	Oct. 09 2007 1200 Hrs	Completed:	Oct. 13 2007 1200 Hrs
Sample Description:	Rusty-red in colour, cloudy with oily-gas odour and a film at the sample surface.		

TEST INFORMATION and PRE-TEST PARAMETERS (100%)

Reference Method:
EPS EPS 1/RM/10 July 1990
Type: LC_{50} Tox 9B
Test Organism: Threespine stickleback

Pre-test Temperature: 16.0 °C
Pre-test D.O.: * 5.1 mg/L
Pre-test pH: 5.8 Adjusted: No

Conductivity of Sample: -- µS/cm
Salinity of Sample: **210** ppt
Salinity of Control: 29 ppt

Analyst(s): A. Huybers & G. Harris

Mandatory 30 minute pre-aeration:
Rate: 6.5 ± 1 ml/min/L
Time: 1130 hrs D.O.: *7.4 mg/L
Continued: ____ min. @ _____ hrs
Cont'd throughout test by airstone

TEST CONDITIONS

TSS Batch #: 18
Mortality: 0 % over 7 days prior to test

Test Volume: 10 L Depth: 17.7 cm
Replicate solutions: No
Number of fish per vessel: 10

TEST CONDITIONS (Continued)

Loading Density: 0.46 g/L

Mean wet weight:
0.46 g ± 0.11 g SD
Range: 0.36 g - 0.71 g

Mean fork length:
37.5 mm ± 4.55 mm SD
Range: 33 mm - 45 mm

Photoperiod: 16L/8D Lux: 100 - 500
Static Test - Duration: 96 hours
Control/Dilution Water: Seawater
Temperature: 15 ± 1°C

TEST PARAMETERS / RESULTS

	Initial (0 Hrs)				Final (96 Hrs)					
Conc %	Temp °C	D.O mg/L	pH	Salin ppt	Temp °C	D.O mg/L	pH	**Number Dead**	**Number Stressed**	Comments
50	16.0	*7.4	6.3	123	15.0	*7.5	6.4	**10/10**		All dead @ 2.5 hrs.
25	16.0	*7.4	6.8	75	15.0	*7.4	6.8	**10/10**		All dead @ 2.5 hrs.
12.5	15.5	*7.3	7.1	54	14.5	*7.8	7.4	**10/10**		2 sluggish @ 2.5 hrs 10 dead @ 22 hrs.
6.25	16.0	7.3	7.3	38	15.0	7.9	7.7	**1/10**		1 sluggish @ 22 hrs. 1 dead @ 46 hrs.
3.13	15.5	7.5	7.5	33	15.0	7.8	7.9	**0/10**		
Ctl	16.0	8.1	8.0	29	15.0	8.0	8.1	**0/10**		

96 HOUR LC_{50} RESULTS

LC_{50} Value: 8.25 %
95% Confidence Limits: 7.23 % - 9.41 %
Statistical Method: Speraman Karber - Toxstats

REFERENCE TOXICANT DATA: Batch: 18

Reference Substance: Phenol	Test Date: Oct. 09 – 13 2007	96 Hour LC_{50} for Phenol: 17.7 mg/L
95% C.L. 12.5 – 25.0 mg/L	Historical Phenol Mean: 17.1 mg/L	Warning Limits ± 2 SD: 13.3 – 22.0 mg/L

Comments: * The D.O. meter was set to the **maximum** salinity setting of 42 ppt. As salinity increases, D.O. measurements decrease. Reported measurements are higher than the true measurements. We were unable to measure actual D.O.s due to the limitations of the instrument. Test started at 50% conc. due to high salinity which is known to be lethal to TSS.

Transcribed by: *C. Harris* x *A. Huybers* _____ *G. Harris* _____

Authorized by: *G.Harris* _____ *A. Huybers* x Date: *Oct. 15 2007*

Accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL). The test included in this report is within the scope of this accreditation.

Form No. 5B Version No. 2 Revised: Oct. 15 2007 Pg 1 of 1

Fish Toxicity Report – South Venture Dec. 15, 2007

FISH TOXICITY REPORT (LC_{50})

Client:	Exxon Mobil Canada	Test Facility:	Harris Industrial Testing Service Ltd.
Address:	Founders Square	Location:	1320 Ashdale Rd. Site 13 Box 8 South Rawdon
	Halifax NS		RR #1 Mt Uniacke Nova Scotia Canada B0N 1Z0
Contact:	Megan Tuttle		Ph : 902 757-0232 Fax: 902 757-0973 hits@ns.sympatico.ca

SAMPLE DATA

Sample/Location:	South Venture Platform Produced Water	Lab ID. #	7-525
Sampling Method:	Grab Sample Homogenized: Yes	Sampler:	Ildo Santiago
Date/Time Collected:	Dec. 15 2007 0930 Hrs	Received:	Dec. 17 2007
Date/Time Started:	Dec. 18 2007 1300 Hrs	Completed:	Dec. 22 2007 1300 Hrs
Sample Description:	Orange in colour and opaque with petroleum odour.		

TEST INFORMATION and PRE-TEST PARAMETERS (100%)

Reference Method:
EPS EPS 1/RM/10 July 1990
Type: LC_{50} Tox 9B
Test Organism: Threespine stickleback

Pre-test Temperature: 16.0 °C
Pre-test D.O.: *6.7 mg/L
Pre-test pH: 5.9 Adjusted: No

Conductivity of Sample: -- µS/cm
Salinity of Sample: 89 ppt
Salinity of Control: 32 ppt

Analyst(s): A. Huybers & G. Harris

Mandatory 30 minute pre-aeration:
Rate: 6.5 ± 1 ml/min/L
Time: 1230 hrs D.O.: *6.7 mg/L
Continued: ___ min. @ ___ hrs
Cont'd throughout test by airstone

TEST CONDITIONS

TSS Batch #: 18
Mortality: 0 % over 7 days prior to test

Test Volume: 10 L Depth: 17.7 cm
Replicate solutions: No
Number of fish per vessel: 10

TEST CONDITIONS (Continued)

Loading Density: 0.34 g/L

Mean wet weight:
0.34 g ± 0.07 g SD
Range: 0.27 g - 0.50 g

Mean fork length:
37.2 mm ± 3.61 mm SD
Range: 31 mm - 42 mm

Photoperiod: 16L/8D Lux: 100 - 500
Static Test - Duration: 96 hours
Control/Dilution Water: Seawater
Temperature: 15 ± 1°C

TEST PARAMETERS / RESULTS

	Initial (0 Hrs)				Final (96 Hrs)					
Conc %	Temp °C	D.O mg/L	pH	Salin ppt	Temp °C	D.O mg/L	pH	**Number Dead**	**Number Stressed**	Comments
100	16.0	*6.7	6.0	89	15.0	*7.6	6.6	**10/10**		All equilibrium loss @ 45 mins. All dead @ 23 hrs.
50	14.5	*8.0	7.0	59	15.0	*7.5	7.0	**10/10**		All dead @ 23 hrs.
25	14.0	*8.2	7.5	46	15.0	*7.7	7.5	**10/10**		All dead @ 23 hrs.
12.5	14.0	8.3	7.8	38	15.0	7.3	7.9	**0/10**		
6.25	14.0	8.3	8.0	35	15.0	7.8	8.0	**0/10**		
Ctl	14.0	8.3	8.3	32	15.0	8.0	8.1	**0/10**		

96 HOUR LC_{50} RESULTS

LC_{50} Value: 17.8 %
95% Confidence Limits: 12.5 % - 25 %
Statistical Method: Binomial – Stephan's

REFERENCE TOXICANT DATA: Batch: 18

Reference Substance: Phenol
95% C.L.: 12.5 – 25.0 mg/L
Test Date: Nov. 28 – Dec. 02 2007
Historical Phenol Mean: 17.1 mg/L
96 Hour LC_{50} for Phenol: 17.7 mg/L
Warning Limits ± 2 SD: 13.3 – 22.0 mg/L

Comments: * The D.O. meter was set to the **maximum** salinity setting of 40 ppt. As salinity increases, D.O. measurements decrease. Reported measurements are higher than the true measurements. We were unable to measure actual D.O.s due to the limitations of the instrument.

Transcribed by: *C. Harris* x *A. Huybers* _____ *G. Harris* _____

Authorized by: *G.Harris* _____ *A. Huybers* x Date: *Dec. 27 2007*

Accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL). The test included in this report is within the scope of this accreditation.

Form No. 5B Version No. 2 Revised: Oct. 15 2007 Pg 1 of 1

Fish Toxicity Report – Alma Jan. 19, 2008

FISH TOXICITY REPORT (LC_{50})

Client:	Exxon Mobil Canada	Test Facility:	Harris Industrial Testing Service Ltd.
Address:	Founders Square	Location:	1320 Ashdale Rd. Site 13 Box 8 South Rawdon
	Halifax NS		RR #1 Mt. Uniacke Nova Scotia Canada B0N 1Z0
Contact:	Megan Tuttle		Ph : 902 757-0232 Fax: 902 757-0973 hits@ns.sympatico.ca

SAMPLE DATA

Sample/Location:	Alma Platform Overboard Produced Water	Lab ID. #	8-35
Sampling Method:	Grab Sample Homogenized: Yes	Sampler:	Ildo Santiago
Date/Time Collected:	Jan. 19 2008 1145 Hrs	Received:	Jan. 19 2008
Date/Time Started:	Jan. 21 2008 1315 Hrs	Completed:	Jan. 25 2008 1315 Hrs
Sample Description:	Clear and colourless with a petroleum odour and an iron-like precipitate after aeration.		

TEST INFORMATION and PRE-TEST PARAMETERS (100%)

Reference Method:
EPS EPS 1/RM/10 July 1990
Type: LC_{50} Tox 9B
Test Organism: Threespine stickleback

Pre-test Temperature: 15.5 °C
Pre-test D.O.: 8.8 mg/L
Pre-test pH: 5.0 Adjusted: No

Conductivity of Sample: 10,180 µS/cm
Salinity of Sample: 6 ppt
Salinity of Control: 29.1 ppt

Analyst(s): A. Huybers & G. Harris

Mandatory 30 minute pre-aeration:
Rate: 6.5 ± 1 ml/min/L
Time: 1245 hrs D.O.: 8.8 mg/L
Continued: ___ min. @ ___ hrs
Cont'd throughout test by airstone

TEST CONDITIONS

TSS Batch #: 18
Mortality: 0 % over 7 days prior to test

Test Volume: 10 L Depth: 17.7 cm
Replicate solutions: No
Number of fish per vessel: 10

TEST CONDITIONS (Continued)

Loading Density: 0.50 g/L

Mean wet weight:
0.50 g ± 0.12 g SD
Range: 0.39 g - 0.78 g

Mean fork length:
44.2 mm ± 3.68 mm SD
Range: 40 mm - 49 mm

Photoperiod: 16L/8D Lux: 100 - 500
Static Test - Duration: 96 hours
Control/Dilution Water: Seawater
Temperature: 15 ± 1°C

TEST PARAMETERS / RESULTS

Conc %	Initial (0 Hrs) Temp °C	D.O mg/L	pH	Salin ppt	Final (96 Hrs) Temp °C	D.O mg/L	pH	Number Dead	Number Stressed	Comments
100	14.0	8.8	4.9	5.7	14.0	8.4	5.1	**10/10**		All dead @ 20 hrs. 8 dead, 2 eq. loss @ 20 hrs.
50	14.0	9.1	5.9	17.7	14.5	7.9	7.6	**10/10**		9 dead, 1 eq. loss @ 69 hrs. 10 dead @ 96 hrs.
25	15.0	8.5	6.8	23.0	14.5	6.8	7.8	**1/10**		1 dead @ 20 hrs.
12.5	15.5	8.8	7.4	25.1	14.5	7.6	7.9	**0/10**		
6.25	15.0	8.9	7.6	27.2	14.5	8.0	8.1	**0/10**		
Ctl.	15.0	8.0	7.9	29.1	14.5	8.2	8.3	**0/10**		

96 HOUR LC_{50} RESULTS

LC_{50} Value: 33.0 %
95% Confidence Limits: 28.9 % - 37.6 %
Statistical Method: Spearman Karber - Toxstats

REFERENCE TOXICANT DATA: Batch: 18

Reference Substance: Phenol
95% C.L. 12.2 – 21.6 mg/L
Test Date: Jan. 18 – 22 2008
Historical Phenol Mean: 17.1 mg/L
96 Hour LC_{50} for Phenol: 16.5 mg/L
Warning Limits ± 2 SD: 13.4 – 21.7 mg/L

Comments:

Transcribed by: C. Harris _____x_____ A. Huybers _____ G. Harris _____

Authorized by: G.Harris _____x_____ A. Huybers _____ Date: Dec. 27 2007

Accredited by the Canadian Association for Environmental Analytical Laboratories (CAEAL). The test included in this report is within the scope of this accreditation.

Form No. 5B Version No. 2 Revised: Oct. 15 2007 Pg 1 of 1

Attachment 2-4 Stantec Microtox Report – Thebaud Aug. 13, 2007

Stantec Consulting Ltd.
11B Nicholas Beaver Road RR3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419
stantec.com

MICROTOX® ACUTE TOXICITY TEST REPORT

Work Order : 211858
Sample Number : 19315

Stantec

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.	Time Collected :	Not given
Location :	South Rawdem NS	Date Collected :	2007-08-13
Substance :	Produce Water	Date Received :	2007-08-16
Sampling Method :	Grab	Date Tested :	2007-08-16
Sampled By :	N/A	Temp. on arrival :	21.0°C
Sample Description:	Clear, colourless, strong odour.		
Test Method :	Toxicity Test Using Luminescent Bacteria, Protocol EPS 1/RM/24, Environment Canada, 1992.		

TEST RESULTS

Test Endpoint	Value	95% Confidence Limits	Calculation Method
15 minute IC50	0.53%	0.49-0.58	Least Square Regression

The results reported relate only to the sample tested.

REFERENCE TOXICANT DATA

Reagent Batch :	7A1027	15 minute IC50 :	1.24mg/L
Expiry Date :	01/2009	95% Confidence Limits :	1.04-1.47mg/L
Date Tested (yyyy-mm-dd) :	2007-08-16	Historical Mean IC50 :	1.41mg/L
Reference Substance :	Zinc (as zinc sulphate)	Warning Limits (± 2SD) :	0.66-2.27mg/L
Statistical Method :	Least Square Regression	Analyst(s):	CR

CONDITIONS OF ACUTE MICROTOX TEST

Test Organism :	*Vibrio fischeri*	Test Initiation Time :	15:55
Reagent Batch :	7A1027	Observation Time(s) :	15 minutes
Date Reagent Received :	2007-06-12	Sample Pre-aeration/Aeration :	None
Reagent Holding Temperature :	-21 °C	Sample pH :	5.4
Analyzer Model Number :	M500	pH Adjustment :	None
Test Well Temperature :	15.0 ± 0.3 °C	Salinity Adjustment :	2% NaCl
Highest Concentration Tested :	50 %	Dilution Water :	SDI Diluent
Number of Controls :	2	Sample Storage :	4±2 °C
Number of Concentrations Tested :	8	Colour Correction :	None
Number of Replicates :	2	Analyst(s):	CR

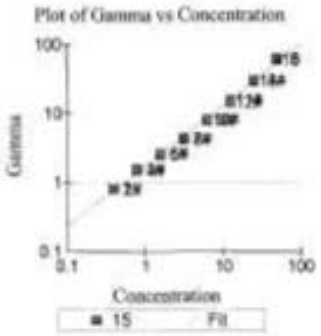
Date: 2007-08-23 (yyyy-mm-dd)

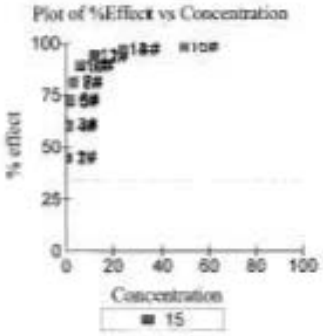
Approved by: J. Lindsay, Project Manager

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Stantec

Work Order: 211858
Sample Number: 19315





15 Mins Data:

Sample	Conc	Io	It	Gamma	% effect
Control	0.000	96.09	74.52	0.7755 #	
Control	0.000	97.91	75.07	0.7667 #	
Control	0.000	95.20	73.91	0.7764 #	
Control	0.000	92.52	75.58	0.8169 #	
1	0.3906	96.41	41.85	0.8058 #	44.62%
2	0.3906	95.27	41.21	0.8122 #	44.82%
3	0.7813	97.23	29.98	1.549 #	60.77%
4	0.7813	93.83	29.50	1.493 #	59.89%
5	1.563	94.22	20.86	2.541 #	71.76%
6	1.563	95.96	20.57	2.657 #	72.65%
7	3.125	93.68	13.85	4.302 #	81.14%
8	3.125	95.88	14.52	4.176 #	80.68%
9	6.250	95.98	8.42	7.935 #	88.81%
10	6.250	97.03	8.33	8.131 #	89.05%
11	12.50	95.69	4.49	15.71 #	94.01%
12	12.50	93.60	4.74	14.48 #	93.54%
13	25.00	91.03	2.35	29.36 #	96.71%
14	25.00	94.48	2.41	29.73 #	96.75%
15	50.00	93.01	1.17	61.32 #	98.40%
16	50.00	95.46	1.25	58.86 #	98.33%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 15 Mins data:
IC50 Concentration:0.5295% (95% confidence range: 0.4871 to 0.5756)
95% Confidence Factor: 1.087
Estimating Equation:LOG C =1.140 x LOG G -0.2761
Coeff. of Determination (R^2):0.9970
Slope: 0.8742
Correction Factor: 0.7839

Signature:

AquaTox Microtox Report –Thebaud Nov. 26, 2007

AQUATOX
AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

MICROTOX® ACUTE TOXICITY TEST REPORT

Work Order : 212434
Sample Number : 20188

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.	Time Collected :	14:00
Location :	South Rawden NS	Date Collected :	2007-11-26
Substance :	Thebaud Produced Water	Date Received :	2007-11-28
Sampling Method :	Not given	Date Tested :	2007-11-29
Sampled By :	R. Sweet	Temp. on arrival :	4.0°C
Sample Description:	Clear, colourless, odourless.		

Test Method : Toxicity Test Using Luminescent Bacteria, Protocol EPS 1/RM/24, Environment Canada, 1992.

TEST RESULTS

Test Endpoint	Value	95% Confidence Limits	Calculation Method
15 minute IC50	1.19%	0.98-1.44	Least Square Regression

The results reported relate only to the sample tested.

REFERENCE TOXICANT DATA

Reagent Batch :	7E1021	15 minute IC50 :	1.80 mg/L
Expiry Date :	05/2009	95% Confidence Limits :	1.50-2.16 mg/L
Date Tested (yyyy-mm-dd) :	2007-11-02	Historical Mean IC50 :	1.42 mg/L
Reference Substance :	Zinc (as zinc sulphate)	Warning Limits (± 2SD) :	0.69-2.25 mg/L
Statistical Method :	Least Square Regression	Analyst(s):	CR

CONDITIONS OF ACUTE MICROTOX TEST

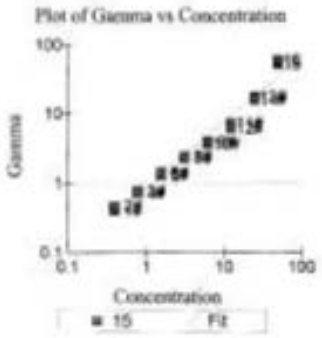
Test Organism :	*Vibrio fischeri*	Test Initiation Time :	11:43
Reagent Batch :	7E1021	Observation Time(s) :	15 minutes
Date Reagent Received :	2007-08-23	Sample Pre-aeration/Aeration :	None
Reagent Holding Temperature :	-23 °C	Sample pH :	5.9
Analyzer Model Number :	M500	pH Adjustment :	None
Test Well Temperature :	15.0 ± 0.3 °C	Salinity Adjustment :	None
Highest Concentration Tested :	50 %	Dilution Water :	SDI Diluent
Number of Controls :	2	Sample Storage :	4±2 °C
Number of Concentrations Tested :	8	Colour Correction :	None
Number of Replicates :	2	Analyst(s):	CR

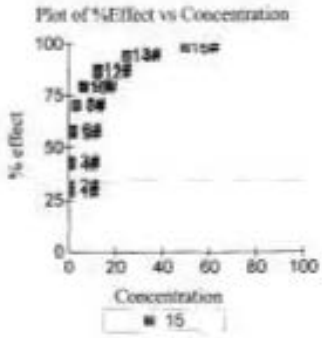
Date: 2007-12-11
(yyyy-mm-dd)

Approved by: J. Lindsay
Project Manager

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order: 212434
Sample Number: 20188





15 Mins Data:

Sample	Conc	Io	It	Gamma	% effect
Control	0.000	94.16	70.58	0.7496 #	
Control	0.000	93.88	71.77	0.7645 #	
Control	0.000	94.61	72.93	0.7708 #	
Control	0.000	96.89	74.01	0.7639 #	
1	0.3906	90.89	49.26	0.4063 #	28.89%
2	0.3906	89.13	46.21	0.4701 #	31.98%
3	0.7813	89.51	38.51	0.7716 #	43.55%
4	0.7813	90.53	40.09	0.7212 #	41.90%
5	1.563	93.79	30.87	1.316 #	56.82%
6	1.563	90.80	28.62	1.418 #	58.65%
7	3.125	97.74	22.58	2.299 #	69.69%
8	3.125	91.14	20.38	2.409 #	70.66%
9	6.250	92.58	14.19	3.973 #	79.89%
10	6.250	94.48	15.23	3.728 #	78.85%
11	12.50	88.98	8.15	7.321 #	87.98%
12	12.50	90.77	9.61	6.199 #	86.11%
13	25.00	88.12	3.62	17.55 #	94.61%
14	25.00	92.41	4.16	15.93 #	94.09%
15	50.00	91.54	1.31	52.26 #	98.12%
16	50.00	90.31	1.14	59.38 #	98.34%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 15 Mins data:
IC50 Concentration:1.189% (95% confidence range: 0.9827 to 1.439)
95% Confidence Factor: 1.210
Estimating Equation:LOG C =1.036 x LOG G +0.0752
Coeff. of Determination (R^2):0.9742
Slope: 0.9406
Correction Factor: 0.7622

Signature: _____

AquaTox Microtox Report –Venture Oct. 7, 2007

AQUATOX
AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

MICROTOX® ACUTE TOXICITY
TEST REPORT

Work Order : 212137
Sample Number : 19749

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.	Time Collected :	Not given
Location :	South Rawden NS	Date Collected :	2007-10-07
Substance :	Venture Produce H2O	Date Received :	2007-10-10
Sampling Method :	Grab	Date Tested :	2007-10-10
Sampled By :	R. Beaton	Temp. on arrival :	12.0°C
Sample Description:	Cloudy, orange, strong odour.		
Test Method :	Toxicity Test Using Luminescent Bacteria, Protocol EPS 1/RM/24, Environment Canada, 1992.		

TEST RESULTS

Test Endpoint	Value	95% Confidence Limits	Calculation Method
15 minute IC50	13.0%	12.8-13.1	Least Square Regression

The results reported relate only to the sample tested.

REFERENCE TOXICANT DATA

Reagent Batch :	7E1021	15 minute IC50 :	1.23 mg/L
Expiry Date :	05/2009	95% Confidence Limits :	1.01-1.50mg/L
Date Tested (yyyy-mm-dd) :	2007-10-05	Historical Mean IC50 :	1.41 mg/L
Reference Substance :	Zinc (as zinc sulphate)	Warning Limits (± 2SD) :	0.68-2.24 mg/L
Statistical Method :	Least Square Regression	Analyst(s):	CR

CONDITIONS OF ACUTE MICROTOX TEST

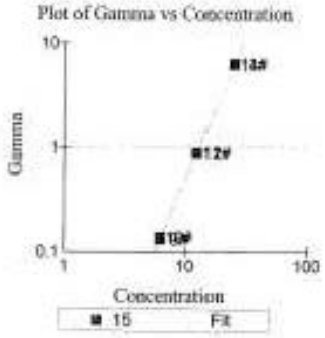
Test Organism :	*Vibrio fischeri*	Test Initiation Time :	15:30
Reagent Batch :	7E1021	Observation Time(s) :	15 minutes
Date Reagent Received :	2007-08-23	Sample Pre-aeration/Aeration :	None
Reagent Holding Temperature :	-21 °C	Sample pH :	5.5
Analyzer Model Number :	M500	pH Adjustment :	None
Test Well Temperature :	15.0 ± 0.3 °C	Salinity Adjustment :	None
Highest Concentration Tested :	50 %	Dilution Water :	SDI Diluent
Number of Controls :	2	Sample Storage :	4±2 °C
Number of Concentrations Tested :	8	Colour Correction :	None
Number of Replicates :	2	Analyst(s):	CR

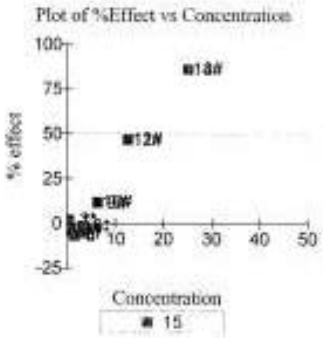
Date: 2007-10-19
(yyyy-mm-dd)

Approved by: Project Manager

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order: 212137
Sample Number: 19749





15 Mins Data:

Sample	Conc	Io	It	Gamma	% effect
Control	0.000	96.53	70.20	0.7272 #	
Control	0.000	92.68	68.77	0.7420 #	
Control	0.000	91.62	68.35	0.7460 #	
Control	0.000	90.84	68.16	0.7503 #	
1	0.3906	90.12	66.00	0.0123 *	1.220%
2	0.3906	89.93	65.28	0.0213 *	2.091%
3	0.7813	90.82	68.89	-0.0225 *	-2.311%
4	0.7813	86.95	67.49	-0.0448 *	-4.693%
5	1.563	90.36	70.51	-0.0498 *	-5.250%
6	1.563	90.91	71.99	-0.0637 *	-6.809%
7	3.125	91.24	71.37	-0.0521 *	-5.506%
8	3.125	94.86	71.32	-0.0138 *	-1.409%
9	6.250	93.07	61.02	0.1308 #	11.57%
10	6.250	93.72	61.10	0.1372 #	12.07%
11	12.50	91.39	36.04	0.8800 #	46.81%
12	12.50	93.16	36.60	0.8871 #	47.01%
13	25.00	92.99	9.54	6.227 #	86.16%
14	25.00	92.18	9.39	6.278 #	86.26%
15	50.00	90.89	0.33	203.2 *	99.51%
16	50.00	92.20	0.15	454.7 *	99.78%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 15 Mins data:
IC50 Concentration:12.96% (95% confidence range: 12.82 to 13.10)
95% Confidence Factor: 1.011
Estimating Equation:LOG C =0.3607 x LOG G +1.113
Coeff. of Determination (R^2):0.9998
Slope: 2.772
Correction Factor: 0.7414

Signature:

AquaTox Microtox Report – South Venture Dec. 15, 2007

AQUATOX
AquaTox Testing & Consulting Inc.
118 Nicholas Beaver Rd
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

MICROTOX® ACUTE TOXICITY TEST REPORT

Work Order : 212558
Sample Number : 20347

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.	Time Collected :	Not given
Location :	South Rawdon NS	Date Collected :	2007-12-15
Substance :	SV Produced water	Date Received :	2007-12-18
Sampling Method :	Grab	Date Tested :	2007-12-18
Sampled By :	Ildo Jentiago	Temp. on arrival :	6.0°C
Sample Description:	Cloudy light brown, strong odour.		
Test Method :	Toxicity Test Using Luminescent Bacteria, Protocol EPS 1/RM/24, Environment Canada, 1992.		

TEST RESULTS

Test Endpoint	Value	95% Confidence Limits	Calculation Method
15 minute IC50	12.2%	10.1-14.7	Least Square Regression

The results reported relate only to the sample tested.

REFERENCE TOXICANT DATA

Reagent Batch :	7E1021	15 minute IC50 :	1.17 mg/L
Expiry Date :	05/2009	95% Confidence Limits :	0.96-1.42 mg/L
Date Tested (yyyy-mm-dd) :	2007-12-14	Historical Mean IC50 :	1.42 mg/L
Reference Substance :	Zinc (as zinc sulphate)	Warning Limits (± 2SD) :	0.69-2.24 mg/L
Statistical Method :	Least Square Regression	Analyst(s):	JP

CONDITIONS OF ACUTE MICROTOX TEST

Test Organism :	*Vibrio fischeri*	Test Initiation Time :	15:30
Reagent Batch :	7E1021	Observation Time(s) :	15 minutes
Date Reagent Received :	2007-08-23	Sample Pre-aeration/Aeration :	None
Reagent Holding Temperature :	-22 °C	Sample pH :	5.5
Analyzer Model Number :	M500	pH Adjustment :	None
Test Well Temperature :	15.0 ± 0.3 °C	Salinity Adjustment :	2% NaCl
Highest Concentration Tested :	50 %	Dilution Water :	SDI Diluent
Number of Controls :	2	Sample Storage :	4±2 °C
Number of Concentrations Tested :	8	Colour Correction :	None
Number of Replicates :	2	Analyst(s):	RD

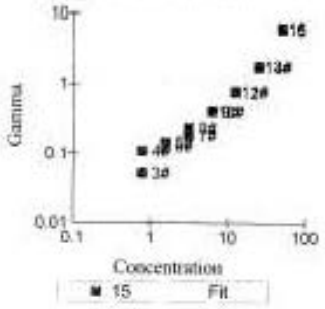
Date: 2008-01-08 (yyyy-mm-dd)

Approved by: [signature] Project Manager

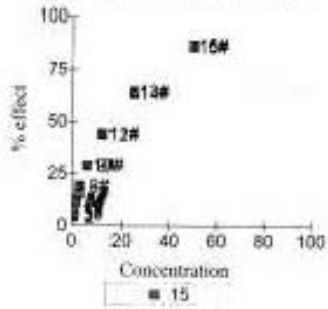
Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order: 212550
Sample Number: 20347

Plot of Gamma vs Concentration



Plot of %Effect vs Concentration



15 Mins Data:

Sample	Conc	Io	It	Gamma	% effect
Control	0.000	93.98	70.69	0.7522 #	
Control	0.000	83.50	65.53	0.7848 #	
Control	0.000	88.06	67.22	0.7633 #	
Control	0.000	84.95	62.81	0.7394 #	
1	0.3906	81.08	58.86	0.0408 *	4.471%
2	0.3906	84.44	61.50	0.0433 *	4.158%
3	0.7813	86.02	62.09	0.0528 #	5.015%
4	0.7813	87.01	59.63	0.1089 #	9.817%
5	1.563	84.53	56.11	0.1448 #	12.65%
6	1.563	81.95	55.22	0.1278 #	11.33%
7	3.125	90.65	58.36	0.1804 #	15.28%
8	3.125	87.43	53.77	0.2356 #	19.07%
9	6.250	86.19	46.69	0.4028 #	28.72%
10	6.250	94.16	50.93	0.4050 #	28.82%
11	12.50	88.48	37.56	0.7901 #	44.14%
12	12.50	92.03	39.56	0.7678 #	43.43%
13	25.00	86.88	23.54	1.805 #	64.35%
14	25.00	88.34	24.56	1.733 #	63.42%
15	50.00	86.68	9.42	5.993 #	85.70%
16	50.00	95.66	9.85	6.380 #	86.45%

- used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 15 Mins data:
IC50 Concentration:12.18% (95% confidence range: 10.08 to 14.72)
95% Confidence Factor: 1.209
Estimating Equation:LOG C =0.9495 x LOG G +1.086
Coeff. of Determination (R^2):0.9620
Slope: 1.013
Correction Factor: 0.7599

Signature: _____

AquaTox Microtox Report – Alma Jan. 19, 2008

AquaTox Testing & Consulting Inc.
118 Nicholas Beaver Rd
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

MICROTOX® ACUTE TOXICITY TEST REPORT

Work Order : 212694
Sample Number : 20525

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.	Time Collected :	11:45
Location :	South Rawden NS	Date Collected :	2008-01-19
Substance :	Produced Water	Date Received :	2008-01-23
Sampling Method :	Grab	Date Tested :	2008-01-24
Sampled By :	G. Harris	Temp. on arrival :	6.0°C
Sample Description:	Clear, colourless, some odour.		

Test Method : Toxicity Test Using Luminescent Bacteria, Protocol EPS 1/RM/24, Environment Canada, 1992, with deviation(s) as noted below.

TEST RESULTS

Test Endpoint	Value	95% Confidence Limits	Calculation Method
15 minute IC50	1.44%	1.27-1.64	Least Square Regression

The results reported relate only to the sample tested.

REFERENCE TOXICANT DATA

Reagent Batch :	7J1001	15 minute IC50 :	2.66 mg/L*
Expiry Date :	09/2009	95% Confidence Limits :	2.25-3.14 mg/L
Date Tested (yyyy-mm-dd) :	2008-01-17	Historical Mean IC50 :	1.46 mg/L
Reference Substance :	Zinc (as zinc sulphate)	Warning Limits (± 2SD) :	0.65-2.39 mg/L
Statistical Method :	Least Square Regression	Analyst(s):	AS

*Note: The IC50 result for the reference toxicant test was between the upper 95% and 99% confidence limits in the warning chart. Statistically this can be expected to occur in 5% of the reference toxicant tests performed. No other unusual circumstances were observed and therefore the result is considered acceptable.

CONDITIONS OF ACUTE MICROTOX TEST

Test Organism :	*Vibrio fischeri*	Test Initiation Time :	15:15
Reagent Batch :	7J1001	Observation Time(s) :	15 minutes
Date Reagent Received :	2007-12-11	Sample Pre-aeration/Aeration :	None
Reagent Holding Temperature :	-23 °C	Sample pH :	4.7
Analyzer Model Number :	M500	pH Adjustment :	None
Test Well Temperature :	15.0 ± 0.3 °C	Salinity Adjustment :	2% NaCl
Highest Concentration Tested :	50 %	Dilution Water :	SDI Diluent
Number of Controls :	2	Sample Storage :	4±2 °C
Number of Concentrations Tested :	8	Colour Correction :	None
Number of Replicates :	2	Analyst(s):	LB

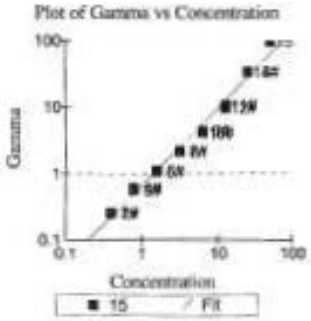
Noted Deviation(s): The maximum 3 day sample holding time as specified by the test method was exceeded.

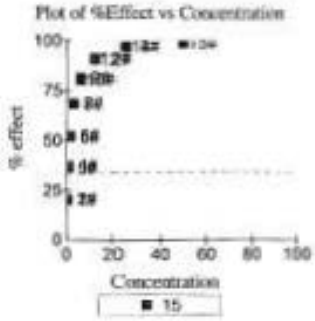
Date 2008-02-05 (yyyy-mm-dd)

Approved by: (Project Manager)

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order: 212694
Sample Number: 20525





15 Mins Data:

Sample	Conc	Io	It	Gamma	% effect
Control	0.000	95.77	75.52	0.7886 #	
Control	0.000	96.94	74.40	0.7675 #	
Control	0.000	93.34	73.62	0.7887 #	
Control	0.000	89.58	72.87	0.8135 #	
1	0.3906	89.65	56.63	0.2499 #	20.00%
2	0.3906	91.00	57.12	0.2579 #	20.50%
3	0.7813	91.71	46.31	0.5636 #	36.05%
4	0.7813	91.85	45.41	0.5970 #	37.38%
5	1.563	91.26	34.78	1.072 #	51.73%
6	1.563	89.82	33.90	1.092 #	52.20%
7	3.125	95.22	23.97	2.136 #	68.12%
8	3.125	82.39	20.56	2.164 #	68.39%
9	6.250	87.45	12.91	4.348 #	81.30%
10	6.250	89.89	13.96	4.084 #	80.33%
11	12.50	88.55	6.02	10.61 #	91.39%
12	12.50	89.75	6.66	9.640 #	90.60%
13	25.00	84.12	1.93	33.41 #	97.09%
14	25.00	87.53	1.98	33.90 #	97.14%
15	50.00	84.07	0.68	96.61 #	98.98%
16	50.00	94.68	0.70	105.8 *	99.06%

A - used in calculation; * - invalid data; D - deleted from calcs.

Calculations on 15 Mins data:
IC50 Concentration: 1.442% (95% confidence range: 1.272 to 1.635)
95% Confidence Factor: 1.134
Estimating Equation: LOG C =0.8473 x LOG G +0.1589
Coeff. of Determination (R^2): 0.9863
Slope: 1.164
Correction Factor: 0.7896

Signature: Laura J Bonnell

Stantec Consulting Ltd.
11B Nicholas Beaver Road RR3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419
stantec.com

Sea Urchin Test Report
Fertilization Inhibition

Stantec

Work Order : 211858
Sample Number : 19315

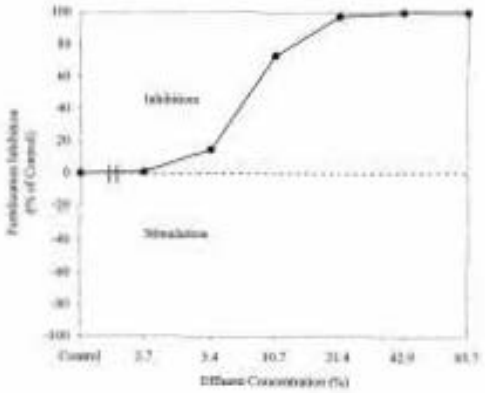
Sample Identification

Company :	Harris Industrial Testing Service Ltd.		
Location :	South Rawdon NS	Date Collected :	2007-08-13
Substance :	Produce Water	Time Collected :	Not given
Sampling Method :	Grab	Date Received :	2007-08-16
Sampled By :	Not peovided	Time Received :	14:00
Shipped By:	Fed Ex/Rd	Date Tested :	2007-08-16
Temp. on arrival :	21.0 °C	Lab Storage:	4±2 °C
Sample Description:	Clear, colourless, strong odour.		

Test Results

Effect	Value	95% Confidence Limits	Statistical Method
IC25 (Reproduction)	6.1%	5.7-6.4	Linear Interpolation (Toxstat 3.5) b

Sea Urchin Reproductive Inhibition



Work Order : 211858
Sample Number: 19315

Test Conditions

Test Organism [a]	*Lytechinus pictus*	Test Type	Static non-renewal
Gamete Batch	Ur07-08-16	Test Volume (per replicate)	10 mL
Source	Stantec in-house culture	Test Solution Depth	3 cm
Life Stage	Gamete (sperm / egg)	Test Vessel	20 mL scintillation vial
Mean Organism Mortality	0% (previous 7 days)	Exposure Time (Sperm)	10 minutes
Salinity Adjustment [c]	Yes	Exposure Time (Eggs)	10 minutes
pH Adjustment	None	# Replicates	4
Sample Filtration	No	Volume sperm suspension	0.1 mL per replicate
Sample Pre-aeration Time	0:00	Volume of egg suspension	1 mL per replicate
Test Aeration	None	Eggs per replicate	2000
Light Intensity	Ambient lighting (~400 lux)	Sperm per replicate	4.0×10^5
Test Temperature	20.0 ± 1 °C	Test Initiation Time	15:40
Control/Dilution Water [d]	Artificial seawater	Analyst(s)	EJ

[a] Test Organism: Adult sea urchins (*Lytechinus pictus*) were obtained from Marinus Scientific (Garden Grove CA USA) following the Environment Canada procedures for the importation of test organisms (September 1999). They were received by the laboratory on May 17, 2007 in good condition. Sea urchins were placed in glass aquaria containing artificial seawater (salinity 30‰ and temperature 12-14°C), and are continually held under these conditions. The organisms were held at the laboratory for a minimum of two weeks prior to collection of the gametes for testing purposes. No organisms exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used as a source of gametes for testing.

[c] Salinity Adjustment : The salinity of the effluent sample was adjusted following Environment Canada's Salinity Adjustment Guidance Document (revised December 2001), using the Hypersaline Brine Addition procedure. Hypersaline brine (~90 ‰) was prepared by dissolving Instant Ocean® Sea Salt in reverse osmosis water. Prior to test initiation, the brine was added to the effluent sample, to achieve a final salinity of 30 ± 2 g/kg.

[d] Control/Dilution Water: Artificial seawater was prepared in advance over the course of 3 or 4 days by adding Instant Ocean® salts to reverse osmosis water at a rate of 6.8 kg per day. The water was then left to age for a period of two weeks, after which it was filtered prior to use. During the entire process, the water was continuously aerated

Test Protocol: Biological Test Method: Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars). Environment Canada Report EPS 1/RM/27, December 1992 (with November 1997 amendments).

Comments

There were no unusual conditions or deviations from the test protocol. The results reported relate only to the sample tested.

Reference Toxicant Data

Substance	Copper (as Copper Sulphate)	Historical Mean IC25	144.9 µg/L
Test Date	2007-08-16	Historical Warning Limits (±2SD)	59.4 - 368.5 µg/L
Test Duration	20 minutes	Statistical Method	Linear Interpolation[e]
IC25 Fertilization	129.6 µg/L	Gamete Batch	Ur07-08-01
95% Confidence Limits	122.2 - 137.2 µg/L	Analyst(s)	EJ

The reference toxicant test was conducted under conditions identical to the test.

References

[b] West, Inc. and D. Gulley. 1996. Toxstat Release 3.5. Western Ecosystems Technology, Cheyenne, WY, U.S.A.

Environment Canada. September 1999. Recommended Procedure for the Importation of Test Organisms for Sublethal Toxicity Testing.

Date: 2007-09-11

Approved By: J. Lindsay
Project Manager

Work Order : 211858
Sample Number : 19315

FERTILIZATION (%)

Concentration (%)	Replicate A	B	C	D	Average	Standard Deviation	CV (%)
Control	76	83	82	77	79.5	3.5	4.4
Blank	0	0	0	0	0.0	0.0	–
0.33	–	77	–	–	–	–	–
0.67	–	–	86	–	–	–	–
1.3	–	–	–	80	–	–	–
2.7	83	79	76	77	78.8	3.1	3.9
5.4	65	69	67	70	67.8	2.2	3.3
10.7	21	20	25	20	21.5	2.4	11.1
21.4	0	2	4	2	2.0	1.6	81.6
42.9	0	0	0	0	0.0	0.0	–
85.7	0	0	0	0	0.0	0.0	–

Initial Water Chemistry (100% Effluent)

	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)	Pre-aeration Time (h)[1,2]
Initial Chemistry:	21.0	5.9	6.1	78	20	–
Chemistry after Salinity Adjustment[1]:	20.0	6.3	7.0	98	30	–
Chemistry after Pre-Aeration[1,2]:	–	–	–	–	–	0:00

Exposure Concentrations Water Chemistry

Concentration (%)	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)
85.7	21.0	6.3	5.7	81	30
42.9	–	–	–	–	–
21.4	–	–	–	–	–
10.7	–	–	–	–	–
5.4	21.0	8.2	7.1	100	31
2.7	–	–	–	–	–
1.3	–	–	–	–	–
0.67	–	–	–	–	–
0.33	21.0	8.3	7.2	100	31
Blank	–	–	–	–	–
Control	21.0	8.2	7.1	100	31

* % saturation, adjusted for barometric pressure
"–" not required
[1] if applicable
[2] @ <100 bubbles/min

Data Reviewed By : J
Date : 2007-09-06

AquaTox Sea Urchin Laboratory Report –Thebaud Nov. 26, 2007

AquaTox Testing & Consulting Inc.
118 Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel (519) 763-4412 Fax (519) 763-4419

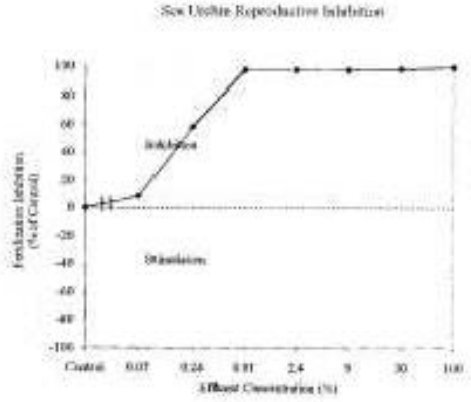
Work Order : 212434
Sample Number : 20188

Sample Identification

Company :	Harris Industrial Testing Service Ltd.		
Location :	South Rawden NS	Date Collected :	2007-11-26
Substance :	Thebaud Produced Water	Time Collected :	14:00
Sampling Method :	Not given	Date Received :	2007-11-28
Sampled By :	R. Sweet	Time Received :	14:05
Shipped By:	Fed Ex/Rd	Date Tested :	2007-11-28
Temp. on arrival :	4.0 °C	Lab Storage:	4±2 °C
Sample Description:	Clear, colourless, odourless.		

Test Results

Effect	Value	95% Confidence Limits	Statistical Method
IC25 (Reproduction)	0.11%	0.07-0.14	Linear Interpolation (Toxstat 3.5) b



Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order: 212434
Sample Number: 20188

Test Conditions

Test Organism*	*Lytechinus pictus*	Test Type	Static non-renewal
Gamete Batch	Ur 07-11-01	Test Volume (per replicate)	10 mL
Source	In-house culture	Test Solution Depth	3 cm
Life Stage	Gamete (sperm / egg)	Test Vessel	20 mL scintillation vial
Mean Organism Mortality	7.7% (previous 7 days)	Exposure Time (Sperm)	10 minutes
Salinity Adjustment†	No	Exposure Time (Eggs)	10 minutes
pH Adjustment	None	# Replicates	4
Sample Filtration	No	Volume sperm suspension	0.1 mL per replicate
Sample Pre-aeration Time	0:20	Volume of egg suspension	1 mL per replicate
Test Aeration	None	Eggs per replicate	2600
Light Intensity	Ambient lighting (~400 lux)	Sperm per replicate	4.0×10^5
Test Temperature	20.0 ± 1 °C	Test Initiation Time	15:45 h
Control/Dilution Water‡	Artificial seawater	Analyst(s)	MR/RD

*Test Organism: Adult sea urchins (*Lytechinus pictus*) were obtained from Marinus Scientific (Garden Grove CA USA) following the Environment Canada procedures for the importation of test organisms (September 1999). They were received by the laboratory on May 17, 2007 in good condition. Sea urchins were placed in glass aquaria containing artificial seawater (salinity 30‰ and temperature 12-14°C), and are continually held under these conditions. The organisms were held at the laboratory for a minimum of two weeks prior to collection of the gametes for testing purposes. No organisms exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used as a source of gametes for testing.

† Salinity Adjustment: The salinity of the effluent sample was adjusted following Environment Canada's Salinity Adjustment Guidance Document (revised December 2001), using the Direct Salt Addition procedure. Prior to test initiation, Instant Ocean® Sea Salt was added to the undiluted effluent sample. The dry salt (~36g/L) was added during the stirring of the effluent sample, to achieve a final salinity of 30 ± 2 g/kg. After salinity adjustment, the sample was stored in a closed container with minimal head space at 4 ± 2°C in darkness. The salinity adjusted sample was held for 16-24 hours before use in toxicity testing.

‡ Control/Dilution Water: Artificial seawater was prepared in advance over the course of 3 or 4 days by adding Instant Ocean® salts to reverse osmosis water at a rate of 6.8 kg per day. The water was then left to age for a period of two weeks, after which it was filtered prior to use. During the entire process, the water was continuously aerated.

Test Protocol: Biological Test Method: Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars). Environment Canada Report EPS 1/RM/27, December 1992 (with November 1997 amendments).

Comments

There were no unusual conditions or deviations from the test protocol. The results reported relate only to the sample tested.

Reference Toxicant Data

Substance	Copper (as Copper Sulphate)	Historical Mean IC25	131.4 µg/L
Test Date	2007-11-28	Historical Warning Limits (±2SD)	55.5 - 323.5 µg/L
Test Duration	20 minutes	Statistical Method	Linear Interpolation[5]
IC25 Fertilization	47.1 µg/L*	Gamete Batch	Ur07-11-01
95% Confidence Limits	42.1 - 51.0 µg/L	Analyst(s)	MR/RD

The reference toxicant test was conducted under conditions identical to the test.
*Test results fell slightly below historical warning limits, but within the control limits of the reference toxicant warning chart. A record of test non-conformity is kept on file at the laboratory.

References

[5] West, Inc. and D. Gulley. 1996. Toxstat Release 3.5. Western Ecosystems Technology, Cheyenne, WY, U.S.A.

Environment Canada. September 1999. Recommended Procedure for the Importation of Test Organisms for Sublethal Toxicity Testing.

Date: 2008-01-02 (yyyy-mm-dd)

Approved By: J. Lindsay, Project Manager

Work Order : 212434
Sample Number : 20188

FERTILIZATION (%)

Concentration (%)	Replicate A	B	C	D	Average	Standard Deviation	CV (%)
Control	76	85	81	78	80.0	3.9	4.9
Blank	1	0	0	1	0.5	0.6	115.5
0.07	78	59	81	75	73.3	9.8	13.4
0.24	40	23	41	29	33.3	8.7	26.3
0.81	3	2	1	2	2.0	0.8	40.8
2.4	4	3	0	2	2.0	1.6	81.6
9	2	0	1	4	1.8	1.7	97.6
30	0	2	2	1	1.3	1.0	76.6
100	0	0	0	1	0.3	0.5	200.0

Initial Water Chemistry (100% Effluent)

	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)	Pre-aeration Time (h)[1,2]
Initial Chemistry	20.0	5.7	7.5	104	82	–
Chemistry after Salinity Adjustment[1]	–	–	–	–	–	–
Chemistry after Pre-Aeration[2]	21.0	6.9	7.1	98	83	0:20

Exposure Concentrations Water Chemistry

Concentration (%)	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)
100	21.0	6.9	7.1	98	82
30	–	–	–	–	–
9	20.5	7.5	7.2	97	38
2.4	–	–	–	–	–
0.81	–	–	–	–	–
0.24	–	–	–	–	–
0.07	20.5	8.0	7.4	102	31
Blank	20.5	8.1	7.4	100	31
Control	20.5	8.1	7.4	100	31

* % saturation, adjusted for barometric pressure
"–" not measured
[1] if applicable
[2] @ <100 bubbles/min

Data Reviewed By: _____
Date: 2007-12-21

AquaTox Sea Urchin Laboratory Report –Venture Oct.7, 2007

AQUATOX
AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON. N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

Sea Urchin Test Report
Fertilization Inhibition

Work Order : 212137
Sample Number : 19749

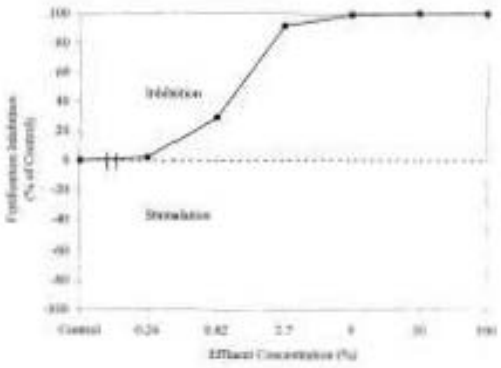
Sample Identification

Company :	Harris Industrial Testing Service Ltd.		
Location :	South Rawdon NS	Date Collected :	2007-10-07
Substance :	Venture Produce H2O	Time Collected :	Not given
Sampling Method :	Grab	Date Received :	2007-10-10
Sampled By :	R. Beaton	Time Received :	14:00
Shipped By:	Fed Ex/Rd	Date Tested :	2007-10-10
Temp. on arrival :	12.0 °C	Lab Storage:	4±2 °C
Sample Description:	Cloudy, orange, strong odour.		

Test Results

Effect	Value	95% Confidence Limits	Statistical Method
IC25 (Reproduction)	0.69%	0.47-1.00	Linear Interpolation (Toxstat 3.5) b

Sea Urchin Reproductive Inhibition



Note: The recommended weekly mortality rate (≤2% per day, averaged over seven days preceding collection of gametes) was exceeded. However the test control passed the method validity criteria and the reference toxicant test, initiated along side this test, using the same batch of organisms, fell with the warning limits of + 2SD and confidence limits of + 3SD .

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

AQUATOX

Sea Urchin Test Report
Fertilization Inhibition

Work Order : 212137
Sample Number: 19749

Test Conditions

Test Organism [a]	: *Lytechinus pictus*	Test Type	: Static non-renewal
Gamete Batch	: Ur07-10-01	Test Volume (per replicate)	: 10 mL
Source	: In-house culture	Test Solution Depth	: 3 cm
Life Stage	: Gamete (sperm / egg)	Test Vessel	: 20 mL scintillation vial
Mean Organism Mortality	: 8% (previous 7 days)	Exposure Time (Sperm)	: 10 minutes
Salinity Adjustment	: Not required (salinity = 28.0‰)	Exposure Time (Eggs)	: 10 minutes
pH Adjustment	: None	# Replicates	: 4
Sample Filtration	: No	Volume sperm suspension	: 0.1 mL per replicate
Sample Pre-aeration Time	: 0.00	Volume of egg suspension	: 1 mL per replicate
Test Aeration	: None	Eggs per replicate	: 2000
Light Intensity	: Ambient lighting (~400 lux)	Sperm per replicate	: 4.0×10^5
Test Temperature	: 20.0 ± 1 °C	Test Initiation Time	: 15:05 h
Control/Dilution Water [#]	: Artificial seawater	Analyst(s)	: MR/EJ

[a] Test Organism: Adult sea urchins (*Lytechinus pictus*) were obtained from Marinus Scientific (Garden Grove CA USA) following the Environment Canada procedures for the importation of test organisms (September 1999). They were received by the laboratory on May 17, 2007 in good condition. Sea urchins were placed in glass aquaria containing artificial seawater (salinity 30‰ and temperature 12-14°C), and are continually held under these conditions. The organisms were held at the laboratory for a minimum of two weeks prior to collection of the gametes for testing purposes. No organisms exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used as a source of gametes for testing.

[#] Control/Dilution Water: Artificial seawater was prepared in advance over the course of 3 or 4 days by adding Instant Ocean® salts to reverse osmosis water at a rate of 6.8 kg per day. The water was then left to age for a period of two weeks, after which it was filtered prior to use. During the entire process, the water was continuously aerated.

Test Protocol: Biological Test Method: Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars). Environment Canada Report: EPS 1/RM/27, December 1992 (with November 1997 amendments).

Comments

There were no unusual conditions or deviations from the test protocol. The results reported relate only to the sample tested.

Reference Toxicant Data

Substance	: Copper (as copper sulphate)	Historical Mean IC25	: 140.3 µg/L
Test Date	: 2007-10-25	Historical Warning Limits (±2SD)	: 68.4 - 295.6 µg/L
Test Duration	: 20 minutes	Statistical Method	: Linear Interpolation (Toxs
IC25 Fertilization	: 123.9 µg/L	Gamete Batch	: Ur07-10-02
95% Confidence Limits	: 93.8 - 141.8 µg/L	Analyst(s)	: MR/RD

The reference toxicant test was conducted under conditions identical to the test.

References

[b] West, Inc. and D. Gulley. 1996. Toxstat Release 3.5. Western Ecosystems Technology, Cheyenne, WY, U.S.A.

Environment Canada. September 1999. Recommended Procedure for the Importation of Test Organisms for Sublethal Toxicity Testing.

Date: 2007-11-05
yyyy-mm-dd

Approved By: J. Lindsay
Project Manager

Work Order: 212137
Sample Number: 19749

FERTILIZATION (%)

Concentration (%)	Replicate A	B	C	D	Average	Standard Deviation	CV (%)
Control	96	97	96	98	96.8	1.0	1.0
Blank	2	0	1	0	0.8	1.0	127.7
0.006	–	–	–	–	–	–	–
0.02	–	–	–	–	–	–	–
0.07	–	–	–	–	–	–	–
0.24	96	96	94	93	94.8	1.5	1.6
0.82	78	59	64	74	68.8	8.8	12.8
2.7	10	4	11	7	8.0	3.2	39.5
9	2	0	0	1	0.8	1.0	127.7
30	0	0	0	0	0.0	0.0	–
100	0	0	0	0	0.0	0.0	–

Initial Water Chemistry (100% Effluent)

	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)	Pre-aeration Time (h)[1,2]
Initial Chemistry:	18.5	5.5	6.0	80	260	–
Chemistry after Salinity Adjustment[1]:	–	–	–	–	–	–
Chemistry after Pre-Aeration[1,2]:	–	–	–	–	–	0:00

Exposure Concentrations Water Chemistry

Concentration (%)	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)
100	18.5	5.5	6.0	80	260
30	19.5	6.7	6.1	86	89
9	20.0	7.3	6.4	90	53
2.7	20.0	7.7	6.5	91	39
0.82	20.0	8.0	6.7	94	36
0.24	20.0	8.0	6.7	94	33
0.07	20.0	8.0	6.6	93	32
0.02	20.0	8.1	6.7	94	32
0.006	20.0	8.2	6.7	94	32
Blank	20.0	8.2	6.6	91	32
Control	20.0	8.2	6.6	91	32

* % saturation, adjusted for barometric pressure
–: * not required
[1] if applicable
[2] @ <100 bubbles/min

Data Reviewed By: JC
Date: 2007-10-25

AQUATOX
AquaTox Testing & Consulting Inc.
115 Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

Sea Urchin Test Report
Fertilization Inhibition
1 of 3

Work Order : 212550
Sample Number : 20347

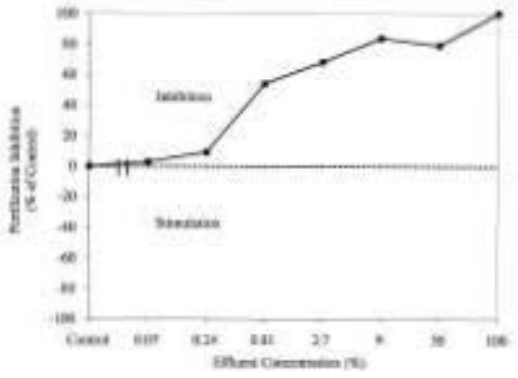
Sample Identification

Company :	Harris Industrial Testing Service Ltd.		
Location :	South Reaubos NS	Date Collected :	2007-12-15
Substance :	SV Produced Water	Time Collected :	Not given
Sampling Method :	Grab	Date Received :	2007-12-18
Sampled By :	Bdo Jentiego	Time Received :	14:00
Shipped By:	Fed Ex/Rd	Date Tested :	2007-12-18
Temp. on arrival :	6.0 °C	Lab Storage:	4±2 °C
Sample Description:	Cloudy light brown, strong odour.		

Test Results

Effect	Value	95% Confidence Limits	Statistical Method
IC25 (Reproduction)	0.37%	0.15-0.51	Linear Interpolation (Toxstat 3.5) b

Sea Urchin Reproductive Inhibition



Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order : 212550
Sample Number: 20347

Test Conditions

Test Organism [a]	*Lytechinus pictus*	Test Type	Static non-renewal
Gamete Batch	Ur 07-12-01	Test Volume (per replicate)	10 mL
Source	In-house culture	Test Solution Depth	3 cm
Life Stage	Gamete (sperm / egg)	Test Vessel	20 mL scintillation vial
Mean Organism Mortality	4.5% (previous 7 days)	Exposure Time (Sperm)	10 minutes
Salinity Adjustment [b]	No	Exposure Time (Eggs)	10 minutes
pH Adjustment	None	# Replicates	4
Sample Filtration	No	Volume sperm suspension	0.1 mL per replicate
Sample Pre-aeration Time	0:00	Volume of egg suspension	1 mL per replicate
Test Aeration	None	Eggs per replicate	2000
Light intensity	Ambient lighting (~400 lux)	Sperm per replicate	4.0×10^5
Test Temperature	20.0 ± 1 °C	Test Initiation Time	15:30 h
Control/Dilution Water [c]	Artificial seawater	Analyst(s)	MR/RD

[a] Test Organism: Adult sea urchins (*Lytechinus pictus*) were obtained from Marinus Scientific (Garden Grove CA USA) following the Environment Canada procedures for the importation of test organisms (September 1999). They were received by the laboratory on October 16, 2007 in good condition. Sea urchins were placed in glass aquaria containing artificial seawater (salinity 30‰ and temperature 12-14°C), and are continually held under these conditions. The organisms were held at the laboratory for a minimum of two weeks prior to collection of the gametes for testing purposes. No organisms exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used as a source of gametes for testing.

[b] Salinity Adjustment: The salinity of the effluent sample was adjusted following Environment Canada's Salinity Adjustment Guidance Document (revised December 2001), using the Direct Salt Addition procedure. Prior to test initiation, Instant Ocean® Sea Salt was added to the undiluted effluent sample. The dry salt (~30g/L) was added during the stirring of the effluent sample, to achieve a final salinity of 30 ± 2 g/kg. After salinity adjustment, the sample was stored in a closed container with minimal head space at 4 ± 2°C in darkness. The salinity adjusted sample was held for 16-24 hours before use in toxicity testing.

[c] Control/Dilution Water: Artificial seawater was prepared in advance over the course of 3 or 4 days by adding Instant Ocean® salts to reverse osmosis water at a rate of 6.8 kg per day. The water was then left to age for a period of two weeks, after which it was filtered prior to use. During the entire process, the water was continuously aerated.

Test Protocol: Biological Test Method: Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars). Environment Canada Report EPS 1/RM/27, December 1992 (with November 1997 amendments).

Comments

There were no unusual conditions or deviations from the test protocol. The results reported relate only to the sample tested.

Reference Toxicant Data

Substance	Copper (as Copper Sulphate)	Historical Mean IC25	126.2 µg/L
Test Date	2008-12-18	Historical Warning Limits (±2SD)	52.8 - 313.6 µg/L
Test Duration	20 minutes	Statistical Method	Linear Interpolation [a]
IC25 Fertilization	83.6 µg/L	Gamete Batch	Ur07-12-01
95% Confidence Limits	64.1 - 116.5 µg/L	Analyst(s)	MR/RD

The reference toxicant test was conducted under conditions identical to the test.

References

[a] Weis, Inc. and D. Gulley. 1996. Toxstat Release 3.5. Western Ecosystems Technology. Cheyenne, WY, U.S.A.

Environment Canada. September 1999. Recommended Procedure for the Importation of Test Organisms for Sublethal Toxicity Testing.

Date: 2008-01-25 (yyyy-mm-dd)

Approved By: J. Rinda (Project Manager)

Work Order : 212550
Sample Number : 20347

FERTILIZATION (%)

Concentration (%)	Replicate A	B	C	D	Average	Standard Deviation	CV (%)
Control	58	63	57	61	59.8	2.8	4.6
Blank	1	1	1	0	0.8	0.5	66.7
0.07	56	60	56	60	58.0	2.3	4.0
0.24	52	39	66	80	54.3	11.7	21.5
0.81	17	31	35	27	27.5	7.7	28.1
2.7	20	20	20	16	19.0	2.0	10.5
9	9	11	9	10	9.8	1.0	9.8
30	13	12	12	13	12.5	0.6	4.6
100	0	0	0	0	0.0	0.0	-

NOTES : 2007-12-21 : Scored by MR.
Eggs in the 9% exposure appeared clumped together.

Initial Water Chemistry (100% Effluent)

	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)	Pre-aeration Time (hr)[1,2]
Initial Chemistry	20.0	5.7	6.7	88	90	-
Chemistry after Salinity Adjustment [1]	-	-	-	-	-	-
Chemistry after Pre-Aeration [1,2]	-	-	-	-	-	0:00

Exposure Concentrations Water Chemistry

Concentration (%)	Temp. (°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)
100	19.0	5.7	6.7	88	90
30	-	-	-	-	-
9	-	-	-	-	-
2.7	-	-	-	-	-
0.81	20.0	6.7	6.9	90	36
0.24	-	-	-	-	-
0.07	-	-	-	-	-
Blank	20.0	8.1	7.3	98	31
Control	20.0	8.1	7.3	98	31

* % saturation, adjusted for barometric pressure
"-" not measured
[1] if applicable
[2] @ <100 bubbles/min

Data Reviewed By : JC
Date : 2008-01-24

AQUATOX
AquaTox Testing & Consulting Inc.
113 Nicholas Beaver Rd.
RR 5
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

Sea Urchin Test Report
Fertilization Inhibition

Work Order : 212694
Sample Number : 20525

SAMPLE IDENTIFICATION

Company :	Harris Industrial Testing Service Ltd.		
Location :	South Rawden NS	Date Collected :	2008-01-19
Substance :	Produced Water	Time Collected :	11:45
Sampling Method :	Grab	Date Received :	2008-01-23
Sampled By :	G. Harris	Time Received :	13:45
Temp. on arrival :	6.0°C	Date Tested :	2008-01-24
Sample Description :	Clear, colourless, some odour.		

Test Method : Fertilization Assay Using Echinoids (Sea Urchins and Sand Dollars). Environment Canada, Conservation and Protection. Ottawa, Ontario. EPS 1/RM/27, December 1992 (as amended November 1997), with deviation(s) as noted below.

TEST RESULTS

Effect	Value	95% Confidence Limits	Statistical Method
IC25 (Fertilization)	0.54%	0.38-0.70	Linear Interpolation (Toxstat 3.5) a

The results reported relate only to the sample tested.

COPPER (AS COPPER SULPHATE) REFERENCE TOXICANT DATA

Date Tested :	2008-01-24	Statistical Method :	Linear Interpolationa
Gamete Batch :	Ur08-01-01	Historical Mean IC25 :	122.8 µg/L
Test Duration :	20 minutes	Warning Limits (± 2SD) :	52.7 - 296.9 µg/L
IC25 Fertilization :	116.7 µg/L	Analyst(s) :	EI/RD
95% Confidence Limits :	111.4 - 122.0 µg/L		

The reference toxicant test was performed under the same experimental conditions as those used with the test sample.

TEST CONDITIONS

Test Vessel :	20 mL glass scintillation vial	Sperm Exposure Time [d] :	20 min
Volume per Replicate :	10 mL	Egg Exposure Time :	10 min
Number of Replicates :	4 per treatment	Total Duration of Test :	20 min
Depth of Test Solution :	Approx. 3 cm	pH Adjustment :	None
Sperm Density :	40000000 per vessel	Sample Filtration :	None
Sperm : Egg Ratio :	20000 : 1	Test Aeration :	None
Control/Dilution Water :	Artificial Sea Water[c]	Test Method Deviation(s) :	Yes (see 'Comments')

[c] no additional chemicals added
[d] 10 min exposure, continued for an additional 10 min after addition of eggs

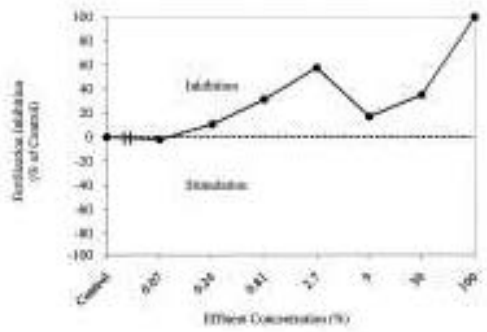
COMMENTS

•All test validity criteria as specified in the test method cited above were satisfied.
•No organisms or gametes exhibiting unusual appearance, behaviour, or undergoing unusual treatment were used in the Noted Deviation(s). The maximum 3 day sample holding time as specified by the test method was exceeded. There were no other unusual conditions or deviations from the test protocol.

Accredited by the Canadian Association of Environmental Analytical Laboratories (CAEAL)

Work Order : 212694
Sample Number : 20525

Sea Urchin Fertilization Inhibition



TEST ORGANISM

Adult Test Organism :	*Lytechinus pictus*	Holding Salinity :	30 ± 2 ‰
Adult Organism Source :	Marinus Scientific	Holding Vessel :	Glass aquaria
Source Location :	Garden Grove CA USA	Adult Mortality Rate :	0% (previous 7 days)
Date Received :	2007-10-16	Life Stage Tested :	Gamete (sperm/egg)
Holding Water :	Artificial Sea Water[2]	Gamete Batch Tested :	Ur08-01-01
Holding Temperature :	12 - 14 °C		

Reference : Recommended Procedure for the Importation of Test Organisms for Sublethal Toxicity Testing. Environment Canada, September 1999.

REFERENCES

[a] West, Inc. and D. Gulley. 1996. Toxstat Release 3.5. Western Ecosystems Technology. Cheyenne, WY. U.S.A.

[b]Environment Canada. 2001. Revised Procedures for Adjusting Salinity of Effluent Samples for Marine Sublethal Toxicity Testing Conducted under Environmental Effects Monitoring (EEM) Programs. Method Development and Applications Section, Environmental Technology Centre. December 2001.

Date : 2008-02-19
yyyy-mm-dd

Approved By : *Project Manager*

Work Order : 212694
Sample Number : 20525

FERTILIZATION DATA

Test Performed By : EJ/RD
Enumerated By : EJ

Concentration (%)	Replicate	Fertilized	Unfertilized	% Fertilized	Treatment Mean Fertilization (%)
Control	A	91	9	91	92.25
	B	96	4	96	
	C	93	7	93	
	D	89	11	89	
Blank	A	2	98	2	1.25
	B	2	98	2	
	C	0	100	0	
	D	1	99	1	
0.02	A	–	–	–	–
	B	–	–	–	
	C	–	–	–	
	D	–	–	–	
0.07	A	97	3	97	94.25
	B	93	7	93	
	C	90	10	90	
	D	97	3	97	
0.24	A	85	15	85	82.5
	B	79	21	79	
	C	77	23	77	
	D	89	11	89	
0.81	A	65	35	65	63.5
	B	65	35	65	
	C	66	34	66	
	D	58	42	58	
2.7	A	45	55	45	39.25
	B	37	63	37	
	C	38	62	38	
	D	37	63	37	
9	A	82	18	82	76.75
	B	76	24	76	
	C	76	24	76	
	D	73	27	73	
30	A	50	50	50	60
	B	66	34	66	
	C	50	50	50	
	D	74	26	74	
100	A	0	100	0	0.25
	B	1	99	1	
	C	0	100	0	
	D	0	100	0	

NOTES : At higher test conc. (100, 30%) the fertilization membrane is not fully extended, but rather very close to the egg - EJ

"–" = not counted/not required

Data Reviewed By : JC
Date : 2008-02-12

Work Order : 212694
Sample Number : 20525

INITIAL WATER CHEMISTRY (100% EFFLUENT)

	Temp.(°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)	Pre-aeration Time (h)
Initial Chemistry:	20.0	4.8	9.7	112	9	–
Chemistry after Salinity Adjustment [1]:	20.0	5.5	8.3	119	29	–
Chemistry after Pre-Aeration [1,2]:	20.0	6.0	7.1	101	29	0:20

SALINITY ADJUSTMENT OF 100% EFFLUENT

Method :	Direct Salt Addition	Volume Adjusted :	800 mL
Salt Added :	Instant Ocean™	Amount of Salt Added :	16.8 g
Date Adjusted :	2008-01-23	Aging Time :	17.5
Aging Conditions :	Sealed, complete darkness, minimal air space	Aging Temperature :	4±2°C

Reference : Salinity Adjustment Guidance Document. Environment Canada, revised December 2001.[3]

EXPOSURE CONCENTRATIONS WATER CHEMISTRY

Concentration (%)	Temp.(°C)	pH	Dissolved O_2 (mg/L)	O_2 Sat. (%)*	Salinity (‰)
Control	19.0	8.0	7.5	100	32
Blank	19.0	8.0	7.5	100	32
0.02	19.0	8.0	7.6	101	32
0.07	–	–	–	–	–
0.24	–	–	–	–	–
0.81	–	–	–	–	–
2.7	–	–	–	–	–
9	19.0	7.9	7.5	100	32
30	19.0	7.6	7.3	97	32
100	19.0	6.2	7.4	98	29

* % saturation, adjusted for temperature and barometric pressure
"–" not required/not measured
[1] if required
[2] at <100 bubbles/min

Data Reviewed By : [signature]
Date : 2008-02-14

3.0 AIR QUALITY

Photo of Sable Island Horses courtesy Sable Island Green Horse Society

3.1 BACKGROUND:

The Sable Island Air Monitoring Program began in mid-2003. The results of this monitoring, which covered data collected in 2003 and 2004, was last reported in the SOEP 2005 Annual Report which was prepared in collaboration with Environment Canada. Since the issuance of that report, issues with equipment calibration and quality assurance/quality control have delayed data analysis (M. Hingston, EC, pers. comm. December, 2007). However, it has come to our attention that EC staff presented a poster at the **Sustainability and Environmental Research Symposium**, Dalhousie University, Halifax, March 14th 2008 (Attachment 3-1; Also available in pdf format at www.greenhorsesociety.com) which appears to include air quality monitoring results for Sable Island from 2005-2007 incl. This data will be related to wind conditions and flare observations on the Thebaud platform with anomalies in Sable Island air quality in the 2008 program.

3.2 GOAL

The intent of program is to provide feedback to so as to promote continuous improvement in reducing flare emissions.

3.3 OBJECTIVES

- To provide baseline information on ambient air quality on Sable Island.
- To monitor trends in air quality as Nova Scotia offshore oil and gas exploration is expanded.

3.4 SAMPLING METHODOLOGY:

Survey Date:	Daily
Platform:	Thebaud
Type of Sample:	Flare Plume Observations
Number of Samples/Station:	Twice daily
Equipment:	NSDOEL Smoke Chart
Sampling QA/QC	Occasional simultaneous observations by independent observer

3.5 ANALYSIS

a) Parameters Analyzed

Parameters	Analysis Method
Flare plume colour	Matching shade of smoke from flare with nearest shade on the chart

b) Analysis QA/QC: Occasional simultaneous observations by independent observer

3.6 RESULTS[9]

Table 3-1: Flare Plume Observations

Month	Total No. of Obs.	No. of Obscured[10] Obs.	Flare Plume Shade			
			Clear	#1	#2	Comments
January	55	4	15	36	N/A	
February	18	3	9	6	N/A	Period of observations - Feb 10-19
March	62	8	18	34	N/A	No flare for 3 days due shutdown
April	59	11	23	23	2	
May	N/A	N/A	N/A	N/A	N/A	No observations reported for month
June	54	24	10	16	1	
July	55	19	14	17	N/A	Flare extinguished for 3 obs. periods; Plant shut in for one day
August	55	5	17	28	4	
September	34	3	28	3	N/A	
October	61	2	45	N/A	N/A	Plant shutdown for 7 days
November	57	N/A	55	N/A	N/A	Plant shutdown for 1 days
December	61	N/A	51	2	N/A	Plant shutdown for 4 days

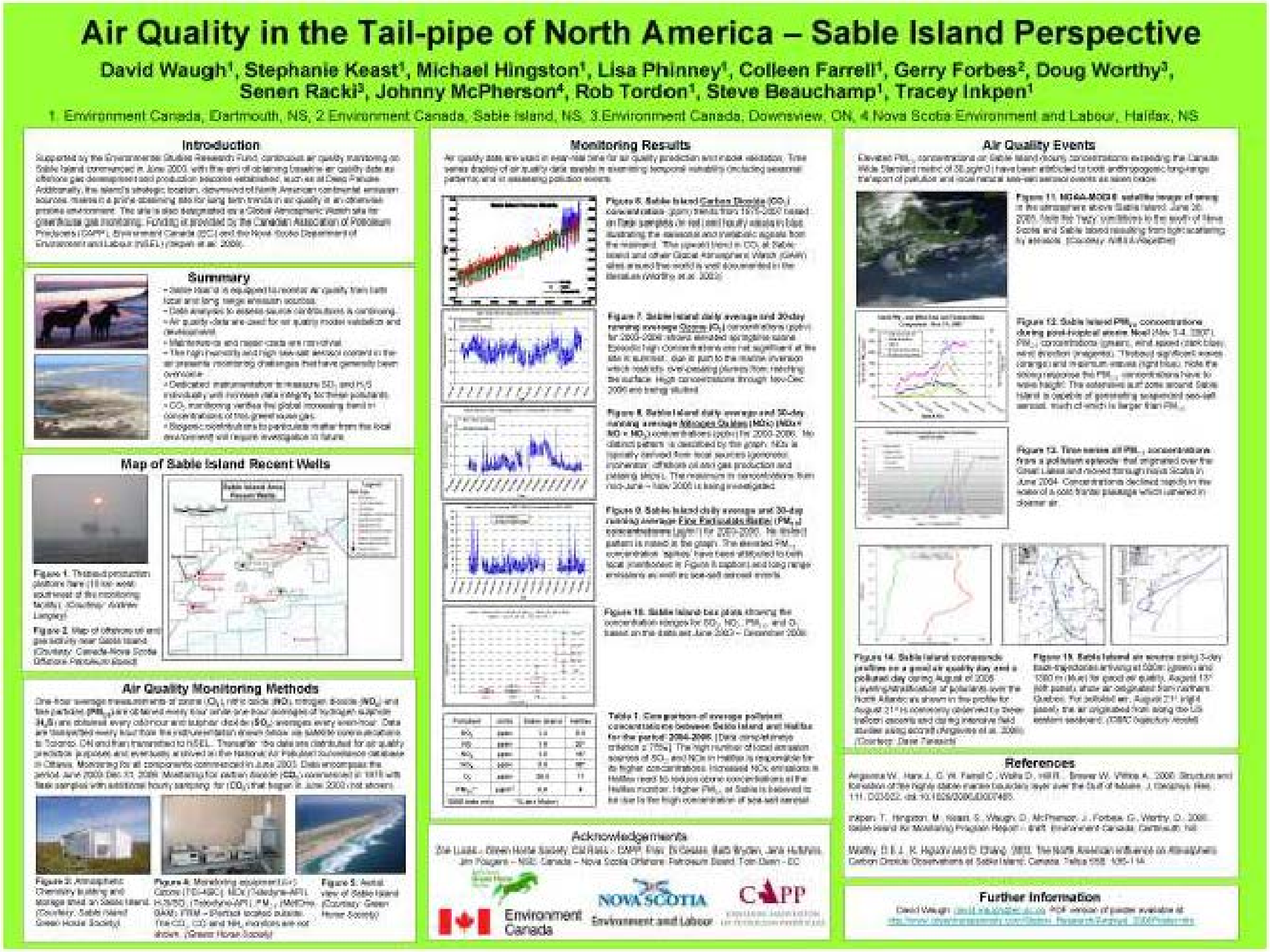
3.7 SUMMARY AND CONCLUSIONS

- There appears to be recent air quality data available from EC for the Sable Air Quality Monitoring Station. This data will be incorporated in the scope of the 2008 program.

- Most observations from the Thebaud platform were that the flare plume was typically either clear or very light gray (#1 or #2 on NSDOEL Smoke Chart: Attachment 3-3). There appeared to be a general improvement in flare plume colour towards the latter half of the year.

[9] For detailed results refer to Attachment 3-2.
[10] Due to fog, rain, snow, etc.

Attachment 3-1 EC poster presented at the Sustainability and Environmental Research Symposium.



Attachment 3-2 Thebaud Flare Plume Observations

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
JAN 01-2007	1200 HRS	CLEAR	NORMAL	MODERATE N WINDS
JAN 01-2007	1600 HRS	CLEAR	NORMAL	MODERATE N WINDS
JAN 02-2007	1200 HRS	CLEAR	NORMAL	STRONG SSE WINDS
JAN 02-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG SSE WINDS
JAN 03-2007	1200 HRS	CLEAR	NORMAL	GALE FORCE WEST WIND
JAN 03-2007	1600 HRS	CLEAR	NORMAL	GALE FORCE WEST WIND
JAN 04-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SSW WINDS
JAN 04-2007	1800 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WEST WINDS
JAN 05-2007	1300 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JAN 05-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JAN 06-2007	1200 HRS	OBSCURED IN FOG	N/A	LOW CEILING IN FOG AND RAIN
JAN 06-2007	1700 HRS	OBSCURED IN FOG	N/A	LOW CEILING IN FOG AND RAIN
JAN 07-2007	1300 HRS	CLEAR	N/A	GALE FORCE WEST WIND
JAN 07-2007	1700 HRS	CLEAR	N/A	GALE FORCE WEST WIND
JAN 08-2007	1300 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT SW WINDS
JAN 08-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SOUTH WINDS
JAN 09-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE N WINDS
JAN 09-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE N WINDS
JAN 10-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT W WINDS
JAN 10-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT W WINDS
JAN 11-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WEST WINDS
JAN 11-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WEST WINDS
JAN 12-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WEST WINDS
JAN 12-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WEST WINDS
JAN 13-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG SW WINDS
JAN 13-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG SW WINDS
JAN 14-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT E WINDS
JAN 14-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT E WINDS
JAN 15-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE WEST WIND
JAN 15-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE WEST WIND
JAN 17-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WIND
JAN 18-2007	1200 HRS	CLEAR	NORMAL	STRONG NORTH WEST WIND
JAN 18-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG WEST WIND
JAN 19-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SOUTH WINDS
JAN 19-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT SOUTH WINDS
JAN 20-2007	1200 HRS	CLEAR	NORMAL	GALE FORCE WESTERLY WINDS
JAN 20-2007	1700 HRS	CLEAR	NORMAL	GALE FORCE WESTERLY WINDS
JAN 21-2007	1300 HRS	*#1 FROM SMOKE CHART*	NORMAL	STRONG NW WINDS
JAN 21-2007	1700 HRS	CLEAR	NORMAL	STRONG TO GALE FORCE NW WINDS
JAN 22-2007	1100 HRS	CLEAR	NORMAL	GALE FORCE NW WINDS
JAN 22-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
JAN 23-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT NE WINDS
JAN 23-2007	1700 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT / MODERATE
JAN 24-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE / STRONG N'LY WINDS
JAN 24-2007	1900 HRS	CLEAR	NORMAL	STRONG / GALE FORCE NW WINDS

JAN 25-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WNW WINDS
JAN 25-2007	2000 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT WESTERLY WINDS
JAN 26-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG NE WINDS
JAN 26-2007	1900 HRS	OBSCURED IN SNOW	N/A	GALE / STORM FORCE NE WINDS
JAN 27-2007	1100 HRS	OBSCURED IN SNOW	NORMAL	STORM FORCE NW
JAN 27-2007	1400 HRS	CLEAR	NORMAL	STORM FORCE NNW WINDS
JAN 28-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG WESTERLY WINDS
JAN 28-2007	2100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
JAN 29-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG NE WINDS, LIGHT SNOW
JAN 29-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NE WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
FEB 10-2007	1400 HRS	NO 1 FR. SMOKE CHART	NORMAL	STRONG NW WINDS
FEB 10-2007	2000 HRS	CLEAR	NORMAL	MODERATE TO STRONG NW WINDS
FEB 11-2007	1300 HRS	CLEAR	NORMAL	STRONG NW WINDS
FEB 11-2007	1900 HRS	NO 1 FR. SMOKE CHART	NORMAL	STRONG NW WINDS
FEB 12-2007	1200 HRS	NO 1 FR. SMOKE CHART	NORMAL	MODERATE WEST WINDS
FEB 12-2007	1600 HRS	OBSCURED IN SNOW	N/A	STRONG WSW WINDS
FEB 13-2007	1100 HRS	CLEAR	NORMAL	GALE FORCE NW WINDS
FEB 13-2007	1600 HRS	CLEAR	NORMAL	GALE FORCE NW WINDS
FEB 14-2007	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT VRBL WINDS
FEB 14-2007	1800 HRS	CLEAR	NORMAL	MODERATE SE WINDS
FEB 15-2007	1200 HRS	OBSCURED IN FOG AND RAIN	OBSCURED	GALE TO STORM FORCE SOUTHERLY WINDS
FEB 15-2007	1900 HRS	CLEAR	NORMAL	GALE TO STORM FORCE SOUTHERLY WINDS
FEB 16-2007	1300 HRS	CLEAR	NORMAL	GALE FORCE WESTERLY WINDS
FEB 16-2007	1900 HRS	CLEAR	NORMAL	GALE FORCE WESTERLY WINDS
FEB 18-2007	1300 HRS	NO 1 FR. THE SMOKE CHART	NORMAL	LIGHT WESTERLY WINDS
FEB 18-2007	1900 HRS	NO 1 FR. THE SMOKE CHART	NORMAL	LIGHT SOUTHERLY WINDS
FEB 19-2007	1300 HRS	CLKEAR	NORMAL	MODERATE EASTERLY WINDS
FEB 19-2007	1800 HRS	OBSCURED	OBSCURED	STRONG NE WINDS AND MODERATE SNOW

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
MAR 01-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SE WINDS
MAR 01-2007	1600 HRS	CLEAR	NORMAL	MODERATE SE WINDS
MAR 02-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE W WINDS
MAR 02-2007	1600 HRS	CLEAR	NORMAL	MODERATE W WINDS
MAR 03-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 03-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 04-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE W WINDS
MAR 04-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE W WINDS
MAR 05-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
MAR 05-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
MAR 06-2007	1600 HRS	CLEAR	NORMAL	SW 30 TO 40 KNOTS
MAR 06-2007	1900 HRS	CLEAR	NORMAL	SW 35 TO 45 KNOTS - SNOW SHOWERS REDUCED VISIBILITY
MAR 07-2007	1100 HRS	CLEAR	NORMAL	NW 35 TO 42 KNOTS - SNOW

				SHOWERS REDUCED VISIBILITY
MAR 07-2007	2000 HRS	OSSCURED IN SNOW	OBSCURED	MODERATE TO HEAVY SNOW REDUCED VISIBILITY
MAR 08-2007	1100 HRS	NO 1 FR. SMOKE CHART	NORMAL	LIGHT NW WIND
MAR 08-2007	2000 HRS	NO 1 FR. SMOKE CHART	NORMAL	LIGHT NW WIND
MAR 09-2007	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
MAR 09-2007	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS MODERATE SNOW SHOWERS
MAR 10-2007	1200 HRS	NO 1 FR. SMOKE CHART	NORMAL	MODERATE WESTERLY WINDS
MAR 10-2007	1800 HRS	CLEAR	NORMAL	MODERATE SW WINDS
MAR 11-2007	1200 HRS	NO 1 FR. SMOKE CHART	NORMAL	STRONG SOUTHERLY WINDS
MAR 11-2007	1900 HRS	OBSCURED	OBSCURED	DENSE FOG VISIBILITY REDUCED
MAR 12-2007	1200 HRS	NO 1 FR SMOKE CHART	NORMAL	STRONG TO GALE FORCE NW WINDS
MAR 12-2007	1800 HRS	CLEAR	NORMAL	STRONG NW WINDS
MAR 13-2007	1200 HRS	NO 1 FR SMOKE CHART	NORMAL	MODERATE SSW WINDS
MAR 13-2007	1800 HRS	CLEAR	NORMAL	LIGHT WSW WINDS
MAR 14-2007	1200 HRS	CLEAR	NORMAL	MODERATE TO STRONG SOUTH WINDS
MAR 14-2007	1900 HRS	CLEAR	NORMAL	STRONG TO GALE FORCE SSW WINDS
MAR 15-2007	1200 HRS	CLEAR	NORMAL	STRONG SSW WINDS
MAR 15-2007	1800 HRS	NO 1 FR SMOKE CHART	NORMAL	STRONG SSW WINDS
MAR 16-2007	1300 HRS	NO 1 FR SMOKE CHART	NORMAL	STRONG SSE WINDS, RAIN AND FOG
MAR 16-2007	1700 HRS	CLEAR	NORMAL	STRONG SSE WINDS
MAR 17-2007	1200 HRS	OBSCURED	OBSCURED	STRONG SSE WINDS, DENSE FOG
MAR 17-2007	1600 HRS	OBSCURED	OBSCURED	STRONG SSE WINDS, DENSE FOG
MAR 18-2007	1200 HRS	CLEAR	NORMAL	GALE FORCE SE WINDS AND MIST
MAR 18-2007	1700 HRS	NO 1 FR SMOKE CHART	NORMAL	LIGHT WEST WINDS
MAR 19-2007	1100 HRS	CLEAR	NORMAL	GALE FORCE WSW WINDS
MAR 19-2007	1700 HRS	CLEAR	NORMAL	STRONG TO GALE FORCE WSW WINDS
MAR 20-2007	1200 HRS	NO 1 FR SMOKE CHART	NORMAL	MODERATE SOUTH WINDS
MAR 20-2007	1900 HRS	CLEAR	NORMAL	GALE FORCE SOUTH WINDS
MAR 21-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
MAR 21-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
MAR 22-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
MAR 22-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
MAR 23-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 23-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 24-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 24-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 25-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 25-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 26-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 26-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
MAR 27-2007	1200 HRS	OBSCURED IN FOG	NA	MODERATE SW WINDS
MAR 27-2007	1600 HRS	OBSCURED IN FOG	NA	MODERATE SW WINDS
MAR 28-2007	1200 HRS	OBSCURED IN FOG	NA	MODERATE SW WINDS
MAR 28-2007	1600 HRS	OBSCURED IN FOG	NA	MODERATE SW WINDS
MAR 29-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS

MAR 29-2007	1600 HRS	N FLARE PSD		
MAR 30-2007	1200 HRS	N FLARE PSD		
MAR 30-2007	1600 HRS	N FLARE PSD		
MAR 31-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
MAR 31-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
APR1-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG NW WINDS
APR1-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	STRONG NW WINDS
APR2-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT N WINDS
APR2-2007	1600 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT N WINDS
APR 3-2007	1500 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE EASTERLY WINDS
APR 3-2007	1700 HRS	CLEAR	NORMAL	MODERATE EASTERLY WINDS
APR 4-2007	1100 HRS	#2 FROM SMOKE CHART	NORMAL	MODERATE NNW WINDS
APR 4-2007	1700 HRS	#2 FROM SMOKE CHART	NORMAL	MODERATE NNW WINDS
APR 5-2007	1100 HRS	OBSCURED	OBSCURED	DENSE FOG
APR 5-2007	1700 HRS	OBSCURED	OBSCURED	DENSE FOG
APR 6-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
APR 6-2007	1700 HRS	CLEAR	NORMAL	MODERARE WSW WINDS
APR 7-2007	1200 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT SSW WINDS
APR 7-2007	1700 HRS	CLEAR	NORMAL	LIGHT EASTERLY WINDS
APR 8-2007	1100 HRS	CLEAR	NORMAL	GALE / STORM FORCE SW WINDS
APR 8-2007	1700 HRS	CLEAR	NORMAL	GALE / STORM FORCE SW WINDS
APR 9-2007	1100 HRS	CLEAR	NORMAL	STRONG SSW WINDS
APR 9-2007	1700 HRS	CLEAR	NORMAL	STRONG / GALE FORCE SSW WINDS
APR 10-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT WNW WINDS
APR 10-2007	1700 HRS	CLEAR	NORMAL	LIGHT WNW WINDS
APR 11-2007	1200 HRS	CLEAR	NORMAL	LIGHT NW WINDS
APR 11-2007	1800 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
APR 12-2007	1100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
APR 12-2007	1800 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
APR 13-2007	1200 HRS	CLEAR	NORMAL	STRONG SE WINDS
APR 13-2007	1800 HRS	OBSCURED IN FOG	OBSCURED IN FOG	FOG AND MIST
APR 14-2007	1200 HRS	# 1 FROM SMOKE CHART	NORMAL	LIGHT SOUTH WIND
APR 14-2007	1400 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT SOUTH WIND
APR 15-2007	1100 HRS	CLEAR	NORMAL	LIGHT NORTH WIND
APR 15-2007	2100 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE ENE WIND
APR 16-2007	1100 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE EAST WIND
APR 16-2007	1700 HRS	CLEAR	NORMAL	MODERATE EAST WIND
APR 17-2007	1200 HRS	OBSCURED	OBSCURED	GALE FORCE EAST WIND
APR 17-2007	1700 HRS	OBSCURED	OBSCURED	GALE FORCE EAST WIND
APR 18-2007	1200 HRS	OBSCURED	OBSCURED	GALE FORCE NORTH EAST WIND
APR 18-2007	1600 HRS	OBSCURED	OBSCURED	GALE FORCE NORTH EAST WIND
APR 19-2007	1200 HRS	CLEAR	NORMAL	GALE FORCE NORTH EAST WIND
APR 19-2007	1600 HRS	CLEAR	NORMAL	GALE FORCE NORTH EAST WIND
APR 20-2007	1200 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE ENE WIND
APR 20-2007	1600 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE EAST WIND

APR 21-2007	1200 HRS	CLEAR	NORMAL	MODERATE ENE WIND
APR 21-2007	1600 HRS	CLEAR	NORMAL	MODERATE EAST WIND
APR 22-2007	1200 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE ENE WIND
APR 22-2007	1600 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE EAST WIND
APR 23-2007	1200 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE ENE WIND
APR 23-2007	1600 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE EAST WIND
APR 24-2007	1200 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE ENE WIND
APR 24-2007	1600 HRS	# 1 FROM SMOKE CHART	NORMAL	MODERATE EAST WIND
APR 25-2007	1200 HRS	CLEAR	NORMAL	MODERATE SW WIND
APR 25-2007	1600 HRS	CLEAR	NORMAL	MODERATE SW WIND
APR 26-2007	1200 HRS	CLEAR	NORMAL	MODERATE W WIND
APR 26-2007	1600 HRS	CLEAR	NORMAL	MODERATE W WIND
APR 27-2007	1200 HRS	CLEAR	NORMAL	LIGHT SE WIND
APR 27-2007	1600 HRS	CLEAR	NORMAL	MODERATE W WIND
APR 28-2007	1200 HRS	OBSCURED	OBSCURED	MODERATE SW WIND
APR 28-2007	1600 HRS	OBSCURED	OBSCURED	MODERATE SW WIND
APR 29-2007	1200 HRS	OBSCURED	OBSCURED	MODERATE SW WIND
APR 29-2007	1600 HRS	OBSCURED	OBSCURED	MODERATE SW WIND
APR 30-2007	1200 HRS	# 1 FROM SMOKE CHART	SMALL	LIGHT VARIABLE WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
JUN 01-07	1100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT WINDS
JUN 01-07	1600 HRS	CLEAR	NORMAL	LIGHT WINDS
JUN 02-07	0900 HRS	OBSCURED IN FOG	OBSCURED IN FOG	LIGHT NW WINDS
JUN 02-07	1700 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT EASTERLY WINDS
JUN 03-07	1000 HRS	CLEAR	NORMAL	MODERATE EASTERLY WINDS
JUN 03-07	1800 HRS	CLEAR	NORMAL	MODERATE SE WINDS
JUN 04-07	1000 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE EASTERLY WINDS
JUN 04-07	1700 HRS	CLEAR	NORMAL	MODERATE TO STRONG SE WINDS
JUN 05-07	0900 HRS	OBSCURED IN FOG	OBSCURED IN FOG	STRONG SE WINDS
JUN 05-07	1700 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE TO STRONG SSW WINDS
JUN 06-07	1100 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE TO STRONG SSW WINDS
JUN 06-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE TO STRONG SSW WINDS
JUN 07-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
JUN 07-07	1700 HRS	CLEAR	NORMAL	MODERATE WSW WINDS
JUN 08-07	1100 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT / MODERATE NORTHERLY WINDS
JUN 08-07	1900 HRS	#1 FROM SMOKE CHART	NORMAL	LIGHT / MODERATE NORTHERLY WINDS
JUN 09-07	1100 HRS	OBSCURED IN FOG	OBSCURED IN FOG	LIGHT EASTERLY WINDS
JUN 09-07	1600 HRS	CLEAR	NORMAL	LIGHT EASTERLY WINDS
JUN 10-07	1000 HRS	OBSCURED IN FOG	OBSCURED IN FOG	DENSE FOG MOD./ STRONG EASTERLY WINDS
JUN 10-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MOD / STRONG EASTERLY WINDS
JUN 11-07	1100 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS
JUN 11-07	1700 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS
JUN 15-07	1200 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS

JUN 15-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS
JUN 16-07	1200 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS
JUN 16-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SE WINDS
JUN 17-07	1200 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE WSW WINDS
JUN 17-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE WSW WINDS
JUN 18-07	1200 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE WSW WINDS
JUN 18-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE NW WINDS
JUN 19-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
JUN 19-07	1600 HRS	CLEAR	NORMAL	MODERATE NW WINDS
JUN 20-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
JUN 20-07	1700 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE NW WINDS
JUN 21-07	1200 HRS	PLANT SHUT IN		MODERATE SE WINDS
JUN 21-07	1700 HRS	PLANT SHUT IN		MODERATE SE WINDS
JUN 22-07	1200 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE WSW WINDS
JUN 22-07	1600 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SW WINDS
JUN 23-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
JUN 23-07	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JUN 24-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
JUN 24-07	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JUN 25-07	1200 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
JUN 25-07	1600 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JUN 26-07	1400 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JUN 26-07	1700 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JUN 27-07	1100 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE WNW WINDS
JUN 27-07	1700 HRS	CLEAR	NORMAL	MODERATE TO STRONG WNW WINDS
JUN 28-07	1100 HRS	OBSCURED IN FOG	OBSCURED IN FOG	MODERATE SOUTHERLY WINDS
JUN 28-07	1700 HRS	OBSCURED IN FOG	OBSCURED IN FOG	STRONG SSW WINDS
JUN 29-07	1100 HRS	FLARE IS NOT LIT	NOT LIT	MOODERATE WSW WINDS
JUN 29-07	1700 HRS	OBSCURED IN FOG	OBSCURED IN FOG	LIGHT TO MODERATE WESTERLY WINDS
JUN 30-07	1100 HRS	#1 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS
JUN 30-07	1700 HRS	#2 FROM SMOKE CHART	NORMAL	MODERATE WSW WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
JUL 01-07	1100 HRS	CLEAR	NORMAL	LIGHT WSW WINDS
JUL 01-07	1800 HRS	CLEAR	NORMAL	LIGHT WSW WINDS
JUL 02-07	1100 HRS	CLEAR	NORMAL	LIGHT WESTERLY WINDS
JUL 02-07	1800 HRS	CLEAR	NORMAL	LIGHT WESTERLY WINDS
JUL 03-07	1100 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SE WINDS
JUL 03-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT EASTERLY WINDS
JUL 04-07	1100 HRS	CLEAR	NORMAL	LIGHT SW WINDS
JUL 04-07	1900 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JUL 05-07	11OO HRS	NO 1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
JUL 05-07	1800 HRS	NO 1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS

JUL 06-07	1000 HRS	CLEAR	NORMAL	STRONG SOUTHERLY WINDS
JUL 06-07	1500 HRS	CLEAR	NORMAL	STRONG SOUTH WEST WINDS
JUL 07-07	1100 HRS	FLARE EXTINGUISHED	NO FLARE	LOW VIS IN FOG
JUL 07-07	1800 HRS	FLARE EXTINGUISHED	NO FLARE	LOW VIS IN FOG
JUL 08-07	1000 HRS	FLARE EXTINGUISHED	NO FLARE	MODERATE WSW WINDS
JUL 08-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SSW WINDS
JUL 09-07	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
JUL 09-07	1800 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT AIR, VARIABLE WIND
JUL 11-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT AIR, VARIABLE WIND
JUL 11-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT AIR, VARIABLE WIND
JUL 12-07	1000 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTHERLY WINDS
JUL 12-07	1800 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WEST WINDS
JUL 13-07	0800 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WEST WINDS
JUL 14-07	1000 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SW WINDS
JUL 14-07	1700 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SW WINDS
JUL 15-07	1000 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SW WINDS
JUL 15-07	1700 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SW WINDS
JUL 16-07	1000 HRS	PLANT SHUT IN	NO FLARE	LIGHT SW WINDS
JUL 16-07	1700 HRS	PLANT SHUT IN	NO FLARE	LIGHT SW WINDS
JUL 17-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SSW WINDS
JUL 17-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
JUL 18-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SSW WINDS
JUL 18-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	STRONG SOUTH WEST WINDS
JUL 19-07	1000 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WEST WINDS
JUL 19-07	1700 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WEST WINDS
JUL 20-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SSW WINDS
JUL 20-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
JUL 21-07	1000 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WINDS
JUL 21-07	1700 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WINDS
JUL 22-07	1000 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WINDS
JUL 22-07	1700 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTH WINDS
JUL 25-07	1500 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JUL 25-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SW WINDS
JUL 26-07	1100 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JUL 26-07	1800 HRS	NO 1 FROM SMOKE CHART	NORMAL	MODERATE WESTERLY WINDS
JUL 27-07	1000 HRS	CLEAR	NORMAL	LIGHT WESTERLY WINDS
JUL 27-07	1900 HRS	CLEAR	NORMAL	LIGHT SOUTH WEST WINDS
JUL 28-07	1000 HRS	OBSCURED IN FOG	OBSCURED	MODERATE SOUTH WEST WINDS
JUL 28-07	1900 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SOUTH WEST WINDS
JUL 29-07	1000 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SOUTH SOUTH WEST WINDS
JUL 29-07	1600 HRS	CLEAR	NORMAL	MODERATE SOUTH SOUTHWEST WINDS
JUL 30-07	10000 HRS	OBSCURED IN FOG	OBSCURED	MODERATE SW WINDS
JUL 30-07	1600 HRS	OBSCURED IN FOG	OBSCURED	MODERATE SW WINDS
JUL 31-07	1000 HRS	CLEAR	NORMAL	MODERATE SW WINDS
JUL 31-07	1600 HRS	CLEAR	NORMAL	MODERATE SW WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
AUG 01-07	1000 HRS	OBSCURED IN FOG	NORMAL	LIGHT TO MODERATE NW WINDS
AUG 01-07	1600 HRS	NO 1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
AUG 02-07	1000 HRS	OBSCURED IN FOG	OBSCURED	LIGHT NE WINDS, DENSE FOG
AUG 02-07	1600 HRS	CLEAR	NORMAL	LIGHT NE WINDS, DENSE FOG
AUG 03-07	1000 HRS	NO 2 FROM SMOKE CHART	NORMAL	LIGHT SOUTHERLY WIND
AUG 03-07	1500 HRS	NO 1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 04-07	1000 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
AUG 04-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 05-07	1000 HRS	CLEAR	NORMAL	LIGHT SOUTHWEST WINDS
AUG 05-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT SOUTHWEST WINDS
AUG 06-07	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT NORTHERLY WINDS
AUG 06-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	VERY LIGHT NORTHEAST WINDS
AUG 07-07	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	STRONG SOUTHERLY WINDS
AUG 08-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	STRONG SOUTHERLY WINDS
AUG 08-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	STRONG SOUTHERLY WINDS
AUG 09-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	STRONG SE WINDS
AUG 09-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	GALE FORCE NW WINDS
AUG 10-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 10-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 11-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 11-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 12-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 12-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 13-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 13-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 14-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 14-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 15-07	1000 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 15-07	1600 HRS	NO1 FROM SMOKE CHART	NORMAL	MODERATE SOUTHERLY WINDS
AUG 16-07	1000 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
AUG 16-07	1600 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
AUG 17-07	1000 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 17-07	1600 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 18-07	1000 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 18-07	1600 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 19-07	1000 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 19-07	1600 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 20-07	1000 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 20-07	1600 HRS	CLEAR	NORMAL	MODERATE SW WINDS
AUG 21-07	1700 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT EASTERLY WINDS

AUG 21-07	1900 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT EASTERLY WINDS
AUG 22-07	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT SOUTHWEST WINDS
AUG 22-07	1900 HRS	NO 1 FROM SMOKE CHART	NORMAL	LIGHT NW WINDS
AUG 23-07	1100 HRS	NO1 FROM SMOKE CHART	NORMAL	LIGHT NORTHERLY WINDS
AUG 23-07	1900 HRS	NO2 FROM SMOKE CHART	NORMAL	LIGHT NE WINDS
AUG 24-07	1200 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
AUG 24-07	1800 HRS	CLEAR	NORMAL	MODERATE TO STRONG SOUTHERLY WINDS
AUG 25-07	1200 HRS	CLEAR	NORMAL	GALE FORCE SOUTHERLY WINDS
AUG 25-07	1800 HRS	OBSCURED IN FOG	OBSCURED	STRONG SOUTHWEST WINDS
AUG 26-07	1200 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SOUTHWEST WINDS
AUG 26-07	1800 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SOUTHWEST WINDS
AUG 27-07	1100 HRS	CLEAR	NORMAL	LIGHT NORTHWEST WINDS
AUG 27-07	1800 HRS	NO 1 FROM SMOKE CHART	NORMAL	MODERATE NORTHWEST WINDS
AUG 28-07	1100 HRS	NO 2 FROM SMOKE CHART	NORMAL	LIGHT VARIABLE WINDS
AUG 28-07	1700 HRS	NO 2 FROM SMOKE CHART	NORMAL	VERY LIGHT WINDS, SMOKE NEARLY VERTICAL

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
SEP 05-07	1000 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
SEP 05-07	1700 HRS	CLEAR	NORMAL	MODERATE SOUTHERLY WINDS
SEP 06-07	1000 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 06-07	1700 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 07-07	1000 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 07-07	1700 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 08-07	1000 HRS	OBSCURED IN FOG	OBSCURED	VERY LIGHT WINDS
SEP 08-07	1000 HRS	OBSCURED IN FOG	OBSCURED	VERY LIGHT WINDS
SEP 09-07	1000 HRS	CLEAR	OBSCURED	MODERATE N WINDS
SEP 09-07	1700 HRS	CLEAR	OBSCURED	MODERATE N WINDS
SEP 10-07	1000 HRS	CLEAR	OBSCURED	VERY LIGHT WINDS
SEP 10-07	1700 HRS	CLEAR	OBSCURED	VERY LIGHT WINDS
SEP 11-07	1000 HRS	CLEAR	NORMAL	STRONG SOUTHERLY WINDS
SEP 11-07	1700 HRS	CLEAR	NORMAL	STRONG SOUTHERLY WINDS
SEP 21-07	1700 HRS	NO 1 FROM SMOKE CHART	NORMAL	LIGHT EASTERLY WINDS
SEP 21-07	2000 HRS	CLEAR	NORMAL	LIGHT SOUTH EAST WINDS
SEP 22-07	1000 HRS	CLEAR	NORMAL	LIGHT TO MODERATE SE WINDS
SEP 22-07	1900 HRS	CLEAR	NORMAL	LIGHT TO MODERATE SE WINDS
SEP 23-07	1000 HRS	CLEAR	NORMAL	LIGHT TO MODERATE SE WINDS
SEP 23-07	1700 HRS	NO 1 FROM SMOKE CHART	NORMAL	LIGHT TO MODERATE SW WINDS
SEP 24-07	1000 HRS	CLEAR	NORMAL	MODERATE TO STRONG NW WINDS
SEP 24-07	1900 HRS	CLEAR	NORMAL	MODERATE TO STRONG NW WINDS
SEP 25-07	1000 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 25-07	1500 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 26-07	1000 HRS	CLEAR	NORMAL	STRONG WSW WINDS
SEP 26-07	1100 HRS	CLEAR	NORMAL	STRONG WSW WINDS

SEP 27-06	1000 HRS	CLEAR	NORMAL	MODERATE WSW WINDS
SEP 27-07	1700 HRS	NO 1 FROM SMOKE CHART	NORMAL	LIGHT NE WINDS
SEP 28-07	1000 HRS	CLEAR	NORMAL	MODERATE SOUTH WINDS
SEP 28-07	1300 HRS	CLEAR	NORMAL	STRONG SSE WINDS
SEP 29-07	1000 HRS	OBSCURED IN FOG	OBSCURED	LIGHT SW WINDS
SEP 29-07	1700 HRS	CLEAR	NORMAL	MODERATE NW WINDS
SEP 30-07	1100 HRS	CLEAR	NORMAL	STRONG NW WINDS
SEP 30-07	1700 HRS	CLEAR	NORMAL	MODERATE NW WINDS

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
OCT 01-07	1100 HRS	CLEAR	NORMAL	LIGHT NW WINDS
OCT 02-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
OCT 02-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
OCT 03-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
OCT 03-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
OCT 04-07	1200 HRS	OBSCURED IN FOG	OBSCURED	SW WINDS
OCT 04-07	1600 HRS	OBSCURED IN FOG	OBSCURED	SW WINDS
OCT 05-07	1200 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 05-07	1600 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 06-07	1200 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 06-07	1600 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 07-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 07-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 08-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 08-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 09-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 09-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 10-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 10-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 11-07	1200 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 11-07	1600 HRS	CLEAR	NORMAL	MODERATE W WINDS
OCT 12-07	1200 HRS	CLEAR	NORMAL	SE WINDS
OCT 12-07	1600 HRS	CLEAR	NORMAL	SE WINDS
OCT 13-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 13-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 14-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 14-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 15-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 15-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 16-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 16-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 17-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 17-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 18-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 18-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 19-07	1200 HRS	CLEAR	NORMAL	SW WINDS
OCT 19-07	1600 HRS	CLEAR	NORMAL	SW WINDS
OCT 20-07	1200 HRS	CLEAR	NORMAL	STRONG SSW WINDS
OCT 20-07	1600 HRS	CLEAR	NORMAL	STRONG SSW WINDS
OCT 21-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 21-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 22-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 22-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 23-07	1200 HRS	NO FLARE PLANT SHUT DOWN		

OCT 23-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 24-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 24-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 25-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 25-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 26-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 26-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 27-07	1200 HRS	NO FLARE PLANT SHUT DOWN		
OCT 27-07	1600 HRS	NO FLARE PLANT SHUT DOWN		
OCT 28-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 28-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 29-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 29-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 30-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 30-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 31-07	1200 HRS	CLEAR	NORMAL	STRONG NW WINDS
OCT 31-07	1600 HRS	CLEAR	NORMAL	STRONG NW WINDS

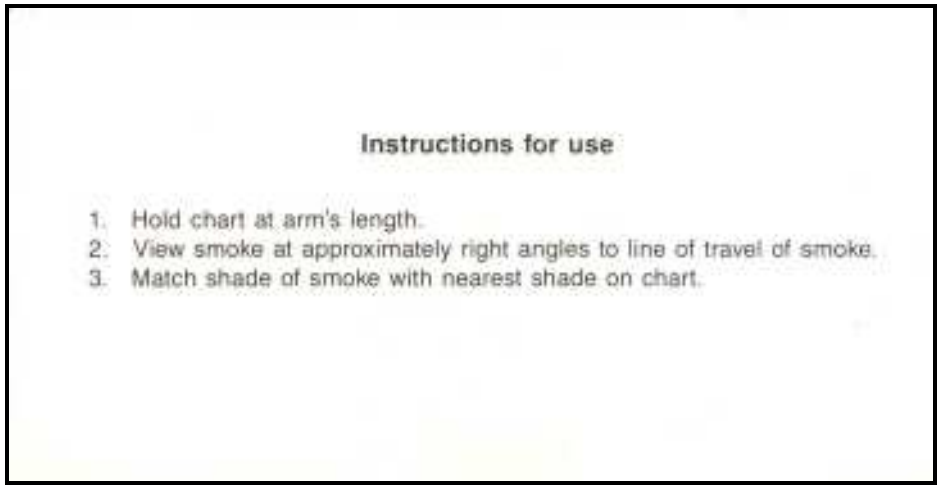
DATE	TIME	PLUME COLOR	SIZE	COMMENTS
NOV 01-07	1100 HRS	CLEAR	NORMAL	LIGHT NW WINDS
NOV 02-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 02-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 03-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 03-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 04-07	1200 HRS	CLEAR	OBSCURED	SW GALES
NOV 04-07	1600 HRS	CLEAR	OBSCURED	SW GALES
NOV 05-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 05-07	1600 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 06-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 06-07	1600 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 07-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 07-07	1600 HRS	CLEAR	NORMAL	LIGHT N WINDS
NOV 08-07	1200 HRS	CLEAR	NORMAL	LIGHT N WINDS
NOV 08-07	1600 HRS	CLEAR	NORMAL	LIGHT N WINDS
NOV 09-07	1200 HRS	CLEAR	NORMAL	MODERATE N WINDS
NOV 09-07	1600 HRS	CLEAR	NORMAL	MODERATE N WINDS
NOV 10-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 10-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 11-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 11-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 12-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 12-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 13-07	1200 HRS	CLEAR	NORMAL	LIGHT N WINDS
NOV 13-07	1600 HRS	CLEAR	NORMAL	LIGHT N WINDS
NOV 14-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 14-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 15-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 15-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 16-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 16-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS

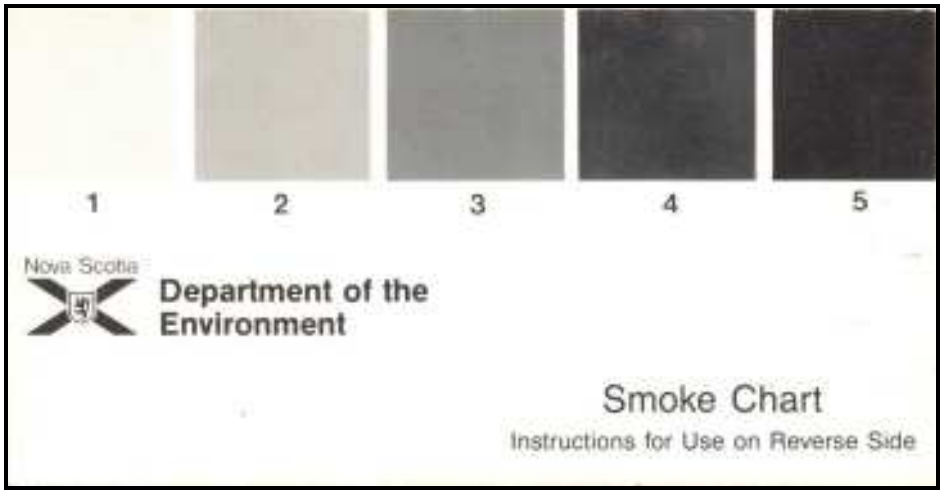
NOV 16-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 17-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 18-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 18-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 19-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 19-07	1600 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 20-07	1200 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 20-07	1600 HRS	CLEAR	NORMAL	MODERATE NE WINDS
NOV 21-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 22-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 23-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
NOV 23-07	1600 HRS	CLEAR	NORMAL	STRONG S WINDS
NOV 24-07	1200 HRS	CLEAR	NORMAL	MODERATE N WINDS
NOV 24-07	1600 HRS	CLEAR	NORMAL	MODERATE N WINDS
NOV 25-07	1200 HRS	CLEAR	NORMAL	STRONG S WINDS
NOV 25-07	1600 HRS	CLEAR	NORMAL	STRONG S WINDS
NOV 26-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 26-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NE WINDS
NOV 27-07	1200 HRS	CLEAR	OBSCURED	GALE FORCE S WINDS
NOV 27-07	1600 HRS	CLEAR	OBSCURED	GALE FORCE S WINDS
NOV 28-07	1200 HRS	CLEAR	OBSCURED	GALE FORCE NW WINDS
NOV 28-07	1600 HRS	CLEAR	OBSCURED	GALE FORCENW WINDS
NOV 29-07	1200 HRS	CLEAR	NORMAL	STRONG SSE WINDS
NOV 29-07	1600 HRS	CLEAR	NORMAL	STRONG SSE WINDS
NOV 30-07	1200 HRS			PLANT SHUT IN
NOV 30-07	1600 HRS			PLANT SHUT IN

DATE	TIME	PLUME COLOR	SIZE	COMMENTS
DEC 01-07	1200 HRS			PLANT SHUT IN
DEC 01-07	1600 HRS			PLANT SHUT IN
DEC 02-07	1200 HRS			PLANT SHUT IN
DEC 02-07	1600 HRS			PLANT SHUT IN
DEC 03-07	1200 HRS			PLANT SHUT IN
DEC 03-07	1600 HRS			PLANT SHUT IN
DEC 04-07	1200 HRS			PLANT SHUT IN
DEC 04-07	1600 HRS			PLANT SHUT IN
DEC 05-07	1200 HRS	CLEAR	NORMAL	MODERATE WNW WINDS
DEC 05-07	1600 HRS	CLEAR	NORMAL	MODERATE W WINDS
DEC 06-07	1200 HRS	CLEAR	NORMAL	MODERATE WNW WINDS
DEC 06-07	1600 HRS	CLEAR	NORMAL	MODERATE WNW WINDS
DEC 07-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG WNW WINDS
DEC 07-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG WNW WINDS
DEC 08-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG SSW WINDS
DEC 08-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG SSW WINDS
DEC 09-07	1200 HRS	CLEAR	NORMAL	MODERATE NW WINDS
DEC 09-07	1600 HRS	CLEAR	NORMAL	MODERATE NW WINDS
DEC 10-07	1200 HRS	CLEAR	NORMAL	LIGHT WNW WINDS
DEC 10-07	1600 HRS	CLEAR	NORMAL	LIGHT WNW WINDS

DEC 11-07	1200 HRS	CLEAR	NORMAL	LIGHT WNW WINDS
DEC 11-07	1600 HRS	CLEAR	NORMAL	LIGHT WNW WINDS
DEC 12-07	1200 HRS	CLEAR	NORMAL	LIGHT S WINDS
DEC 12-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG W WINDS
DEC 13-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG W WINDS
DEC 13-07	1600 HRS	CLEAR	NORMAL	MODERATE NW WINDS
DEC 14-07	1200 HRS	CLEAR	NORMAL	LIGHT NW WINDS
DEC 14-07	1600 HRS	CLEAR	NORMAL	LIGHT NW WINDS
DEC 14-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NW WINDS
DEC 14-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NW WINDS
DEC 15-07	1200 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NW WINDS
DEC 15-07	1600 HRS	CLEAR	NORMAL	MODERATE 2 STRONG NW WINDS
DEC 16-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 16-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 18-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 18-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 19-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 19-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 20-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 20-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 21-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 21-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 22-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 22-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 23-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 23-07	1600 HRS	CLEAR	NORMAL	LIGHT E WINDS
DEC 24-07	1200 HRS	CLEAR	NORMAL	STRONG SW WINDS
DEC 24-07	1600 HRS	CLEAR	NORMAL	STRONG SW WINDS
DEC 25-07	1200 HRS	CLEAR	NORMAL	LIGHT W WINDS
DEC 25-07	1600 HRS	CLEAR	NORMAL	LIGHT W WINDS
DEC 26-07	1200 HRS	CLEAR	NORMAL	LIGHT NNW WINDS
DEC 26-07	1600 HRS	CLEAR	NORMAL	LIGHT NW WINDS
DEC 27-07	1200 HRS	CLEAR	NORMAL	STRONG E WINDS
DEC 27-07	1600 HRS	CLEAR	NORMAL	STRONG E WINDS
DEC 28-07	1200 HRS	CLEAR	NORMAL	MODERATE NW WINDS
DEC 28-07	1600 HRS	CLEAR	NORMAL	MODERATE NW WINDS
DEC 29-07	1200 HRS	NO1 FROM CHART	NORMAL	LIGHT NW WINDS
DEC 29-07	1700 HRS	CLEAR	NORMAL	LIFGT SW WINDS
DEC 30-07	1200 HRS	CLEAR	NORMAL	STRONG WESTERLY WINDS
DEC 30-07	1700 HRS	CLEAR	NORMAL	MOD. TO STRONG WESTERLY WINDS
DEC 31-07	1200 HRS	NO1 FROM CHART	NORMAL	VIS. REDUCED IN SNOW SHOWERS

Attachment 3-3 NSDEL Smoke Chart





4.0 SEABIRD MONITORING

Photo: Sable Island Green Horse Society

4.1 BACKGROUND

Seabird monitoring observations have been made on a relatively continuous basis at the Thebaud production (gas) platform since 1999 by independent observers supplied by Offshore Oil and Gas Observer Group Ltd. (OGOP). The OGOP received periodic training in seabird identification from various experts including CWS biologists. CWS has considered that these observations provided a general appreciation of seabird/platform interactions but were unable to be used to fully assess the relative distribution of seabirds around the platform since the observations were restricted to a single location and therefore limited field of view. In 2005 and 2006, as an alternative to earlier observations at a single location (i.e., a platform) by OGOP observers, a transect gradient approach was adopted involving systematic observations of seabirds by CWS biologists along supply vessel transits to and from offshore platforms which offered the possibility of detecting changes in density of seabirds in relation to distance from SOEP offshore manned and unmanned gas platforms off Nova Scotia. The latter approach was continued in 2007 but was supplemented for purposes of comparison with observations taken in other areas of the Scotian Shelf (i.e., not along regular supply vessel tracks to and from SOEP platforms) by CWS observers aboard 'vessels-of-opportunity' as part a multi-year monitoring program to document the distribution and abundance of seabirds in offshore areas of Atlantic Canada. This program receives support from the Environmental Studies Research Fund, a fund administered by the National Energy Board with funding from offshore oil and gas operators.

Apart from birds observed during systematic surveys, there were two bird encounter events reported in the Sable Island Bank area at roughly the same time. On October 10, an ExxonMobil crew found several dead birds on the Thebaud platform. The species ranged from goldfinches and other passerines to Leach's storm-petrels. On October 7, CWS biologist Carina Gjerdrum reported that several dozen warblers arrived on a DFO research vessel and that she counted 30 dead immature Blackpoll Warblers.

It should be noted that ExxonMobil Canada Properties did apply for a "Migratory Bird Damage Permit" to scare and kill Great Black-back Gulls and Herring Gulls on the unmanned Alma platform. The gulls were creating a serious health hazard and posed extremely high risk for a possible bird strike during helicopter operations.

.

4.2 GOAL

- Determine the extent of attraction of seabirds to SOEP manned and unmanned offshore gas platforms.
- Document the distribution and density of seabirds around the SOEP production area.

4.3 OBJECTIVES

Compare seabird observational data along platform and 'reference' transects on Sable Island Bank.

4.4 2007 SAMPLING

Reporting Organization: Hurley Environment Ltd. in association with CWS

Collection Date(s):	Sept. 29,30, Oct. 5-18.
Platform:	Sept. 26,27: Ryan Leet Oct. 23-24; Oct. 26- 28: Panuke Sea Sept 29-30; Oct. 5-18 CCG Hudson
Type of Sample::	Visual observations of seabirds in accordance with Canadian Wildlife Service Protocol [1].
Test Sample Locations:	A total of 125 surveys @ 5-10-min (52 on PS; 73 on RL) were conducted on the two supply vessels (i.e., Panuke Sea & Ryan Leet) while in transit to/from the shorebase in Dartmouth or between SOEP offshore platforms (Thebaud, Venture, South Venture, and North Triumph) [Note: No transects were made to/from the Alma platform].
Reference Sample Locations:	A total of 401 surveys @ 5 to 10-min were conducted along transects carried out on board the Canadian Coast Guard vessel (CCG) Hudson whilst steaming at random locations on or near the Scotian Shelf.
Sample Preparation:	CWS data sheets then archived in Microsoft Access Database
Equipment:	Binoculars

Sampling QA/QC:	Observations were made by Canadian Wildlife Service seabird biologist and seabird observers contracted by CWS, following a standardized protocol [1] which is summarized below. Surveys are conducted while looking forward from the bridge, scanning ahead to a 90° angle from either the port or starboard side, limiting observations to a transect band 300m wide from the side of the platform. A series of ten-minute observation surveys are conducted, regardless if birds are present or not, with an attempt to ensure consistent coverage throughout the day. Observations are not conducted when visibility is poor (i.e., when the entire width of the 300m transect is not visible due to rain or fog). The transect is scanned continuously by eye, to count and identify birds present in air or on water. Binoculars are used to confirm the species identification, and other details, such as age, moult, carrying fish, etc. Observed birds on the sea surface are continuously recorded throughout the ten-minute period, and their distance from the platform is estimated. Flying birds are not recorded continuously throughout the 10-minute period, as this would overestimate bird density. Instead, flying birds are recorded using instantaneous counts, or "snapshots", at regular intervals throughout the observation period. The number of snapshots conducted depends on the speed of the platform.

4.5 PARAMETERS ANALYZED

Parameters	Analysis Method
Abundance and Distribution of Seabirds	- Data collected by the observer during the trips were entered into an MS ACCESS database designed by the CWS. - The analysis was focused on the six most frequently observed species on platform and reference transects (Tables 4-1 and 4-2 respectively). - The density (birds/km^2) of each of these species was plotted separately as shown in Figs.4-1 – 4-6 incl.

4.6 RESULTS

The Greater Shearwater was by far the most commonly sighted species on supply vessel and reference transects (Tables 4-1 & 4-2). Other frequently observed species were the Northern Gannet, Black-legged Kittiwake, Herring Gull, Northern Fulmar, and Great Black-backed Gull and Leach's Storm Petrel.

Greater Shearwaters were widely abundant in surveyed areas on the Scotian Shelf including most SOEP platform locations (Fig. 4-1). Of the other five (5) frequently sighted species (Tables 4-2 to 4-6 incl.), the Northern Gannet (Fig 4-2) and Black-legged Kittiwake (Fig. 4-3) were most common over the Scotian Shelf in marine areas on the western end of Sable Island. With reference to the SOEP, these two species were frequently sighted in the vicinity of the Thebaud platform (which is located off the southwestern end of Sable Island) but not other platforms.

4.7 SUMMARY AND CONCLUSIONS

- The Greater Shearwater was by far the most widely and commonly sighted species on reference and supply vessel transects. This species spends the austral winter in Atlantic Canada and are migrate in the fall to breeding grounds in the southern hemisphere. Greater Shearwaters are often observed following vessels at sea, in the hope of scavenging any food scraps discharged from the ship.

- Other frequently observed species were the Northern Gannet, Black-legged Kittiwake, Herring Gull, Northern Fulmar, and Great Black-backed Gull. These species are known to actively participate in ship following – taking advantage of the artificial upwelling created by a vessel's wake and residual effect of the disturbance of the sea surface.

- The observer data indicated that the Northern Gannet and Black-legged Kittiwake were most common over the Scotian Shelf in marine areas on the western end of Sable Island during September/October, 2007. The Thebaud platform is located within this area.

- If the SOEP platforms provide additional foraging, refuge or attraction due to lights, seabird densities should be noticeably higher in the immediate vicinity of the platforms. Based on the limited seasonal dataset collected in 2007, there is insufficient information to state conclusively whether the SOEP platforms attract seabirds based on analysis of transect data. Interpretation of seabird observation data in the vicinity of the SOEP platforms is complicated by the nearby presence of Sable Island, which supports colonies of many bird species. .

- While there were no seabird transect surveys carried out in the vicinity of the Alma platform, this unmanned platform has recently attracted enough Black-back Gulls and Herring Gulls to create a high risk of bird strike during helicopter operations. Gulls (or other bird species) are not a safety issue at other unmanned SOEP platforms.

- Reports from the UPEI Veterinary College indicate that injured birds encountered on the Thebaud platform (October 10) and on a DFO research vessel (October 7) died of trauma (Attachments 4-2, 4-3, 4-4). CWS has suggested that the trauma of these predominantly land-based birds was likely caused by collisions with superstructures after the birds were disoriented by the artificial lights on the structures. It is unclear if the birds were seeking refuge during their natural migration or after being blown off course.

4.8 REFERENCES

[1] Environment Canada, July 2006. Standardized Protocols for Pelagic Seabird Surveys from Moving and Stationary Platforms, *Version 1.2*. Canadian Wildlife Service, Environment Canada – Atlantic Region, Dartmouth, Nova Scotia.

Table 4-1 Numbers of seabirds observed during supply vessel surveys

Common Name	Number observed	% of Total Observed
Greater Shearwater	556	61%
Northern Gannet	144	16%
Black-legged Kittiwake	60	7%
Herring Gull	51	6%
Northern Fulmar	27	3%
Great Black-backed Gull	26	3%
Leach's Storm-Petrel	11	1%
Sooty Shearwater	10	1%
Atlantic Puffin	6	1%
Manx Shearwater	3	0%
Pomarine Jaeger	2	0%
Parasitic Jaeger	1	0%
Common Murre	1	0%
Wilson's Storm-Petrel	1	0%
Red Phalarope	1	0%
Great Skua, Bonxie	1	0%
Unknown Gull	1	0%
Common Tern	1	0%
Black Guillemot	1	0%
Manx Shearwater	1	0%
TOTAL	905	

Table 4-2 Numbers of seabirds observed during reference surveys

Common Name	Number observed	% of Total Observed
Greater Shearwater	1629	73
Northern Fulmar	145	6
Herring Gull	88	4
Greater Black-backed Gull	64	3
Great Black-backed Gull	64	3
Northern Gannet	55	2
Black-legged Kittiwake	41	2
Leach's Storm-Petrel	27	1
Atlantic Puffin	24	1
Dovekie, Little Auk	22	1
Unknown Gull	18	1
Pomarine Jaeger	13	1
Coreys Shearwater	13	1
Sooty Shearwater	12	1
Unspecified Storm Petrel	12	1
Common Murre	3	0
Wilson's Storm-Petrel	1	0
Red Phalarope	1	0
Laughing Gull	1	0
TOTAL	2233	

Figure 4-1 Observed density of Greater Shearwater

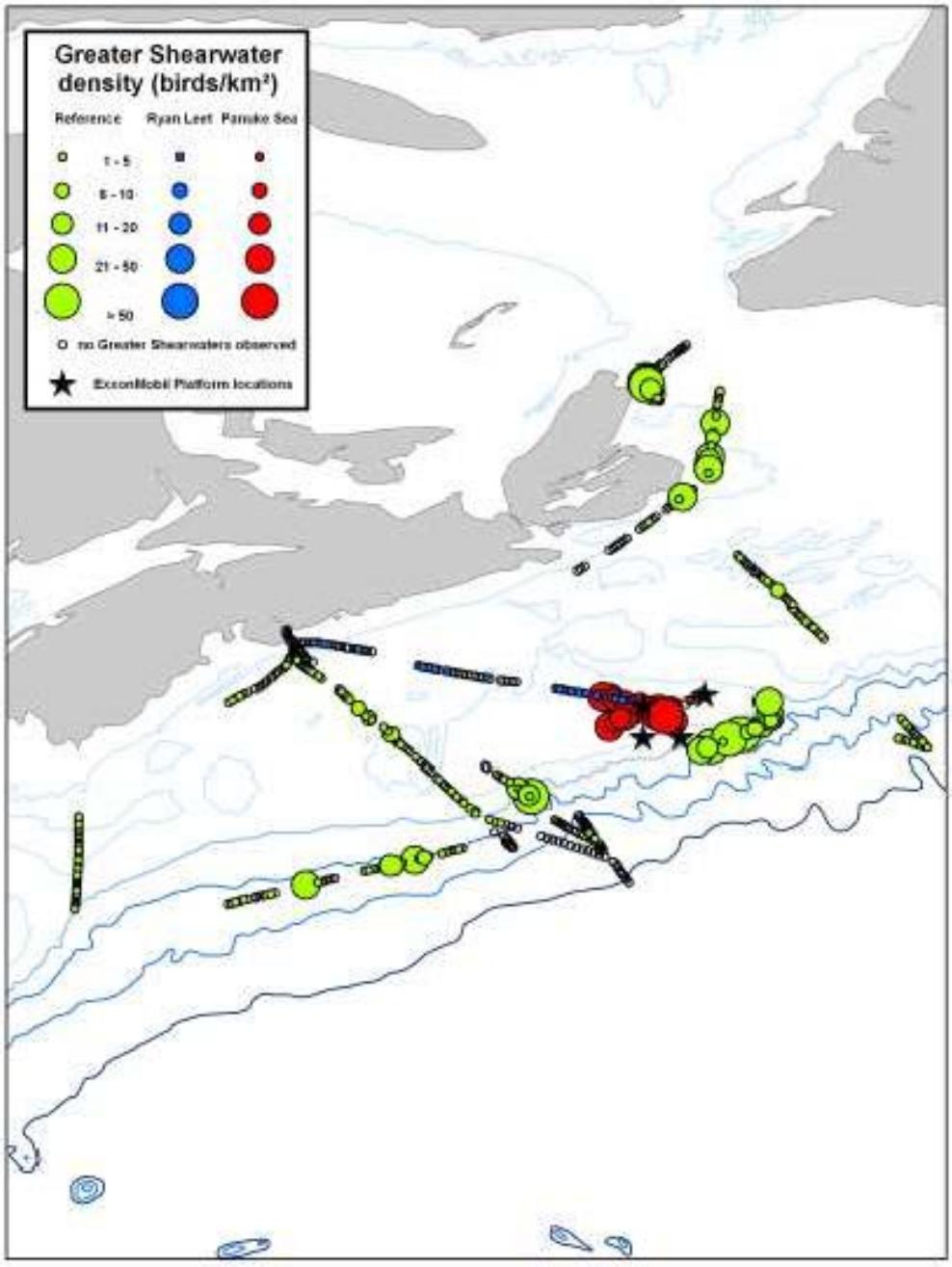


Figure 4-2 Observed density of Northern Gannet

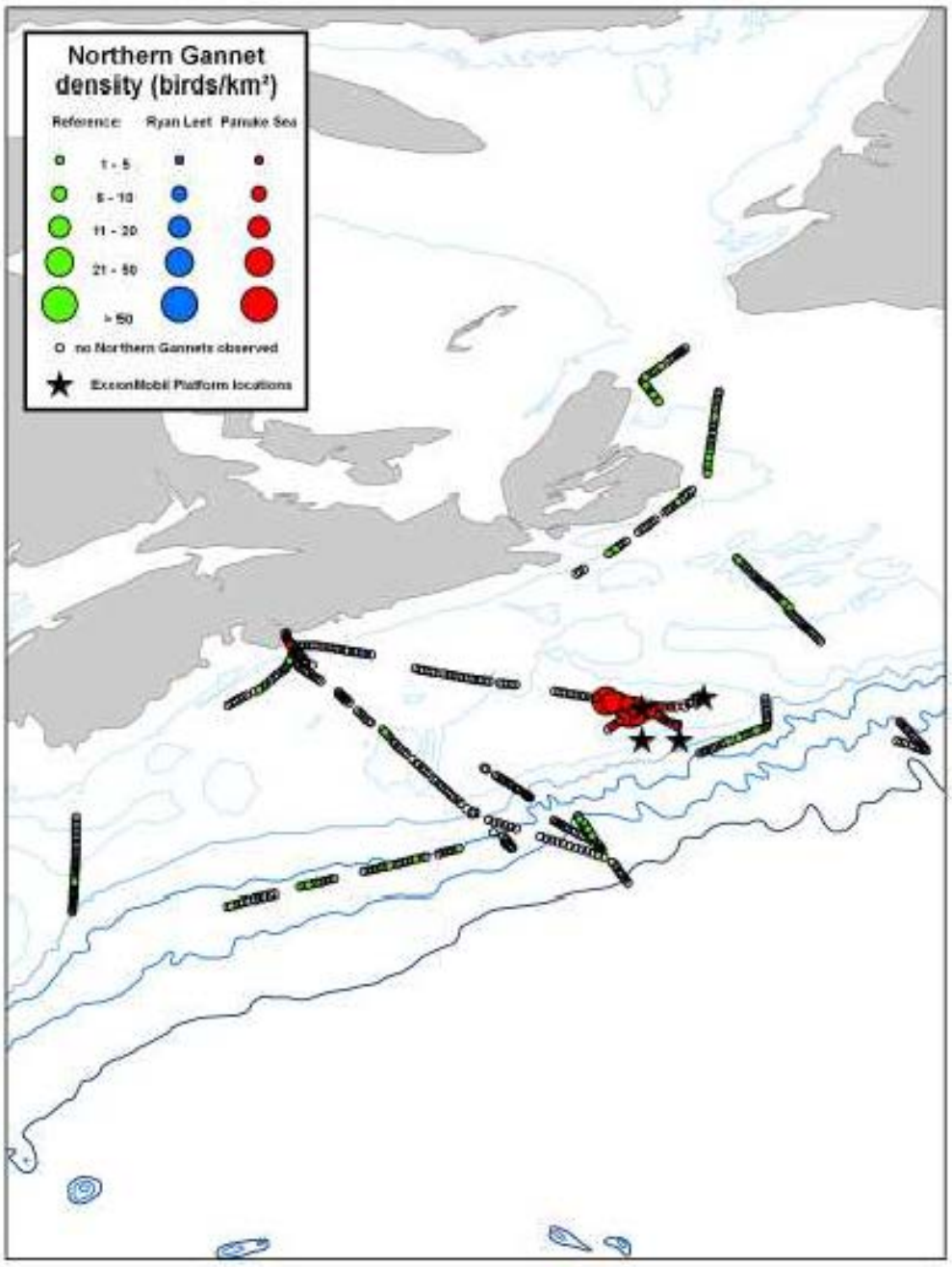


Figure 4-3 Observed density of Black-legged Kittiwake

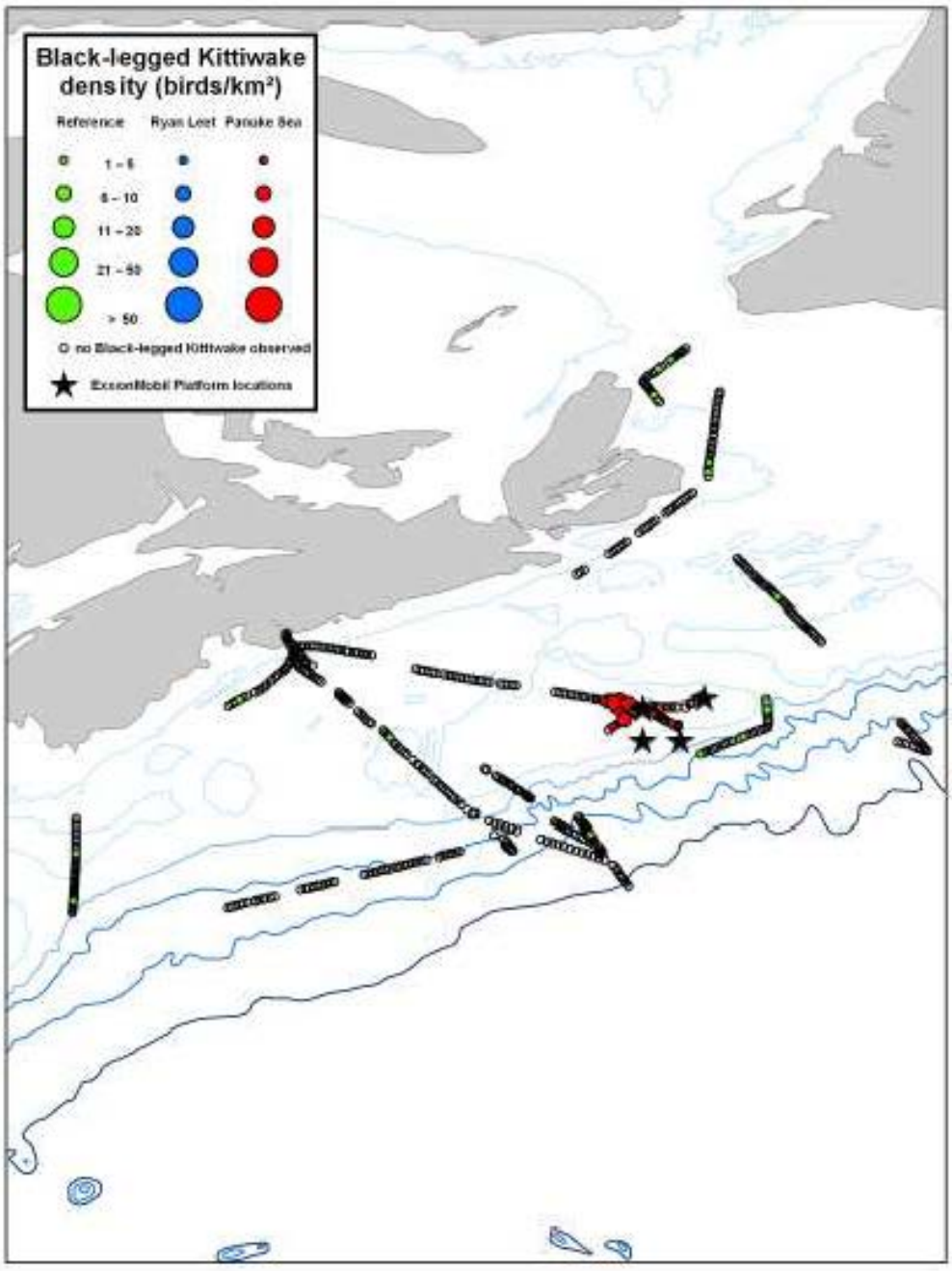


Figure 4-4 Observed density of Herring Gull

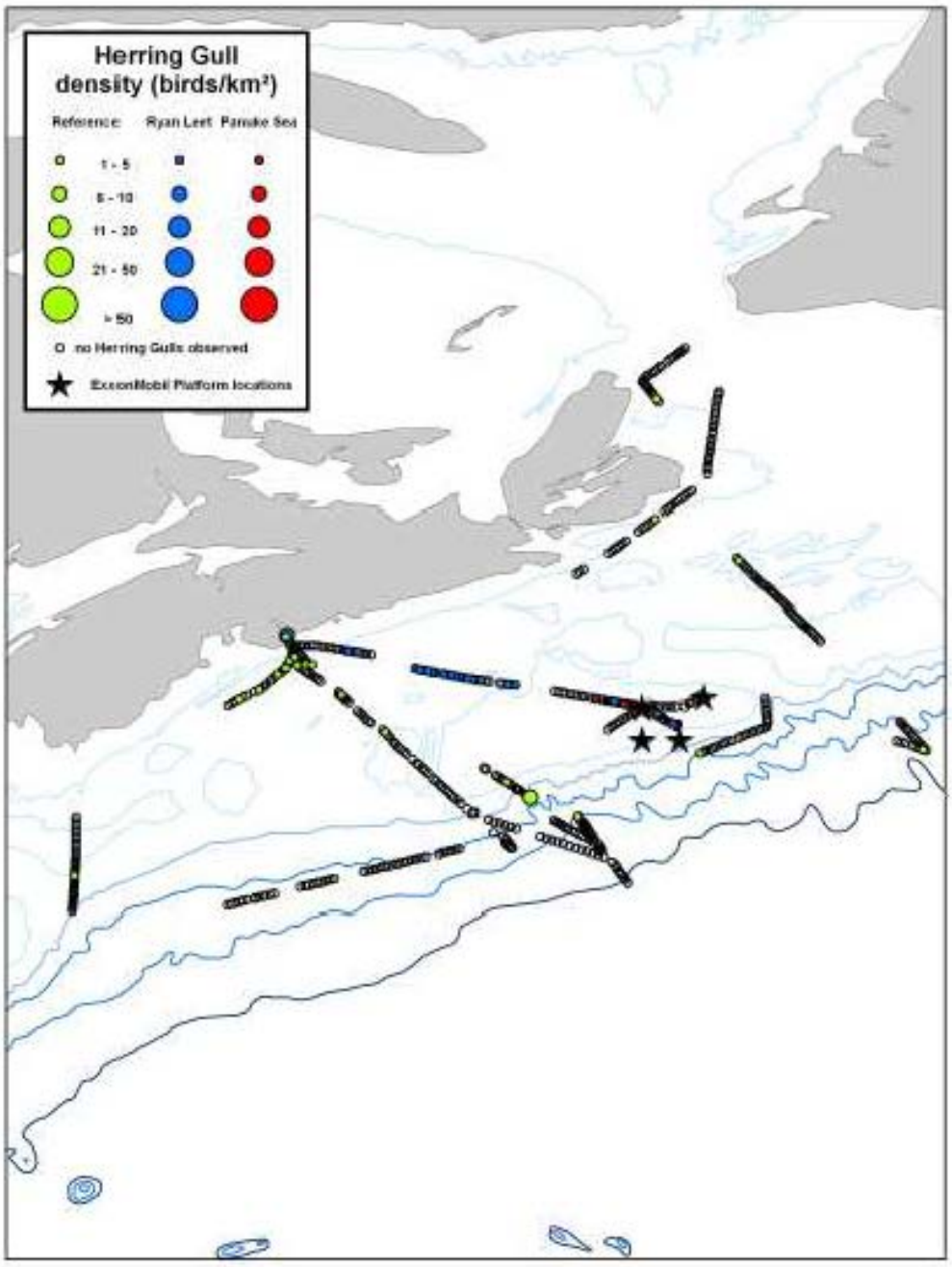


Figure 4-5 Observed density of Northern Fulmar

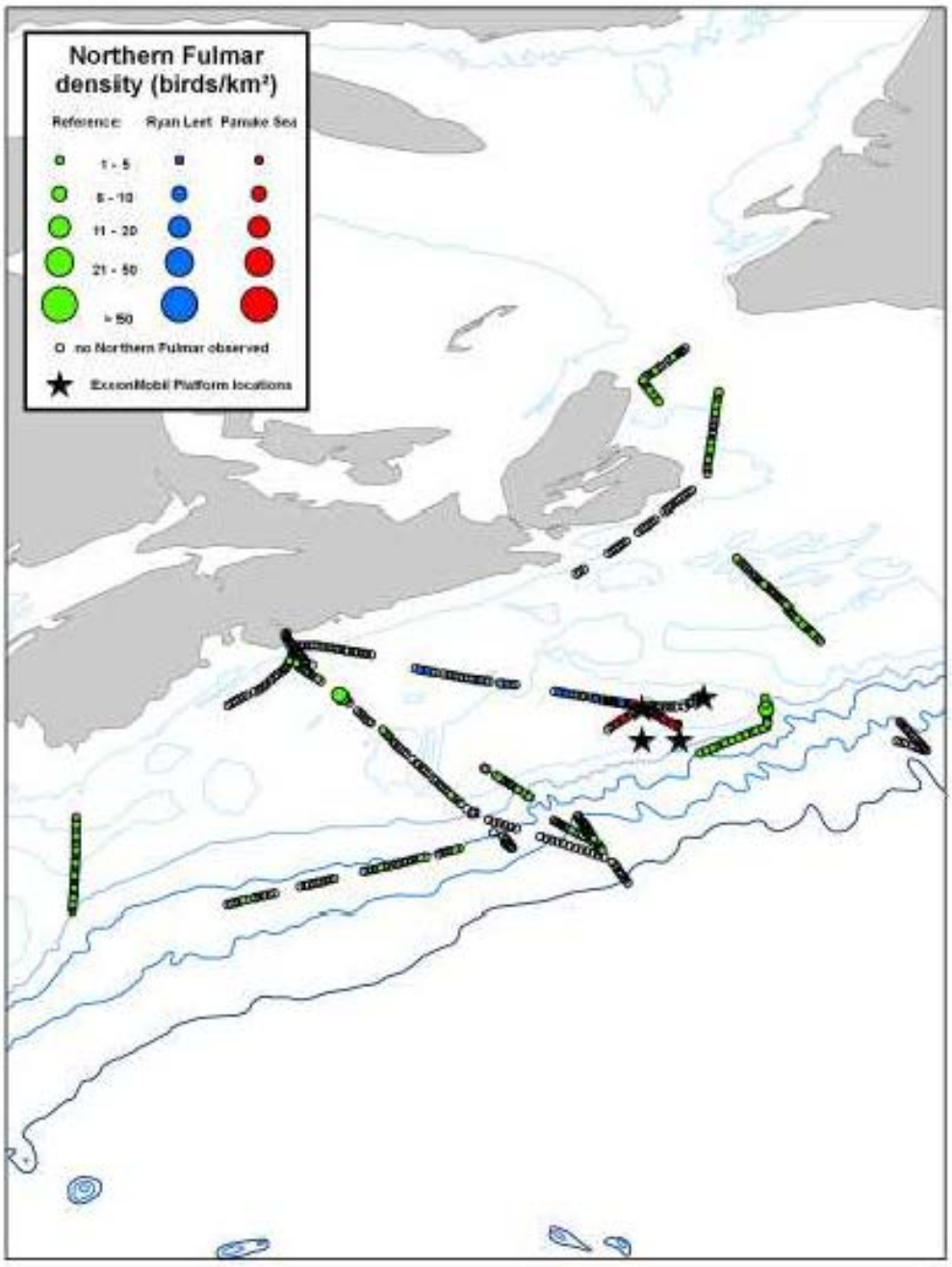
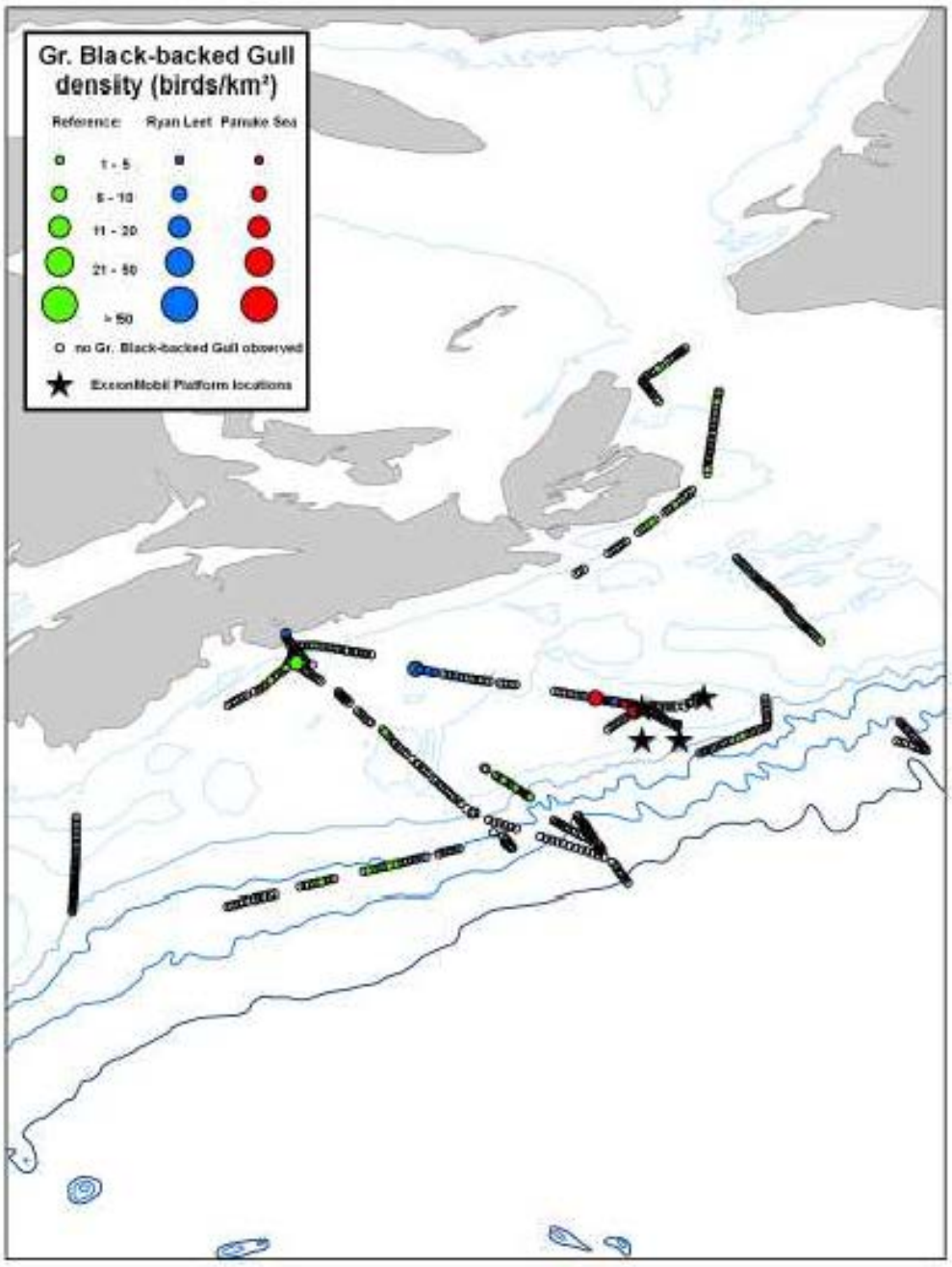


Figure 4-6 Observed density of Greater Black-Backed Gull



Attachment 4-1 List of species code for seabirds seen within the Atlantic Waters of Canada's Exclusive Economic Zone (EEZ).

Common name	Latin name
COMMON, REGULAR OR FREQUENTLY SEEN SPECIES	
Atlantic puffin	*Fratercula arctica*
Black Scoter	*Melanitta nigra*
Black-legged Kittiwake	*Rissa tridactyla*
Common Eider	*Somateria mollissima*
Common Murre	*Uria aalge*
Double-crested Cormorant	*Phalacrocorax auritus*
Dovekie	*Alle alle*
Great Black-backed Gull	*Larus marinus*
Glaucous Gull	*Larus hyperboreus*
Great Cormorant	*Phalacrocorax carbo*
Greater Shearwater	*Puffinus gravis*
Great Skua	*Stercorarius skua*
Herring Gull	*Larus argentatus*
Iceland Gull	*Larus glaucoides*
Leach's Storm-Petrel	*Oceanodroma leucorhoa*
Long-tailed Jaeger	*Stercorarius longicaudis*
Manx Shearwater	*Puffinus puffinus*
Northern Fulmar	*Fulmarus glacialis*
Northern Gannet	*Morus bassanus*
Parasitic Jaeger	*Stercorarius parasiticus*
Pomarine Jaeger	*Stercorarius pomarinus*
Razorbill	*Alca torda*
Red-breasted Merganzer	*Mergus serrator*
Sooty Shearwater	*Puffinus griseus*
Surf Scoter	*Melanitta perspicillata*
Thick-billed Murre	*Uria lomvia*
White-winged Scoter	*Melanitta fusca*
Wilson's Storm-Petrel	*Oceanites oceanicus*

INFREQUENTLY OR RARELY SEEN BIRDS

Audubon's Shearwater	*Puffinus lherminieri*
Black-headed Gull	*Larus ribindus*
Black Guillemot	*Cepphus grille*
Black Scoter	*Melanitta nigra*
Common Tern	*Sterna hirundo*
Cory's Shearwater	*Calonectus diomedea*
Great Cormorant	*Phalacrocorax carbo*
Harlequin Duck	*Histrionicus histrionicus*
Ivory Gull	*Pagophila eburnea*
Lesser Black-backed Gull	*Larus fuscus*
King Eider	*Somateria mollissima*
Long-tailed Duck	*Clangula hyemalis*
Red Phalarope	*Phalaropus fulicaria*
Red-necked Phalarope	*Phalaropus lobatus*
Ring-billed Gull	*Larus delawarensis*
South Polar Skua	*Catharacta maccormicki*

Attachment 4-2 Correspondence between CWS and ExxonMobil related to October, 2007 Bird Encounter Events – Email from Andrew Boyne (CWS) to Doug Bliss (CWS) Oct. 23/07.

"Doug;
This note is just to let you know where things stand with respect to the fall-out and subsequent death of passerines and seabirds on Thebaud platform off Sable Island. On October 10, an ExxonMobil crew found 77 carcasses. They put most overboard but sent 21 to shore which subsequently were sent to the NS Museum. We have not speciated the all the carcasses yet, mainly because we do not have a lab here and many of the birds were in rough shape, having been scavenged, presumeably by gulls, but the species range from goldfinches and other passerines to Leach's strom-petrels. ExxonMobil has sent 8 more birds to shore. We are now in possession of all of the carcasses, including those sent to the NS Museum and plan to ship them to AVC on Thursday for autopsies.

We suspected this was a migration fall-out presumable caused by unfavourable winds pushing birds offshore and then being attracted to the lights on the rig. However, on October 7 on the DFO research cruise that Carina was on they had several dozen warblers arrive on the ship which was on the Scotian Shelf. Carina counted 30 dead immature Blackpoll Warblers and she has collected 5 which will also be sent to AVC.

The interesting points are 1) Carina felt the birds she collected where in very good body condition with lost of fat on their breasts and 2) the weather would not suggest that high winds or any fronts would have pushed birds offshore. Presumeably something else moved them offshore or that this is a natural migration corridor. Being migration season one would expect tired birds looking for a safe haven but you'd expect that these events would be more regular during migration considering the number of vessels and platforms on the Scotian Shelf.

Zoe Lucas was not on Sable during this period to shed any light on whether Sable Island received a similar influx of migrants.

We are unable to ship the birds to AVC until Thursday because they are stored in environmental emergencies' freezer which is in a secure room and they are all at the REET meetings until Thursday. The lack of freezer space at Queen Square is a major problem. With Jon Stone's space cleaned out we now have space for a freezer. I know budgets are tight but we can purchase a small chest freezer for under $500 dollars. Can you please advise whether this is something we may be able to pursue?

Thanks, Andrew"

Attachment 4-3 Correspondence between CWS and ExxonMobil related to October, 2007 Bird Encounter Events – Letter to Andrew Boyne (CWS) from Greg MacDonald (EMC) Nov. 26/07.

"Thank you for meeting with representatives of ExxonMobil Canada and the CNSOPB on November 9th, 2007 to discuss the October 2007 bird encounter events on the Thebaud platform. This meeting helped clarify roles and responsibilities as well as expectations, in the event of any future incidents.

As discussed at our meeting, there were similar observations of birds encountered on a DFO research vessel operating on the Scotian Shelf during the early October timeframe. The preliminary reports from the UPEI Veterinary College indicate that the birds collected on the Thebaud platform and the DFO research vessel died of trauma. As suggested by you and Carina Gjerdrum, this trauma was likely caused by collisions with the superstructures after the birds were disoriented by the artificial lights on the structures.

We look forward to receiving the final results of the analysis that UPEI conducted on the collected birds and the development of the bird collection protocol by CWS for use in the offshore.

We look forward to continuing our cooperation with CWS and the CNSOPB.
Kind regards,

J. Gregory MacDonald"

Attachment 4-4 Report from Atlantic Veterinary College - 2007 Bird Encounter Events

Canadian Cooperative Wildlife Health Centre

Centre Canadien Coopératif de la Santé de la Faune

CCWHC INC # 000000847
AVC # A29311-07

Submitter:
Andrew Boyne
A/Head, Species at Risk Recovery Unit
Canadian Wildlife Service, Environment Canada
45 Alderney Drive, 16th Floor (mailing)/ 7th Floor (office)
Dartmouth, N.S. B2Y 2N6
tel: 902-426-1900 fax: 902-426-6434

SPECIMEN INFORMATION AND HISTORY

A total of 33 birds of various species were submitted for necropsy to the CCWHC Atlantic after being found on a Nova Scotian offshore platform, the Thebaud drilling platform (lat 43.90502 deg, lon -60.24299 deg). Almost 100 birds had been found on the platform in the space of a week. The birds submitted were collected between the 10th and the 22nd of October, 2007. The species submitted included Leach's Storm Petrel, Blackpoll Warbler, White-throated Sparrow, Yellow-rumped Warbler, Common Yellowthroat, American Redstart.
As per submitter: The samples in the clear bags tied together were sent to the N.S. museum of natural history first and then transferred to CWS, Dartmouth. They were collected on October 11th.
The birds in the garbage (black) bags and the red bags were collected on the 12th of October, and on the 15th and 22nd.
Interestingly, an observer out on a DFO research crew reported a die-off of upwards of 50 warblers on the 9th of October, which was the day before the birds were first found on the Thebaud platform. The observer felt that the birds were in good physical condition. Some of these birds were also examined by CCWHC Atlantic (CCWHC INC#000000841, AVC# A29063-07). They were in good body condition and likely died of traumatic lesions.

DIAGNOSIS AND INTERPRETATION

Diagnosis:
Trauma, acute, likely due to collision

Interpretation and conclusions:
The majority of the birds examined were in excellent to good body condition, with only a few thin ones in the mix. The ones in good body condition would have probably completed the autumn migration successfully.
Approximately 30-40% had definitive evidence of trauma, such as bleeding in muscle or body cavities (hemorrhages), tissue tearing or bone breaking (fractures). Most birds had at least some suggestion of trauma, although

03/25/2008 16:36 9025660871 POSTMORTEM AVC PAGE 03/07

Canadian Cooperative Wildlife Health Centre ***Centre Canadien Coopératif de la Santé de la Faune***

Telephone: (902)-566-0567 Fax: (902)-566-0958 Electronic Mail: DAOUST@UPEI.CA National Information Line: 1-800-567-2833

advanced decomposition precluded confirming the finding in some of them. Trauma is the most likely cause of death for most of these birds.

Most of the species examined are migratory birds that were on their way South when they were found dead on the offshore platform. Most long-distance migrants, especially small birds, fly at night; they may travel continuously or land daily around sunrise to rest and forage. When traveling over water or unsuitable habitats, birds that normally stop each day may fly without a break for longer periods. For example, Blackpoll Warblers migrate overland in spring, but autumn migrants travel nonstop over open ocean from southeastern Canada and the northeastern United States to their wintering grounds in northern South America.

Mass mortality events in migrating birds are well documented. These situations have been associated with multiple causes, but, despite the precipitating etiology, trauma is the proximate cause of death in many instances. As you are likely aware, lighted structures (i.e., tall buildings, lighthouses and radio towers and masts) are related to this type of casualty, especially in nearctic-neoptropical migrants that fly at night (blackpoll warblers are included in this group). The light disorients the birds resulting in collision. Air currents running to close to the ground/ocean surface can result in the birds being exposed to tall structures that they would not normally hit or even consider while flying at higher altitudes. There was a similar report of migrating bird mortality on a coastguard vessel (CCWHC INC #0000000841) the day before these birds were found on the platform. Those birds also had evidence of trauma and had been seen flying around a light on the coastguard vessel on the night prior to their death. This supports the idea of disorientation due to lighted structures on the vessel and on the platform. Why does this not happen every year? For this to happen, the air currents running south would have to include in their path the platform and vessel, and be low enough to allow contact with the buildings, as they tend to fly so high up under normal circumstances that no contact with buildings is possible. This is likely to be an exception this year, as similar episodes have not been recorded on the Thebaud platform in the past. Adverse weather can also facilitate collisions with tall buildings. We consulted the Environment Canada and Sable Island weather reports for the area close to the platform. Nothing significant was recorded between October 7-22, although on the 7th, the wind was the strongest (NW 30-48km/hr). Visibility remained good and there was light rain during that period of time. Whether this had any impact on the route the birds took on those days remains uncertain.

To rule out an infectious cause of death, histology (microscopy) and bacteriology tests were performed on some of the birds examined. Bacteriology was negative for any significant bacterial organism capable of causing disease, and microscopically there was no evidence of bacterial lesions in any of the

Established with support from Federal, Provincial and Territorial Governments, the Canadian Wildlife Federation and the Max Bell Foundation

Canadian Cooperative Wildlife Health Centre

Centre Canadien Coopératif de la Santé de la Faune

Telephone: (902)-566-0867
Fax: (902)-566-0958
Electronic Mail: DAOUST@UPEI.CA
National Information Line 1-800-567-2033

Pathology and Microbiology
Atlantic Veterinary College
University of P.E.I.
550 University Ave
Charlottetown, PEI
C1A 4P3

tissues/organs examined. None of the birds was suffering from a bacterial infection at the time of death.

A few birds had incidental lesions that were not directly associated with the cause of death. Namely, there was a blackpoll with filariasis in the blood, and a white-throated sparrow with sarcocystosis in the breast muscle and flukes in the liver (see histologic findings). The only other lesion that probably contributed to death was the renal gout found in another white-throated sparrow. Renal gout often occurs in dehydrated birds and can lead to death. As this particular sparrow did not have any obvious signs of trauma, it may have actually died of dehydration.

DETAILED DIAGNOSTIC FINDINGS

NECROPSY FINDINGS:

Black Bag #1:

Leach's Storm Petrel #1, 35.1 g, sex unknown, immature, good body condition. There was bruising on left side of the body, in the muscles of the base of the neck, approximately 1.5 cm in length, following the vertebral spine. Histology ID: A.

Black Bag #2:

Leach's Storm Petrel #2, 45 g, sex unknown, very good body condition. There was hemorrhage on the right pectoral muscle, approximately 1x1.5 cm. Histology ID: B.

Blackpoll Warbler, 20.3 g, sex unknown, immature, very good body condition. There was subcutaneous hemorrhage at the base of the neck, on the left side and on the left inguinal region. The skull was diffusely black-red. Histology ID: D.

Sparrow (possibly white-throated sparrow), weight not recorded, male, very good body condition. The dorsal muscles of the thorax and both wings were dark red (hemorrhagic, possibly).

Red Bag #1:

Yellow-rumped Warbler, 9.3 g, sex unknown, moderate to poor body condition. The gizzard was empty. There were white specks over the liver, lungs and heart (suggesting visceral gout). The carcass was much decomposed.

Red Bag #2:

White-throated Sparrow, 19 g, male (identified histologically), moderate to poor body condition. The gizzard was empty. The kidneys were mottled white and red (frozen at -80 deg). Histology ID: H.

Red Bag #3:

Axial skeleton (wings) only. Photograph was taken. Positive identification or necropsy examination were not possible.

Red Bag #4:

White-throated Sparrow, 15.2 g, sex unknown, poor body condition. No significant lesions were noted.

White-throated Sparrow, Band#2261-09726. Skeleton only, examination was not possible as little to no soft tissue remained.

Clear Bag #1:

American Redstart, 15.5 g (wet), sex unknown, very good body condition. There was dark red discoloration of the caudal left intercostal muscles (suggesting hemorrhage). The liver was pale, kidneys were mottled.

Established with support from Federal, Provincial and Territorial Governments, the Canadian Wildlife Federation and the Max Bell Foundation

Canadian Cooperative Wildlife Health Centre
Centre Canadien Coopératif de la Santé de la Faune
Telephone: (902) 566-0857
Fax: (902) 566-0958
Electronic Mail: DAOUST@UPEI.CA
National Information Line: 1-800-667-2833
Dept. of Pathology and Microbiology
Atlantic Veterinary College
University of P.E.I.
550 University Ave
Charlottetown, PEI
C1A 4P3

American Redstart (possible), 13.7 g (wet), sex unknown, moderate to poor body condition. No significant lesions were noted.
Blackpoll Warbler #1, 23.7 g (wet), male, adult, very good body condition. The skull was bright red. The liver was pale. Histology ID: E.
Blackpoll Warbler #2, 21.1 g (wet), sex unknown, very good body condition. The skull was bright red. The bird was frozen at -80 deg.
Blackpoll Warbler #3, 24.1 g (wet), male, adult, very good body condition. There were 2 small red areas in the skull. The bird was frozen at -80 deg.

Clear Bag #2:

Blackpoll Warbler #1, 22.1 g (wet), male, first winter (possibly), very good body condition. The skull was bright red.
Blackpoll Warbler #2, 23.9 g (wet), female, first winter (possibly), very good body condition. There were 2 small dark red areas in the skull.
Blackpoll Warbler #3, 28.5 g (wet), sex unknown, first winter (possibly), very good body condition. There was some blood in the tracheal lumen, dark red lungs and 2 red spots on the skull. Approximately 2cc of pale yellow fluid were present in the abdomen. Histology ID: F.
Blackpoll Warbler #4, 19.8 g (wet), male, first winter (possibly), very good body condition. There was some blood in the trachea. The skull was bright red. Approximately 2cc of pale yellow fluid were present in the abdomen.
Blackpoll Warbler #5, 25.6 g (wet), sex unknown, first winter (possibly), very good body condition. Half the skull was bright red. Approximately 2cc of pale yellow fluid were present in the abdomen.

Clear Bag #3:

Leach's Storm Petrel #3, weight not recorded, sex unknown, poor body condition. The carcass was much decomposed, an examination was not possible.
Leach's Storm Petrel #4, weight not recorded, sex unknown, moderate body condition; adipose tissue was orange tinted and very oily, as was the gastric mucosa (normal in petrels). The carcass was much decomposed, an examination was not possible.

Clear Bag #4:

Blackpoll Warbler, weight not recorded, sex unknown, very good body condition. The skull had multiple small red spots. There was some blood in trachea and small amounts of yellow fluid in the abdomen.
Common Yellowthroat (possible), 8.5 g (wet), sex unknown, moderate to poor body condition. The carcass was markedly decomposed.
Unidentified Warbler #1-4, weight not recorded sex unknown, all in poor body condition and 2 of them markedly decomposed.
Unidentified, possible Petrel, headless carcass, wing span 16 centimeters, female, very good body condition. The muscles at the base of the neck were dark red-black and dry. The muscles of the dorsal side of the thorax were diffusely red. The gizzard contained a few seeds and, possibly, part of an exoskeleton from an insect. Histology ID: C.

Clear Bag #5:

White-throated Sparrow #1, 15.1 g, sex unknown, marked decomposition precluded a detailed examination.
White-throated Sparrow #2, 25.5 g, male. There were red spots with a white rim on the skull, approximately 1-3 mm in diameter. There was red discoloration following the skull suture lines and hemorrhage at the base of the head and cranial neck muscles. The

Canadian Cooperative Wildlife Health Centre

Centre Canadien Coopératif de la Santé de la Faune

Telephone: (902)-566-0867
Fax: (902)-566-0958
Electronic Mail: DAOKIRT@UPEI.CA
National Information Line 1-888-347-2833

[illegible]
Dept. of Pathology and Microbiology
Atlantic Veterinary College
University of P.E.I.
550 University Ave
Charlottetown, PEI
C1A 4P3

[illegible]
WCVM, Vet. Pathology
University of Saskatchewan
Saskatoon, SK
[illegible]

[illegible]
Vet de Pathologie
[illegible]

[illegible]
VC Pathology Dept.
University of Guelph
[illegible]

cervical spine was fractured. There were a few feathers in the gizzard. The lungs were diffusely red.

White-throated Sparrow #3, 31.6 g, sex not recorded, good body condition. The skull was red. There was a tear in the left dorsal side of the thoracic cavity, with fractured ribs and hemorrhage in the intercostal muscles. The lungs were red and the gizzard was empty. Histology ID: G.

White-throated Sparrow #4, 28.6 g, sex not recorded. The skull was red. There was hemorrhage on the dorsal side of the thorax. The wings were red. The abdominal viscera were markedly decomposed. The gizzard was empty.

White-throated Sparrow #5, 26.3 g, sex not recorded, poor body condition. The carcass is markedly decomposed, precluding a detailed examination. The gizzard contains only grit.

HISTOLOGIC FINDINGS:

A, Leach's Storm petrel (black bag #1, petrel #1):
There is marked to severe autolysis that somewhat precludes a very detailed examination. Postmortem filamentous bacterial overgrowth is prominent in several parabronchi (artifact).
No significant lesions are present in the sections of brain, lung, heart, kidney, skeletal muscle, spleen, liver, proventriculus, gizzard and intestine.

B, Leach's Storm petrel (black bag#2, petrel #2):
There is marked to severe autolysis that somewhat precludes a very detailed examination.
There are multifocal acute hemorrhages that expand the endo and perimysium of the pectoral muscle. Subcapsule hemorrhage/necrosis is focally present in the liver.
No significant lesions are present in the sections of brain, heart, kidney, spleen, proventriculus, gizzard and intestine.

C, Unidentified petrel (clear bag#4, petrel):
There is marked to severe autolysis that somewhat precludes a very detailed examination.
No significant lesions are present in the sections of brain, lung, skeletal muscle heart, kidney, ovary, oviduct, proventriculus, gizzard and intestine.

D, Blackpoll Warbler (black bag#2, blackpoll):
There is marked to severe autolysis that somewhat precludes a very detailed examination.
There are multifocal acute hemorrhages that expand the endo and perimysium of the pectoral muscle. Subcapsule hemorrhage/necrosis is focally present in the liver.
No significant lesions are present in the sections of brain, heart, kidney, spleen, adrenal gland, proventriculus, gizzard and intestine.

E, Blackpoll Warbler (clear bag#1, blackpoll#1):
There is marked to severe autolysis that somewhat precludes a very detailed examination. In the blood vessels of the lung, there are many tubular basophilic structures, long and thin, that suggest nematode microfilaria but with little definition to confirm their identity.
No significant lesions are present in the sections of brain, heart, kidney, proventriculus, gizzard and intestine.

F, Blackpoll Warbler (clear bag#2, blackpoll#3):
There is severe autolysis that somewhat precludes a very detailed examination.

Established with support from Federal, Provincial and Territorial Governments, the Canadian Wildlife Federation and the Max Bell Foundation

03/29/2008 16:36 9025668871 POSTMORTEM AVC PAGE 07/07

Canadian Cooperative Wildlife Health Centre

Centre Canadien Coopératif de la Santé de la Faune

Atlantic Region
Dept. of Pathology and Microbiology
Atlantic Veterinary College
University of P.E.I.
550 University Ave
Charlottetown, PEI
C1A 4P3

Telephone: (902)-566-0667
Fax: (902)-566-0958
Electronic Mail: DAQUST@UPEI.CA
National Information Line 1-800-567-2003

No significant lesions are present in the sections of brain, heart, kidney, lung, liver, proventriculus, gizzard and intestine.

G, White-throated Sparrow (clear bag#5, sparrow#3):
There is severe autolysis that somewhat precludes a very detailed examination.
There are several intracellular cysts filled with myriads of protozoal zoites (consistent with *Sarcocystis* sp. bradyzoites) in the pectoral skeletal muscle.
The lumen of what appears to be a large bile duct in the liver contains well defined trematode eggs in what is assumed to be an autolytic adult fluke.
No significant lesions are present in the sections of brain, heart, kidney, lung and intestine.

H, White-throated Sparrow (red bag#2, sparrow):
There is severe autolysis that somewhat precludes a very detailed examination.
There are many clusters of mononuclear cells surrounding star-shaped crystal deposits in the renal parenchyma (deposits of uric acid).
No significant lesions are present in the sections of brain, heart, lung, liver, testicle and intestine.

BACTERIOLOGY:
Several postmortem contaminants or overgrown bacteria were cultured from the samples submitted (liver and/or lung tissue from 7 birds). No significant isolates, including no *Salmonella* sp, were cultured.
Interpretation: None of the birds had any evidence of a bacterial infection at the time of death.

VIROLOGY:
As part of the Avian Influenza Surveillance program, routine samples from some of these birds were submitted for AIV PCR. Results were negative.

María Forzán, MVZ, MSc, DipACVP
(902) 566 0545, mforzan@upei.ca

Established with support from Federal, Provincial and Territorial Governments, the Canadian Wildlife Federation and the Max Bell Foundation

5.0 BEACHED SEABIRD SURVEYS

Photos: Sable Island Green Horse Society

5.1 BACKGROUND

Since 1996, regular surveys for beached oiled birds have been conducted on Sable Island to monitor trends in numbers and rates of oiling in beached seabirds, and to collect specimens of contamination for gas chromatographic analysis to generically identify oil types.

Results of analysis of oil samples collected during 1996-2005 have been reported in Lucas and MacGregor [1].

5.2 GOAL

By monitoring numbers and oiling rates in beached seabirds on Sable Island, industry and regulators can identify and correct potential sources of oil contamination arising from industry operations.

5.3 OBJECTIVES

- To monitor trends in oiling rate in beached seabird corpses.
- To generically identify oil types found on seabird feathers and in pelagic tar.

5.4 2007 SAMPLING

Contractor: Zoe Lucas, Sable Island

- Between January 1 and December 31, 2007, nine surveys for beached oil and oiled seabirds were conducted once every 30-40 days on Sable Island. Due to persistent beach flooding (and Grey Seal breeding colonies in December), no surveys were conducted during May, August and December.

- All surveys were conducted by Zoe Lucas.

- Species identification, corpse condition and extent of oiling were recorded for seabird specimens. When possible, the time since death was estimated based on freshness of tissues and degree of scavenging.

- The oiling rate is the fraction of oiled birds of the total number of birds, coded for oil (i.e. with > 50% of body intact) during 2007.

- Samples of beached pelagic tar and oiled feathers, representing contamination on various seabird species, and at various beach locations on the island, were collected.

- Oil samples were packaged in aluminum foil, labeled, kept frozen for periods ranging from one week to several months, and delivered to the laboratory for gas chromatographic analysis (Maxxam Analytics). Interpretation of GC/FID results were conducted by MacGregor & Associates (Halifax) Ltd.

- Oil specimens were solid samples (pelagic tar or oiled seabird feathers) and were dissolved directly in dichloromethane. This extract, filtered to remove solids, was injected on a glass capillary column (SPB-1) in an HP 5890 Gas Chromatograph with Flame

Ionization Detector (GC/FID). Outputs from the GC were retrieved on HPChem station, and chromatograms were produced and assessed manually. Concurrently standard oils such as Bunker C, Scotian shelf crude and condensate, marine diesel, and hydrocarbon n-alkane marker standards (C6-C16 and C18-C32) were run under the same conditions. This permitted identification of the n-alkane peaks in the chromatograms. N-alkane peaks were not quantified: only relative concentration calculations based on peak height were undertaken

- Oil samples found on the beach and bird corpses on Sable Island were identified as representing separate discharge events on the basis of date, bird corpse condition, and oil characteristics.

Survey Date	**January –December 2007**
Platform	Beach, Sable Island
Type of Sample	Oil on beach, oiled seabird feathers
Test Sample Locations	n/a
Reference Sample Locations	n/a
Number of Samples	9 surveys, 3 oil samples
Sample Preparation	frozen
Equipment	Collection by hand from the beach using glass or metal foil containers

5.5 ANALYSIS

Analysis of 3 oil samples collected from the beach and from feathers of beached seabird corpses in February and June 2007.

5.5.1 Parameters Analyzed

Parameters	Analysis Method
HCR, MHCP, URM, URM/MHCP ratio	gas chromatograph (GC/FID)

5.5.2 QA/QC

Maxxam Analytics is a CAEAL facility (Canadian Associates of Environmental Analytical Laboratories).

5.6 RESULTS

Results are presented in Table 5-1, Table 5-2 and Table 5-3

5.7 SUMMARY AND CONCLUSIONS

- During 2007, the corpses of 776 beached gannets, tubenoses, gulls and alcids were collected on Sable Island. Alcids comprised 65.1% of total birds recovered.

- For all species combined, the oiling rate for birds coded for oil (i.e. With >50% of body intact) was 3.8%. The highest rate for a seabird group, 7.1%, was observed in alcids.

- The oiling rate observed in 2007 was the lowest recorded since 2000 (Figure 5-1).

- Of the 3 samples collected and analysed, none contained light or mid-range distillate fuels, or condensates that would be typical of oils produced on offshore gas facilities such as SOEP processing platforms off Sable Island. The contamination source for the single sample containing fuel oil could have been one of any offshore operations in the region, including fishing and military vessels, freighters and container ships, and offshore energy vessels and facilities.

- Although only 3 samples were collected in 2007, the results of generic identification of these oils are consistent with results of samples collected during 2000 to 2006, which indicated that crude oil discharges were likely responsible for a large proportion of pelagic tar and oiled seabirds observed on Sable Island.

5.8 REFERENCES

[1] Lucas Z. & C. MacGregor. 2006. *Characterization and source of oil contamination on the beaches and seabird corpses, Sable Island, Nova Scotia, 1996-2005*. Marine Pollution Bulletin 52: 778-789.

Table 5-1 Beached seabird corpses collected on Sable Island during 2007. Monthly numbers, and annual oiling rate for birds coded for oil (i.e. with > 50% of body intact).

Species	Jan	Feb	Mar	Apr	Jun	Jul	Sep	Oct	Nov	Total birds found	Total coded for oil	Oiling rate %
Northern Gannet	0	0	1	0	10	0	0	1	3	15	15	0
Tubenoses	2	2	19	7	12	35	13	9	9	108	77	1.3
Gulls	16	11	62	20	24	8	1	3	3	148	112	0
Alcids	54	105	113	164	55	8	0	2	4	505	196	7.1
Total	72	118	195	191	101	51	14	15	19	776	400	3.8

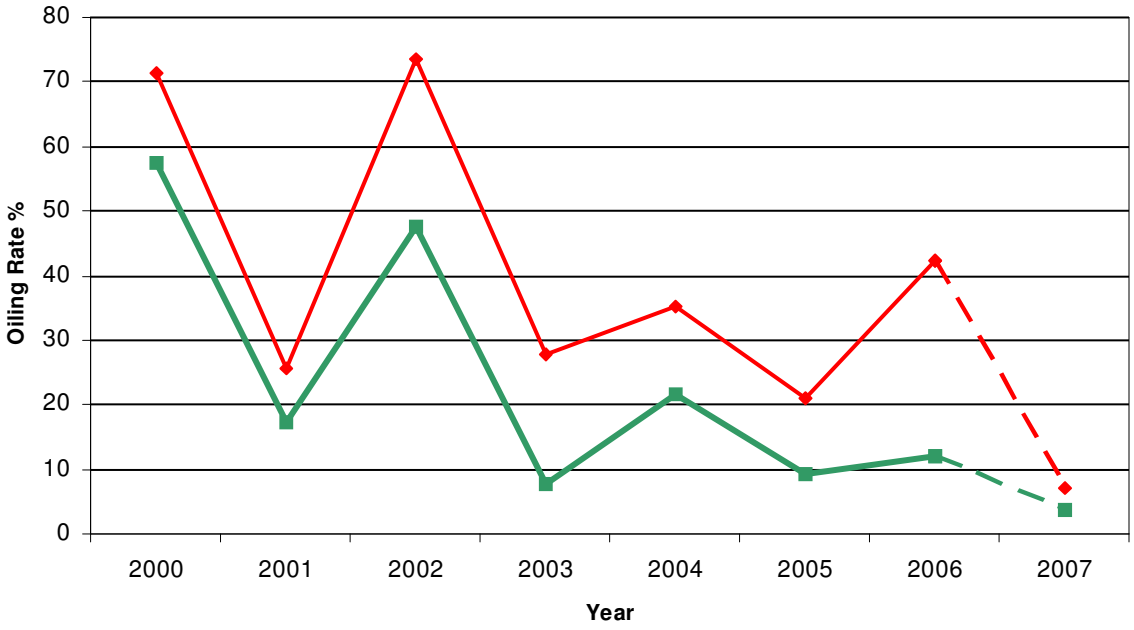
Table 5-1 Three discharge events identified in 3 oil samples collected on Sable Island during 2007

Date	Number of Samples	Matrix	Generic Identification of Oil
Feb 15	1	Alcid	Crude. Slight weathering.
June 4	1	Beach	Crude. Slight weathering.
June 17	1	Shearwater	Fuel oil. Weathered.

Table 5-2 Discharge events identified by generic oil source of samples collected on Sable Island during 2000-2007

Year	Crude oil	Fuel oil	Bilge	Total
2000	6	1	1	8
2001	12	2	2	16
2002	5	3	2	10
2003	6	2		8
2004	6			6
2005	9			9
2006	5	1		6
2007	2	1		3
Total	**51**	**10**	**5**	**66**

Figure 5-1 The oiling rate for 2007 is a percentage of birds coded for oil (i.e., with > 50% of body intact, CWS beached seabird survey protocol). Red = all birds combined; green = alcids



6.0 MUSSEL BODY BURDEN

6.1 BACKGROUND

Thebaud, the main production platform, has been in production since December 1999. As part of the on-going EEM program, shellfish have been collected and analyzed at the site to determine hydrocarbon tainting as a result of drilling in each area.

Mussel collection occurred at Thebaud from 1999 to 2002, 2005, and for this year's EEM program. For the first two years of sampling, moorings were set at 250m, 500m, 1000m, 2000m, 4000m, 10km, and 15km from the platform. Due to increased drilling activity in 2001, and potential risk of damage to the mussel moorings, mussel collection was modified to scraping the mollusks from the rig legs. Samples were removed at the surface (0-1m depth) to provide a sample close to the produced water caisson. In 2003, mussels were unavailable for sampling because of natural sloughing in wave action, which sometimes occurs when mussels reach their maximum size and density.

Most of the current energy at Thebaud (about 70%) is due to elliptical tidal flow. In this average daily sense all jacket legs are all within the 'zone of initial dilution' of the produced water (PW) plume. The envelope defined by average tidal excursion is about 2-3 times the mean flow (i.e. prevailing current). Thus, each leg will be exposed to the PW discharge plume twice per day for some period. For sampling purposes, all jacket legs are the same[11]. The argument to be 'downstream' of the platform is stronger when related to far-field monitoring sites.

6.2 GOAL

The primary objective of the testing program is to evaluate environmental test samples for evidence of hydrocarbon tainting.

6.3 OBJECTIVES

- characterization of hydrocarbon profiles relative to previously analyzed reference condensate samples
- determine flesh moisture, flesh total lipid content and lipid class composition

[11] For 2007, mussels were collected from the east leg of Thebaud platform for analysis.

6.4 2007 SAMPLING

Contractor: AMEC Earth & Environmental

Survey Date:	September 20, 2007
Platform :	Fast Rescue Craft (FRC)
Type of Sample:	Whole mussels
Test Sample Locations:	Thebaud platform, east leg
Reference Sample Locations:	Control Mussels, purchased at Superstore by Amec Earth & Environmental
Number of Samples/Station:	One test and one reference sample
Sample Preparation (i.e. preservation):	Live test mussels were picked out and scrubbed clean under running tap water and then frozen (~30°C). The control mussels were all alive but were cleaned and frozen as the test samples.
Equipment:	NA
Sampling QA/QC:	NA

6.5 ANALYSIS

Contractor: Canadian Institute of Fisheries Technology

6.5.1 Parameters Analyzed

Parameters	Analysis Method
Flesh moisture	A.O.C.S Official Method Ca 2c-25
Flesh total lipid content	Solvent extraction according to [1]
Lipid class composition	Iatroscan thin-layer chromatography-FID
Characterization of hydrocarbon profiles relative to previously analyzed reference condensate samples	Saponification, column chromatography and GC analysis (for details, see QA/QC section)

6.5.2 QA/QC

From each of the two samples, several frozen organisms were randomly chosen. The meats were removed from the shells. A homogenized sample of the meats was prepared from each of the two samples for hydrocarbon, lipid and moisture analyses. A blank consisting of distilled de-ionized water was carried through the hydrocarbon analysis.

Hydrocarbons were isolated by saponification with pentacosane added as internal standard. Recovered hydrocarbons were purified using solid phase extraction cartridges following the method of Ackman et al. (1997). This method isolates both aliphatic and polycyclic aromatic hydrocarbons. Hydrocarbons were then analysed using a Perkin Elmer Autosystem capillary gas chromatograph equipped with a flame ionization detector (FID) and a splitless injection system. The analytes were separated on a DB-1MS column, 60 m x 0.25 mm x 0.25ų phase

(Chromatographic Specialties Inc., Brockville, ON). Conditions and temperature were as follows: FID 300ºC, injector temperature 250ºC, initial column temperature of 60ºC held for 15 minutes and then increased at a rate of 13º/min to a final temperature of 280ºC, and held for 90 minutes.

6.6 RESULTS

The mussel testing results are summarized in Table 6-1, Table 6-2, and Table 6-3 below. An example of the hydrocarbon profile for a typical mussel sample is shown in Figure 6-1.

Table 6-1 Moisture and Lipid Contents (% wet weight) of the Mussels

Sample Site Location	Moisture Contents (%)	Lipid Contents (%)
Thebaud Platform – East leg	89.25	1.13
Control	88.44	1.00

Table 6-2 Lipid Classes (Iatrocan area %[a]) in the Mussels

Sample Site Location	Triacylglycerol	Free Fatty Acid	Sterol	Polar Lipid
Thebaud Platform- east leg	10.0	TR	4.6	85.4
Control	6.7	TR	5.6	87.7

[a] uncorrected for Iatroscan detector response
TR = present at trace levels

Table 6-3 Aliphatic Hydrocarbons of Importance (ppm, dry tissue basis) in the Mussels

Sample Site Location	Aliphatic Hydrocarbons C_{10} - C_{24}[a] (ppm)	Polycyclic Aromatic Hydrocarbons (ppm)	Notable Hydrocarbons	
			Pristane (ppm)	21:6[b] (ppm)
Thebaud Platform leg	14.28	ND	0.20	ND
Control	3.35	ND	TR	ND

[a] The specific alkane pattern suggests a possible biogenic origin for the aliphatic HC's
[b] n-heneicosa-3,6,9,12,15,18-hexaene, a hydrocarbon derived from algae.
ND = not detected; TR = present at trace levels

6.7 SUMMARY AND CONCLUSIONS

- The concentrations of aliphatic hydrocarbons in both the control and test samples were lower than those of the 2005 survey (Figure 6-2).

- The presence of polycyclic aromatic hydrocarbons (PAH) and an unresolved complex matrix in the GC chromatograms would indicate petrogenic hydrocarbon tainting. There is no evidence of either in the samples analyzed here. Furthermore, the aliphatic hydrocarbon profile reported is typical of that produced by naturally occurring phytoplankton. The hydrocarbon profile of both the test sample and control

contained the same biogenic hydrocarbon species in the same relative proportions; only the total amounts differed. There is no difference in the aliphatic hydrocarbon profile in test or control samples (i.e., ratio of even to odd carbon numbered aliphatics is the same in both sample types).; Thus, it is expected that the elevated levels of hydrocarbons in the test sample, as compared to the control, should not be a concern because those aliphatic hydrocarbons are almost certainly derived from phytoplankton.

- No taste panel evaluations were carried out on platform sampled mussels as a precautionary health measure for panelists.

6.8 REFERENCES

[1] Ackman, R.G., Heras, H. and Zhou, S. 1997. Improvements in recovery of petroleum hydrocarbons from marine fish, crabs and mussels. In New Techniques and Applications in Lipid Analysis. Ed. McDonald and Mossoba. AOCS Press.

[2] Zhou, S., R. G. Ackman, J. Parsons, 1996. Very long-chain aliphatic hydrocarbons in lipids of mussels (*Mytilus edulis*) suspended in the water column near petroleum operations off Sable Island, Nova Scotia, Canada. Marine Biology (1996) 126:499 507 _9 Springer-Verlag.

Figure 6-1 Hydrocarbon profile of mussel sample taken from Thebaud platform

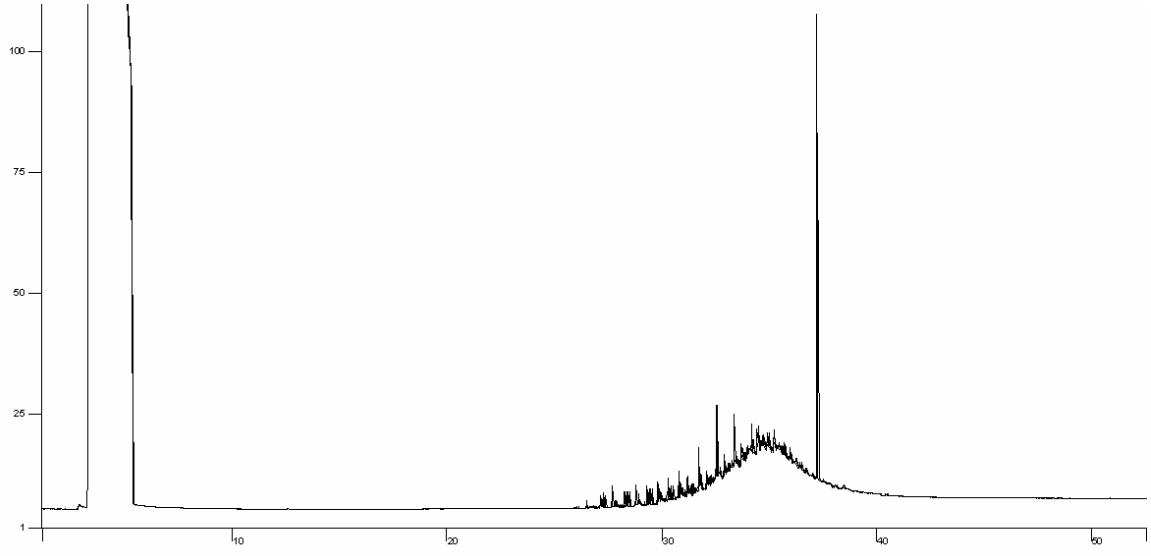
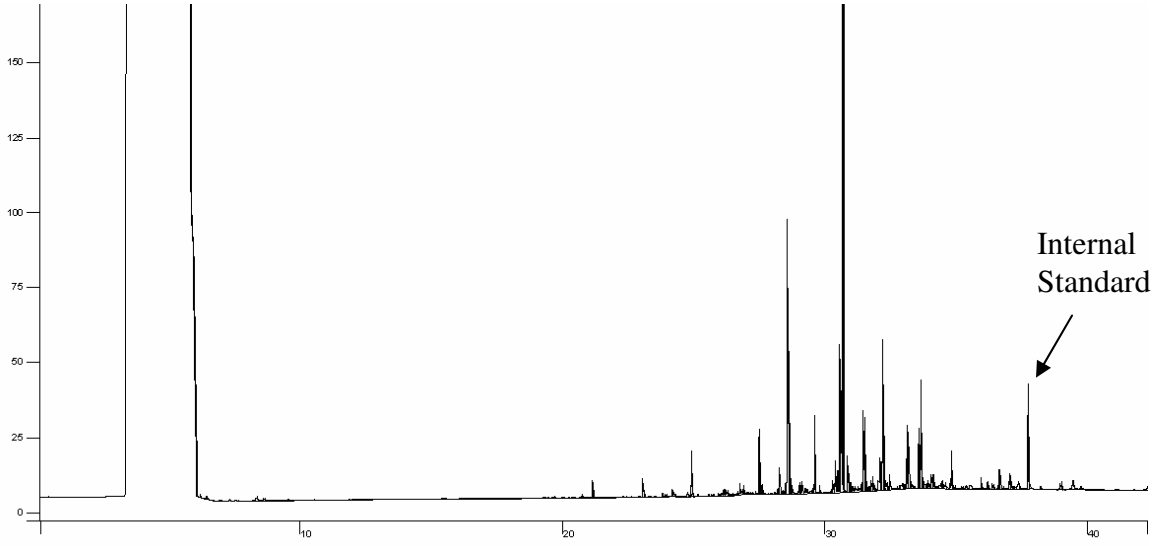


Figure 6-2 Concentration of Aliphatic Hydrocarbons in Blue Mussels at Thebaud



[Note: The absence of UCM. Sharp, well-defined peaks suggest a biogenic origin of the aliphatic hydrocarbons.]

7.0 SEDIMENT CHEMISTRY

7.1 BACKGROUND

Thebaud, the SOEP main production platform, has been in production since December, 1999. Oil-based muds/cuttings from wells drilled prior to January 1, 1999 were discharged under Offshore Waste Treatment Guidelines (OWTG) [1] criteria of 15 g/100g (on a wet solids basis) oil content. Oil-based muds/cuttings from most wells drilled at Thebaud were shipped to shore. Water-based muds/cuttings from all well top-hole sections have been ocean-discharged at all platform locations without treatment as per the OWTG.

Sediment toxicity has been monitored at Thebaud site since 1998. No sediment sampling was carried out in 2004 for operational reasons. The CNSOPB EEM Advisory Committee agreed that sediment chemistry was not required at Thebaud or near the Gully MPA in 2006 since the concentrations of key drill waste indicators (i.e., Barium (Ba) and Total Petroleum Hydrocarbon (TPH)) in 2005 approximated 1998 baseline (pre-drilling) levels or were non-detectable (i.e., Mercury (Hg)). In 2007, DFO COOGER kindly offered to collect and analyze sediment samples collected in the near-field Thebaud area at three sites (i.e., 250m, 500m and 1000m from the platform along the prevailing current axis) and at four far-field reference stations near the Gully MPA (see Table 7-1 & Figure 7-1) which would allow for further verification of earlier results.[12]

7.2 GOAL

To examine sediments collected by DFO COOGER near Thebaud platform and the Gully Marine Protected Area for chemical indicators of drill wastes.

7.3 OBJECTIVES

- Analyze sediments for key potential chemical indicators (TPH, Ba, Hg) of drill wastes at three near-field sampling stations along the major current axis at the Thebaud platform location and at four far-field reference sites near the western boundary of the Gully Marine Protected Area; and,

- Compare results with available historical monitoring data at the same locations

[12] EEM sediment sampling has not been undertaken at Venture and North Triumph platform locations since 2003 when key drill waste chemical indicators returned to 1998 baseline concentration levels. The 2005 EEM program also showed low or non-detectable concentrations of key drill waste indicators near the South Venture platform following discharges of oil-based muds/cuttings (under a discharge limit of 6.9 mg/l oil content) during work-overs at that location in 2004/5. Sampling at Alma was not required since all SBM/cuttings generated during drilling were shipped to shore for treatment and disposal.

7.4 2007 SAMPLING

Agency: DFO (COOGER/Particle Dynamics Lab) – Bedford Institute of Oceanography

Collection Date(s):	August 13, 2007 (Thebaud) August 23, 2007 (Gully Sites)
Platform:	CCGS Hudson
Type of Sample:	Core samples
Test Sample Locations:	Thebaud (250m, 500m, 1000m) (see Figure 7-1 & Table 7-1)
Reference Sample Locations:	Near Gully Marine Protected Area Sites G1, G2, G3a, G4a (see Figure 7-1 & Table 7-1)
Sample Preparation:	Bottom sediment samples for trace metal analysis were collected using a hydraulically damped slow corer. This equipment preserves the sediment water interface in tact. Samples are collected in polycarbonate tubes and then extruded and sliced in 2cm intervals and stored cold (<4C) in plastic containers while at sea. Samples are sub-sampled, dried, sieved and sent for analysis upon returning to the lab.
Equipment:	Hydraulically damped slow core.
Sampling QA/QC:	• Duplicate samples were taken at each site for analysis • GPS used for station keeping • A new cleaned slo-sore polycarbonate tube was used for each collected core

7.5 ANALYSIS

Agency: DFO (Particle Dynamics lab) – Bedford Institute of Oceanography; RPC, Fredericton, NB. (trace metal analysis by HF digestion)

7.5.1 Parameters Analyzed

Parameters	Analysis Method
Mercury	EPA245.5
TPH	Atlantic PIRI
Barium	EPA6020A
Aluminum	EPA6020A
Strontium	EPA6020A

7.5.2 QA/QC

At collection, bottom sediment samples were stored cold at sea. Upon returning to the Particle Dynamics Lab, BIO, the samples were dried at <60 C until the entire sample was

dry, which generally took between 24 to 48 hours. Once dry, samples were sieved through a 1mm mesh to remove larger sand grains and possible shell fragments. A representative 5g sub-sample was sent to RPC, Fredericton for analysis of a standard suite of 31 trace metals including Barium (Ba) using total HF digestion or EPA6020A. The same samples were also analyzed for mercury (Hg) using EPA245.5 methodology. Sediments from the 0-2cm and 2-4cm depth strata were analyzed. Remaining samples down core will be analyzed in a future contract to RPC.

7.6 RESULTS

Historic summary results for key chemical indicators (i.e. TPH, barium, and mercury) are shown in Figure 7-2, Figure 7-3 and Table 7-2 to Table 7-4, inclusive. Sediment chemistry results for aluminum and strontium for 2007 are given in Table 7-5.

7.7 SUMMARY AND CONCLUSIONS

- All sediment samples tested in 2007 resulted in non-detect mercury values (<0.1 mg/Kg) which is consistent with earlier data at the same locations (Table 7-4).

- Barium[13] concentration at the 2007 Thebaud sites remained relatively unchanged from the 2005 values (Table 7-2, Figure 7-2). The values at T-250 and T-500 are higher than the 1998 baseline concentrations of 200 & 107 mg/kg, respectively at those locations. The 2007 barium concentration at T-1000 (166 mg/kg) approximated the 1998 baseline level of 170 mg/kg.

- When sediment grain size is taken into account (as indicated by the Ba/Al ratio, Figure 7-5), the barium concentration recorded at T-250 was clearly outside the range of background levels which would indicate the presence of residual drill mud at this sampling location. Since the 2005 value at T-250 was within the range of background levels, it could be inferred that the distribution of residual drill mud is patchy in the immediate vicinity of the platform. The sample taken at T-500 was borderline outside while the T-1000 sample was within the background range of values.

- The barium concentrations recorded at all Gully sites were slightly higher than the baseline levels recorded in the 1998 spring survey (Table 7-2, Figure 7-2). The exception is G3, which had a barium value of 118 mg/kg, which approximated the baseline level of 120 mg/kg for that site.

- When sediment grain size is taken into account (as measure of the Ba/Al ratio, Figure 7-4), the barium concentrations recorded at the Gully reference sites, fall within the range of background or baseline levels.

- Total Petroleum Hydrocarbons (TPH) concentrations were below the current analytical detection limit (20 mg/kg) at all 2007 sampling locations near Thebaud and the Gully sites (Figure 7-3, Table 7-3). This is consistent with the 2005 findings, with the exception of the slight indication (29 mg/kg) of TPH at the T-250 station in 2005.

[13] Barium is also a natural constituent of many types of clay. Ingested barium appears to remain in the gut rather than actually bioaccumulating in tissues (pers. Comm. J. Payne, DFO).

- Based on records of drilling discharge indicators from 1998 to 2007 at reference stations along the Gully MPA boundary (G2, G3 and G4), (Table 7-2 to Table 7-4, Figure 7-2 and Figure 7-3), there has been no evidence of drilling waste reaching the Gully over this period. TPH values have been very low or non-detectable and barium concentrations have been within the range of baseline levels (78-140 mg/kg) at these stations.

7.8 REFERENCES

[1] National Energy Board, Canada-Newfoundland Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, August 2002. Offshore Waste Treatment Guidelines.

Table 7-1 GPS Co-ordinates of 2007 Grab Sample Locations

Site	Latitude (North)	Longitude (West)
Thebaud 250	43° 53.538	060° 11.825
Thebaud 500	43° 53.529	060° 11.581
Thebaud 1000	42° 53.459	060° 11.179
Gully G1	44° 07.877	059° 29.491
Gully G2	44° 06.163	059° 19.931
Gully G3a	44° 04.356	059° 18.669
Gully G4a	44° 00.781	059° 14.767

Figure 7-1 Location of Sampling Sites

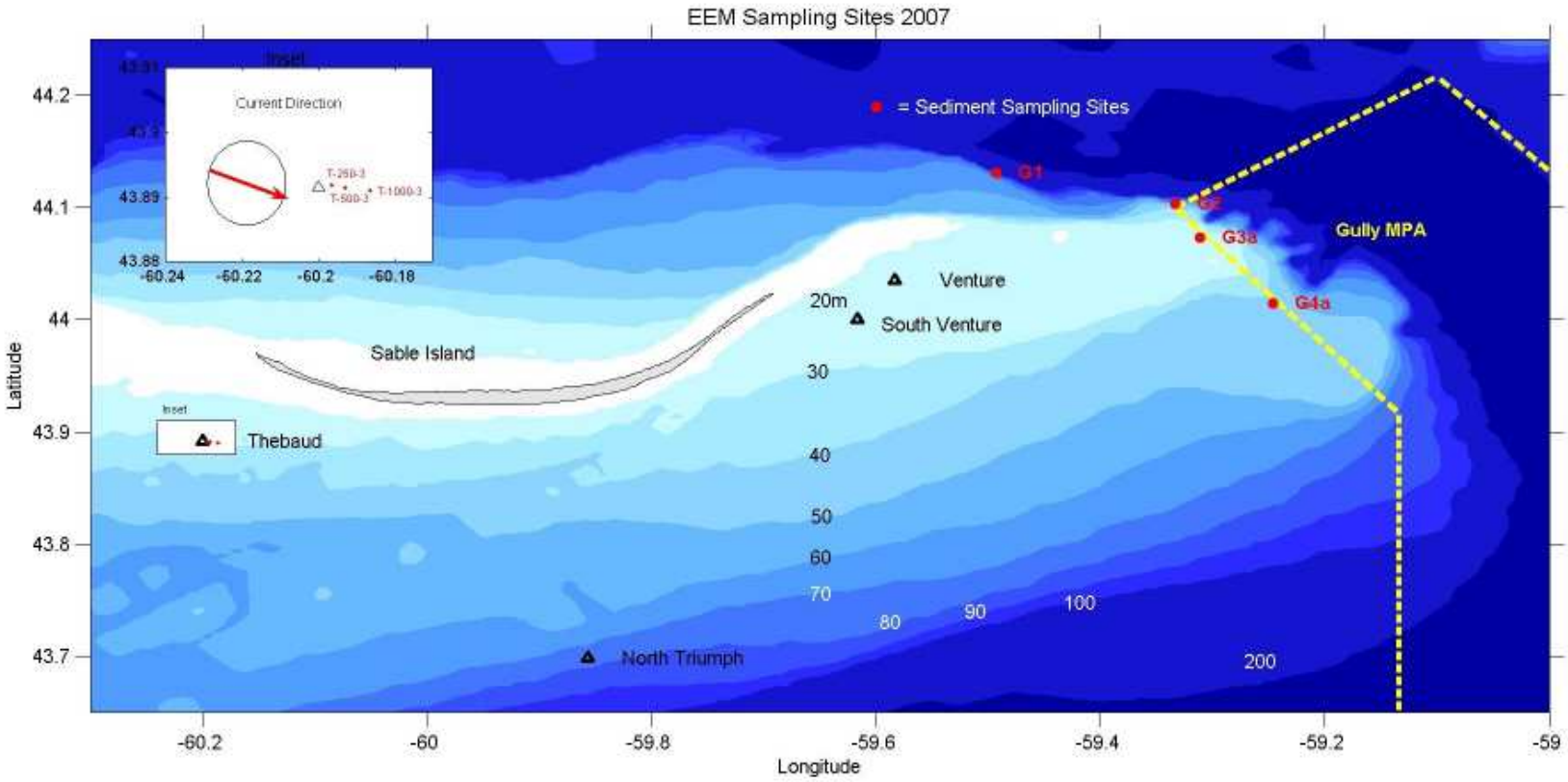
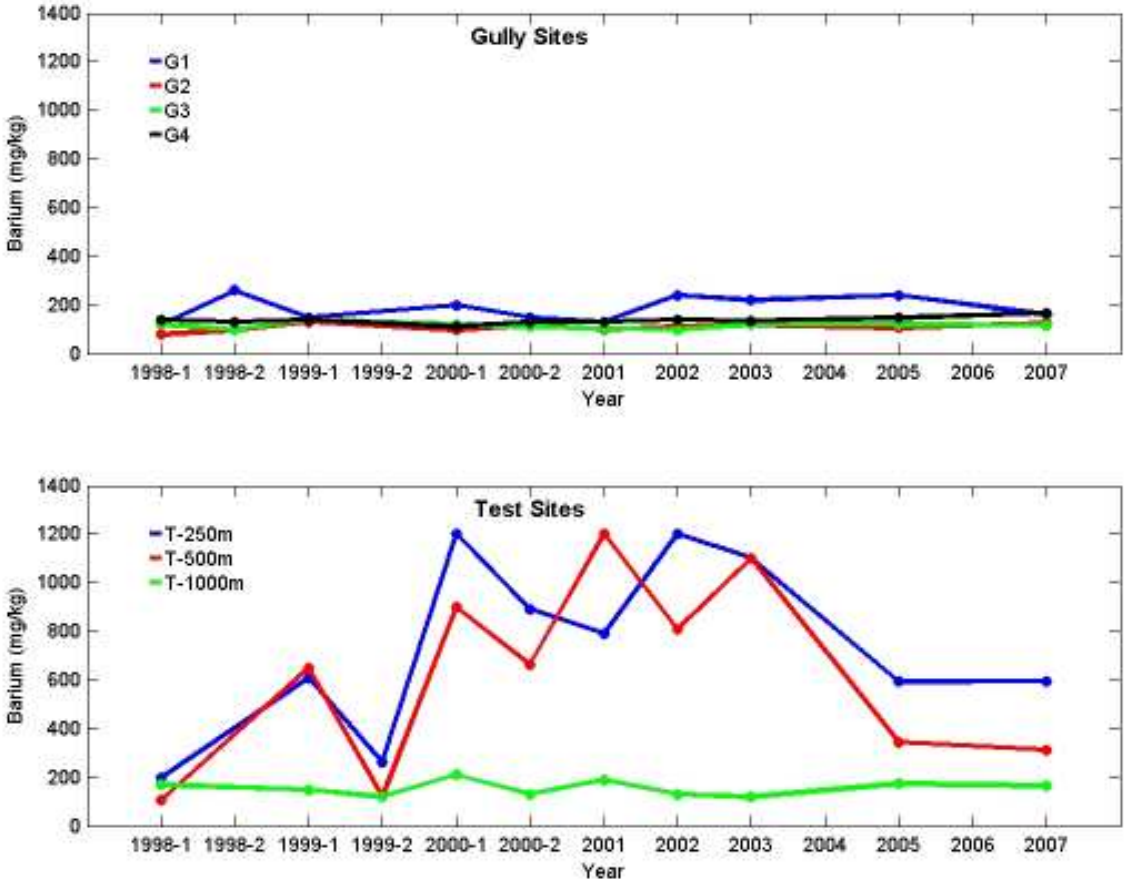
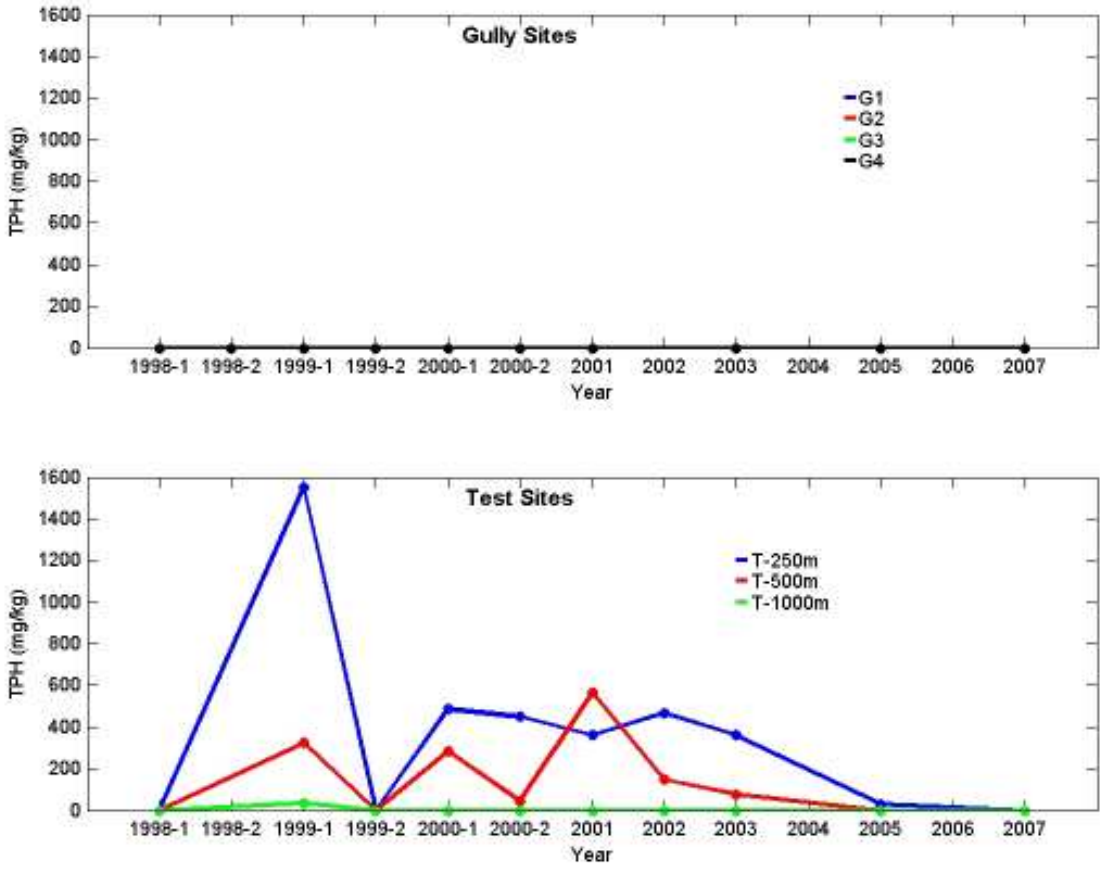


Figure 7-2 Barium concentration in sediments taken at Gully and Thebaud sites



NOTE: 1998-1 values are from pre-drilling baseline survey.

Figure 7-3 TPH concentration in sediments taken at Gully sites, and Thebaud and South Venture sites



NOTE: 1998-1 values are from pre-drilling baseline survey.

Table 7-2 Barium results for sediment samples at Thebaud and Gully sample sites

BARIUM (mg/kg)	T-250	T-500	T-1000	G1	G2	G3**	G4**
1998-1	200	107	170	120	78	120	140
1998-2				260	97	100	130
1999-1	610	650	150	150	130	140	140
1999-2	260	120	120				
2000-1	1200	900	210	200	98	120	110
2000-2	890	665	130	150	120	110	130
2001	790	1200	190	130	100	104	130
2002	1200	810	130	240	110	100	140
2003	1100	1100	120	220	120	120	135
2005	593	345	175	240	105	120	147
2007*	596	314	166	160	126	118	168

*Average of the 0-2 cm and 2-4 cm top sections of the cores
**Sediment samples were actually collected at G3a and G4a locations in 2005 and 2007

Table 7-3 TPH results for sediment samples at Thebaud and Gully sample sites

TPH (mg/kg)	T-250	T-500	T-1000	G1	G2	G3	G4
1998-1	ND	ND	ND	ND	ND	ND	ND
1998-2				ND	0	0	0
1999-1	1550	324	35.5	2.65	5.45	4.99	5.13
1999-2	17.8	9.13	ND	ND	ND	ND	ND
2000-1	486.8	283.01	2.7	ND	ND	ND	ND
2000-2	449.35	45.315	0.36	ND	ND	ND	ND
2001	360	564	ND	ND	ND	ND	ND
2002	468.6	146.05	ND				
2003	359.62	76.34	ND	1.037	ND	ND	0.562
2005	29	ND	ND	ND	ND	ND	ND
2007	ND	ND	ND	ND	ND	ND	ND

**ND = Not Detected, with a detection limit ranging between 0.25 and 32.5 mg/kg.

NOTE: 1998-1 values are from pre-drilling baseline survey.

Table 7-4 Mercury results for sediment collected at Thebaud and Gully sampling locations

MERCURY (mg/kg)	T-250	T-500	T-1000	G1	G2	G3	G4
1998-1	ND	ND	ND	0.01	ND	ND	ND
1998-2				ND	ND	ND	ND
1999-1	ND	ND	ND	ND	ND	ND	ND
1999-2	ND	ND	ND				
2000-1	ND	0.01	ND	ND	ND	ND	ND
2000-2	ND	ND	ND	ND	ND	ND	ND
2001							
2002							
2003							
2005	ND	ND	ND	ND	ND	ND	ND
2007	ND	ND	ND	ND	ND	ND	ND

**ND = Not Detected, with a detection limit of 0.01 mg/kg.

Table 7-5 Sediment chemistry results for 2007.

Station ID	Aluminum (mg/Kg)	Strontium (mg/Kg)
Thebaud 250m East	16250	79.5
Thebaud 500m East	15350	71.5
Thebaud 1000m East	8765	38
Gully 1	8795	44.5
Gully 2	6520	32.5
Gully 3	6830	31
Gully 4	9195	43

Figure 7-4 Ba/Al ratios for Gully sampling sites

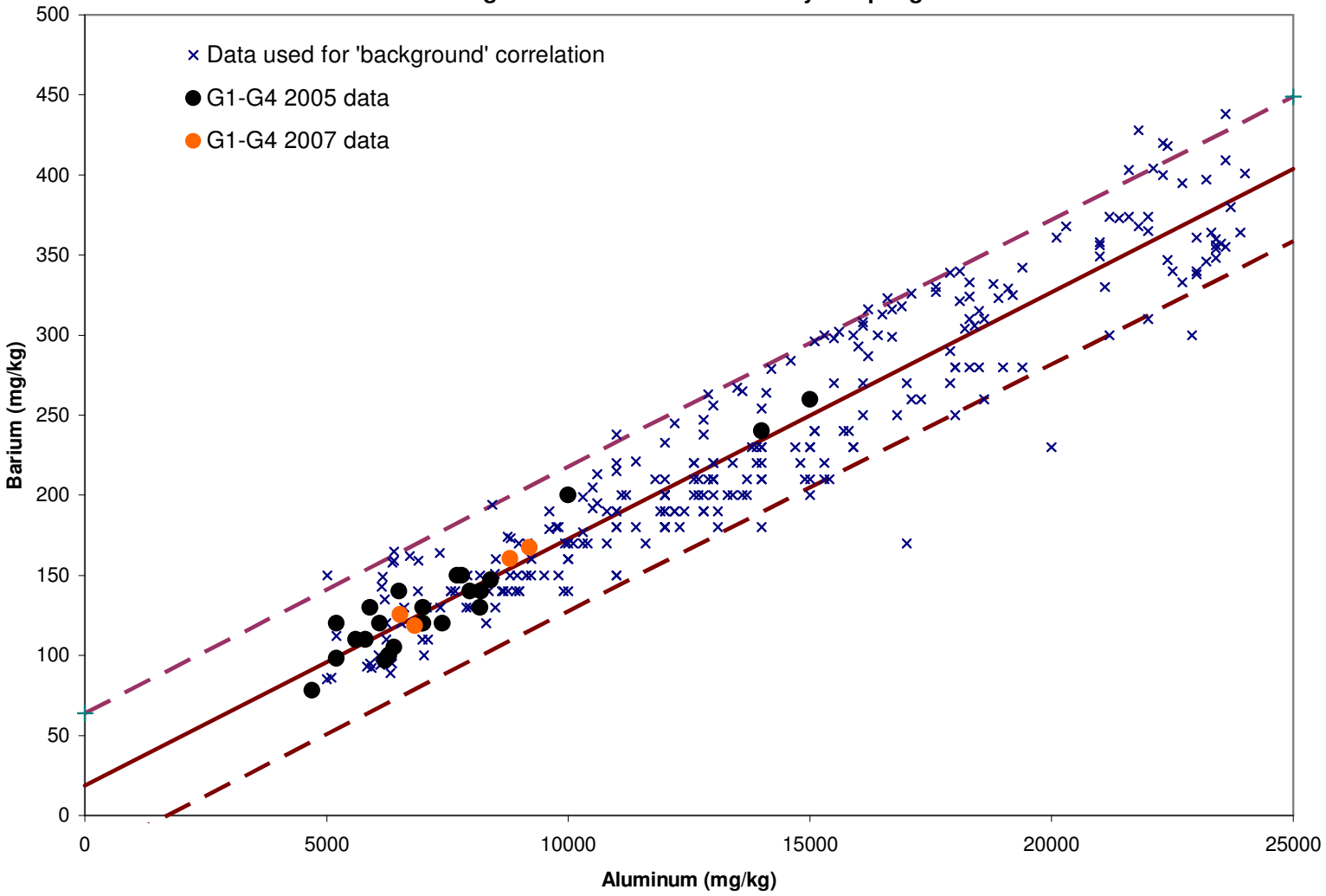
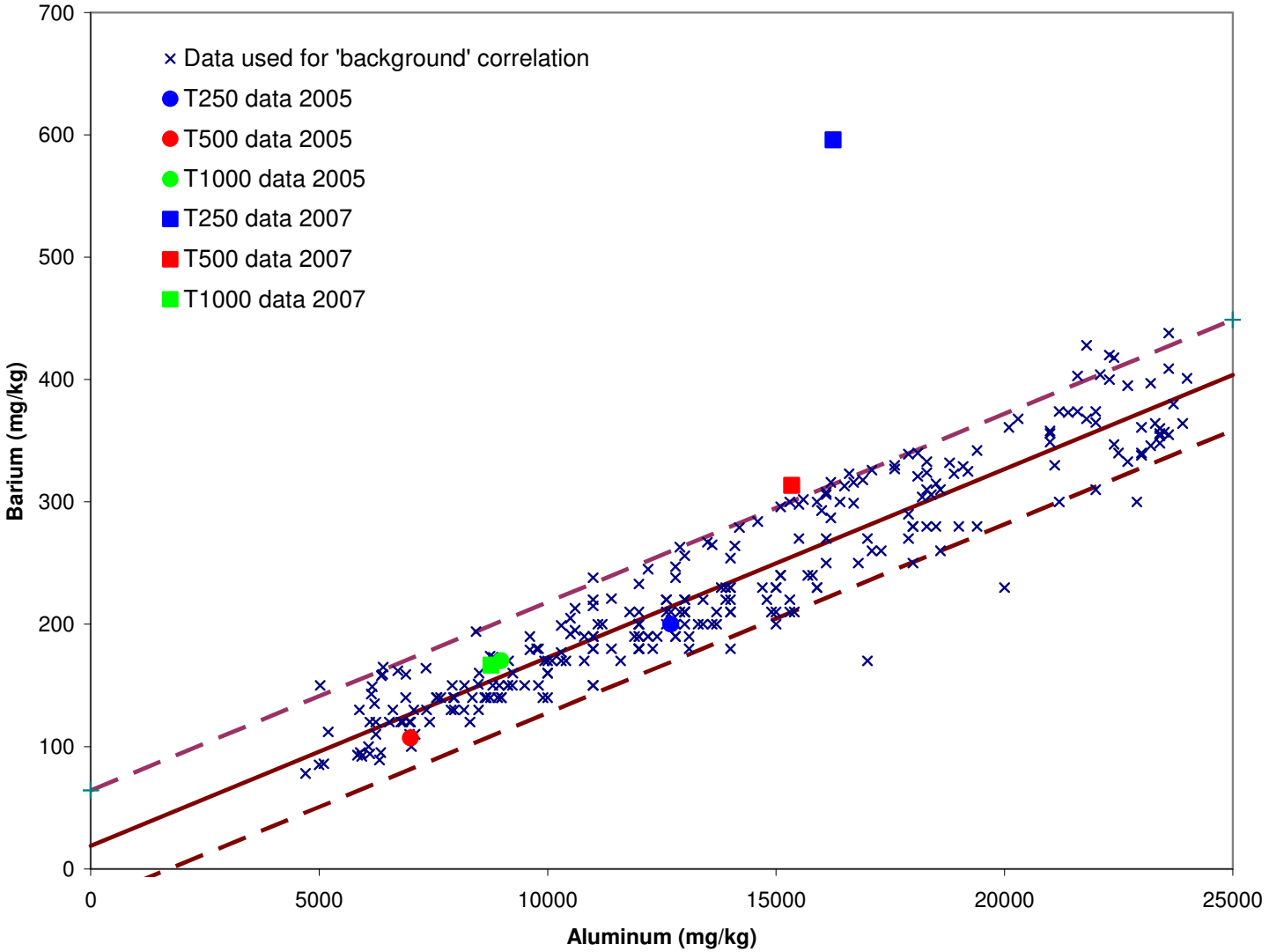


Figure 7-5 Ba/Al ratios for Thebaud sampling sites



8.0 SEDIMENT TOXICITY

8.1 BACKGROUND

Thebaud, the SOEP main production platform, has been in production since December, 1999. Oil-based muds/cuttings from wells drilled prior to January 1, 1999 were discharged under Offshore Waste Treatment Guidelines (OWTG) [3] criteria of 15 g/100g (on a wet solids basis) oil content. Oil-based muds/cuttings from most wells drilled at Thebaud were shipped to shore. Water-based muds/cuttings from all well top-hole sections have been ocean-discharged at all platform locations without treatment as per the OWTG.

Sediment toxicity has been monitored at Thebaud site since 1998. No sediment sampling was carried out in 2004 for operational reasons. The CNSOPB EEM Advisory Committee agreed that sediment chemistry was not required at Thebaud or near the Gully MPA in 2006 since the concentrations of key drill waste indicators (i.e., Barium (Ba) and Total Petroleum Hydrocarbon (TPH)) in 2005 approximated 1998 baseline (pre-drilling) levels or were non-detectable (i.e., Mercury (Hg)). In 2007, DFO COOGER kindly offered to collect and analyse sediment samples collected in the near-field Thebaud area at three sites (i.e., 250m, 500m and 1000m from the platform along the prevailing current axis) and at four far-field reference stations near the Gully MPA (see Figure 8-1 & Table 8-2) which would allow for further verification of earlier results.[14]

8.2 GOAL

To examine sediment toxicity near the SOEP main processing platform and the Gully Marine Protected Area.

8.3 OBJECTIVES

- Use a suitable indicator species to evaluate acute toxicity of sediments collected at three near-field sampling stations along the major current axis at the Thebaud platform location and at four far-field reference sites near the western boundary of the Gully Marine Protected Area;
- Compare results with available historical monitoring data at the same locations; and,
- Utilize data in developing a strategy for future monitoring.

[14] EEM sediment sampling has not been undertaken at Venture and North Triumph platform locations since 2003 when key drill waste chemical indicators returned to 1998 baseline concentration levels. The 2005 EEM program also showed low or non-detectable concentrations of key drill waste indicators near the South Venture platform following discharges of oil-based muds/cuttings (under a discharge limit of 6.9 mg/l oil content) during work-overs at that location in 2004/5. Sampling at Alma was not required since all SBM/cuttings generated during drilling were shipped to shore for treatment and disposal.

8.4 2007 SAMPLING

Agency: DFO (COOGER/Particle Dynamics Lab) – Bedford Institute of Oceanography

Collection Date(s):	**August 13, 2007 (Thebaud)** **August 23, 2007 (Gully Sites)**
Platform:	**CCGS Hudson**
Type of Sample:	**Core samples (Depths 0-2cm and 2-4cm)**
Test Sample Locations:	**Thebaud (250m, 500m, 1000m)** **(see Figure 8-1 & Table 8-2)**
Reference Sample Locations:	**Near Gully Marine Protected Area Sites G1, G2, G3a, G4a (see Figure 8-1 & Table 8-2)**
Sample Preparation:	**Bottom sediment samples were collected using a hydraulically damped slo corer. This equipment preserves the sediment water interface in tact. Samples are collected in polycarbonate tubes and then extruded and sliced in 2cm intervals and stored cold (<4C) in plastic containers while at sea. Samples are sub-sampled, dried, sieved and sent for analysis upon returning to the lab.**
Equipment:	**Hydraulically damped slo corer.**
Sampling QA/QC:	• **Duplicate samples were taken at each site for analysis** • **GPS used for station keeping** • **A new cleaned slo-core polycarbonate tube was used for each collected core.**

8.5 ANALYSIS

Agency: Harris Industrial Testing Service Ltd.

8.5.1 Parameters Analyzed

Parameters	Analysis Method
LC(50)	Ten samples were tested using Benthic amphipod *Eohaustorius estuarius* [1]

8.5.2 QA/QC

All samples were held in the dark at 4 ± 2℃ until testing.

- The *Eohaustorius* were collected from Yaquina Bay, Newport, Oregon, USA by Northwestern Aquatic Sciences on August 14, 2007 and were received at HITS on August 17, 2007. The organisms were acclimated and held in aerating seawater at 15 ± 2℃ (test temperature) in collection site sediment until the commencement of testing.

- The control sediment used for this test was the normal sediment from the Eohaustorius habitat, provided by the supplier.

- Tests were conducted in 1L jars (pre-rinsed with seawater) with ~ 175 ml of sediment and 775 ml of seawater.

- Each sediment and the control had 5 replicates with 20 test organisms per vessel.

- Test organisms were exposed for 10 days (August 20-30, 2007) to continuous fluorescent lighting (756 lux) and light aeration.

- Dissolved oxygen, pH, and temperature were monitored a minimum of five times throughout the test. Ammonia (NH3) and salinity were measured initially and at termination

- A Reference toxicant test was conducted with these organisms in seawater only, in the dark and with no aeration for a period of 96 hours.

8.6 RESULTS

- All monitored parameters, i.e., dissolved oxygen, pH, temperature and salinity, were within acceptable levels throughout the 10-day exposure.

- Control mortality did not exceed 10%.

- The reference toxicant results with Cadmium Chloride fell within the Warning Limits (i.e., ± 2 S.D. from the mean) derived from the historical data generated by this laboratory. (See Table 8-1)

- Based on the criteria below, none of the near-field Thebaud or far-field reference samples taken near the Gully MPA are considered to be toxic. (See Table 8-3; Toxicity Summary for *Eohaustorius estuarius* [Conducted August 13 and 27, 2007])

Environment Canada EPS 1/RM/35 [2], recommends the following two-part guidance when judging the pass/fail of each sediment:

> *"Test sediment from a particular sampling station and depth is judged to have failed this sediment toxicity test if the mean 10-day survival rate for the replicated groups of test organisms exposed to this sediment is more than 20% lower than that in the reference sediment and is significantly different.*
>
> *Reference sediment is defined as a field-collected sample of presumably clean (uncontaminated) sediment, selected for properties (e.g., particle size, compactness, total organic content) representing sediment conditions that closely match those of the sample(s) of test sediment except for the degree of chemical contaminants.*

> *If a reference sediment is unavailable, the test sediment is judged to have failed this sediment toxicity test if the mean 10-day survival for the replicate groups of test organisms exposed to this sediment is more than 30% lower than that in the control sediment and is significantly different. Control sediment is defined as: "clean sediment which does not contain concentrations of one or more contaminants that could affect the survival or behavior of the test organisms. Control sediment might be natural sediment from an uncontaminated site, or formulated (reconstituted) sediment. This sediment must contain no added test material or substance, and must enable an acceptable survival rate for the test organisms during the test. The use of control sediment provides a basis for interpreting data derived from toxicity tests using test sediment(s)."*

The Gully sediment samples cannot be strictly considered as 'reference' in the strictest sense according to the Environment Canada definition. Hence, the 30% toxicity limit was used for comparison purposes.[15] The 'control' sediment used for this test was the normal sediment from the *Eohaustorius* habitat, provided by the supplier.

Table 8-1 *Eohaustorius estuarius* Reference Toxicant Results with Cadmium Chloride

Test	96 Hour LC50 (mg/L)
Aug. 20-24, 2007	14.9 (C.L.: 12.5-17.6)
Historical Mean	19.2
Warning Limits	11.0-33.6

8.7 SUMMARY AND CONCLUSIONS

- No toxic responses (amphipod mortality of 30% or greater) were observed in 2007 using the amphipod, *Eohaustorius estuarius*, at any of the far-field Gully reference or nearfield Thebaud platform sampling sites.

- Toxic responses in sediments collected at the sampling site nearest this platform (i.e., T-250m) in the years immediately following drilling (1999-2002) appear to have stabilized at the baseline level (<10% in 1998) since the fall of 2003 from a high of 81% in the spring of 1999 (Figure 8-2).

- In earlier years, sediment toxicity (as a measure by amphipod survival) appeared to be related to the concentration of TPH rather than the concentration of Barium (see Section 4, Sediment Chemistry).

[15] From an EEM point of view however, the Gully MPA samples provide suitable far-field reference data for comparison with platform sites.

8.8 REFERENCES

[1] Environmental Canada, Dec. 1992 with Oct. 1998 amendments. Biological Test Method: Acute Test for Sediment Toxicity using Marine or Estuarine Amphipods Report EPS 1/RM/26 Environmental Protection, Ottawa, ON. 83 pp.

[2] Environment Canada, 1998. Biological Test Method: Reference Method for Determining Acute Lethality of Sediment to Marine or Estuarine Amphipods. EPS 1/RM/35 Environmental Protection, Ottawa, ON. 75 pp.

[3] National Energy Board, Canada-Newfoundland Offshore Petroleum Board, Canada-Nova Scotia Offshore Petroleum Board, August 2002. Offshore Waste Treatment Guidelines.

Figure 8-1 Location of sampling sites

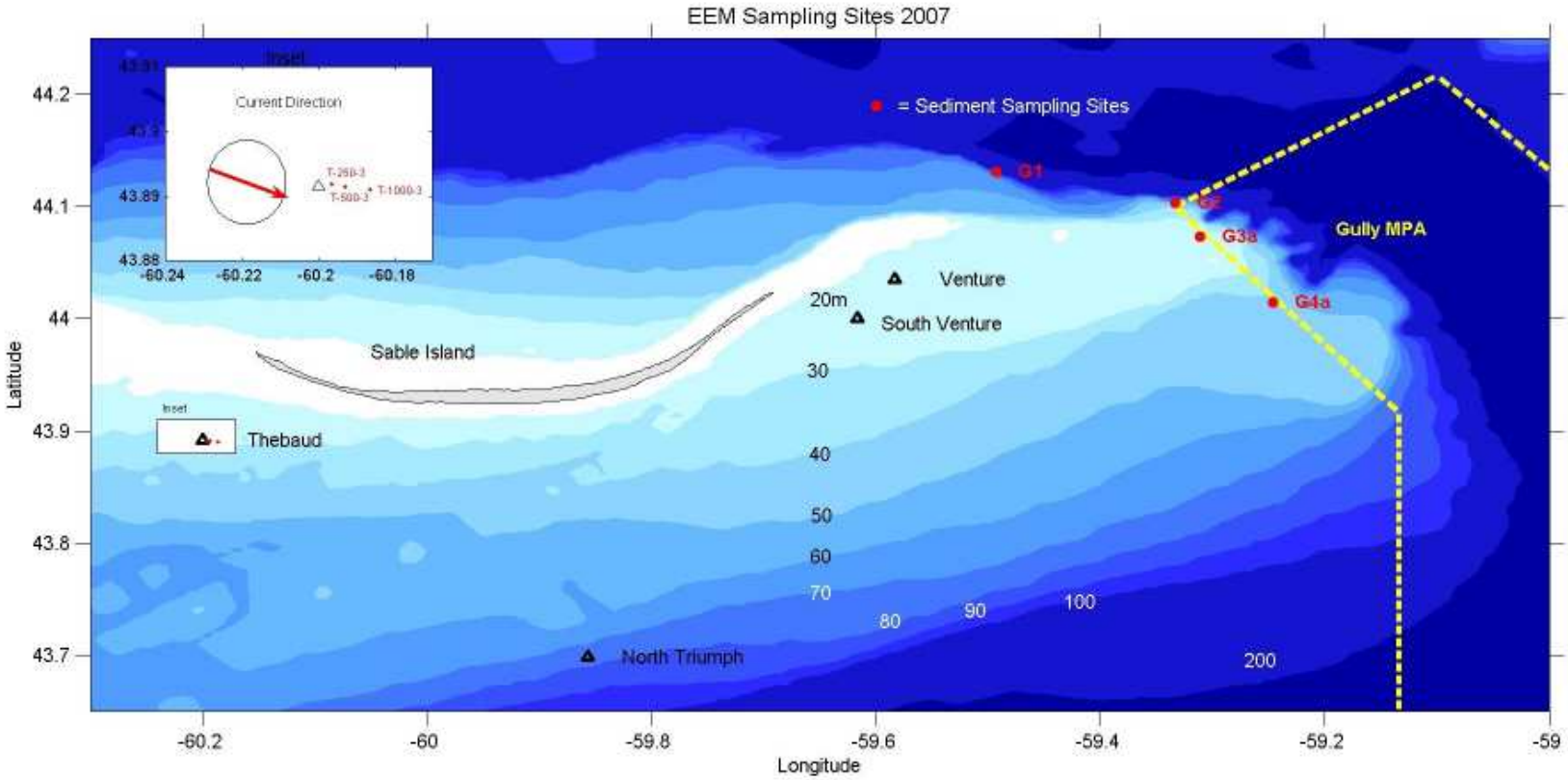


Table 8-2 GPS Co-ordinates of 2007 Grab Sample Locations[16]

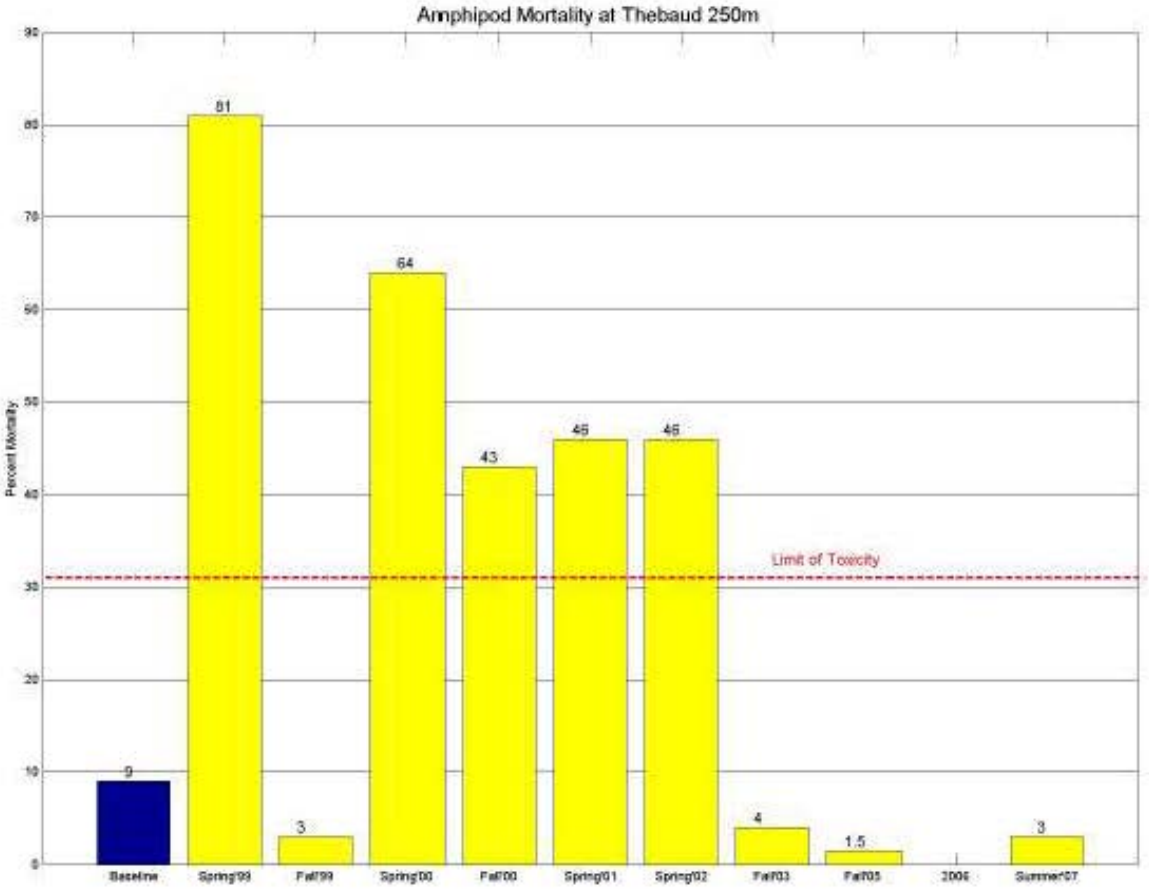
Site	Latitude (North)	Longitude (West)
Thebaud 250	43° 53.538	060° 11.825
Thebaud 500	43° 53.529	060° 11.581
Thebaud 1000	42° 53.459	060° 11.179
Gully G1	44° 07.877	059° 29.491
Gully G2	44° 06.163	059° 19.931
Gully G3a	44° 04.356	059° 18.669
Gully G4a	44° 00.781	059° 14.767

Table 8-3 Toxicity Summary for *Eohaustorius estuarius*

Sample ID	Lab ID	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Total/% Mortality
G-1	#7-354-A	1	2	0	0	2	5
G-2	#7-354-B	1	2	0	1	1	5
G-3	#7-354-C	0	0	0	0	0	0
G-4	#7-354-D	0	1	0	0	0	1
control	Control	0	0	1	0	0	1
T-250	#7-336-A	0	0	0	2	1	3
T-500	#7-336-B	0	0	0	0	0	0
T-1000	#7-336-C	0	0	2	1	0	3
control	Control	0	0	1	0	1	2

[16] Sediment used in the analysis was taken from the top 4 cm of the core sample.

Figure 8-2 Amphipod Mortality (%)



9.0 THERMAL DISCHARGE MONITORING – THEBAUD COMPRESSION PLATFORM

9.1 BACKGROUND

ExxonMobil Canada Properties commissioned a compression platform at the Thebaud field in November 2006 with steady-state operation since February 2007.

Although the compression platform has already been subject to a full and thorough environmental assessment (Joint Public Review Panel 1997), as acknowledged by the Canada-Nova Scotia Offshore Petroleum Board (CNSOPB), ExxonMobil undertook a monitoring program to address the requirement for environmental due diligence which would verify that the Compression Project is within the scope of the overall project assessed and approved in 1997.

The Compression Platform utilizes an indirect seawater cooling system consisting of a closed loop, cooling medium for the transfer of heat from process fluids to the cooling medium and an open, seawater loop for the transfer of heat from the cooling medium to the seawater.

The addition of cooling water discharge from the Thebaud compression platform provides a substantial increase in discharge volume compared with the Produce Water plume. As previously reported by ExxonMobil (ExxonMobil [1]), numerical dispersion simulations indicate that temperature alteration due to thermal discharges from the compression platform during routine operations will be confined to the nearfield platform area (i.e. < 200 m from the discharge caisson) and will represent a minor proportion of the total variability to which marine organisms are exposed in this environment.

9.2 GOAL

Collect data on the average footprint of the excess heat discharged to the environment as cooling water medium for the Thebaud Compression Platform.

9.3 OBJECTIVES

- To ground truth numerical dispersion predictions of cooling water discharge from Thebaud Compression Platform.
- To provide sound physical basis to guide future EEM planning.

9.4 MONITORING PROGRAM

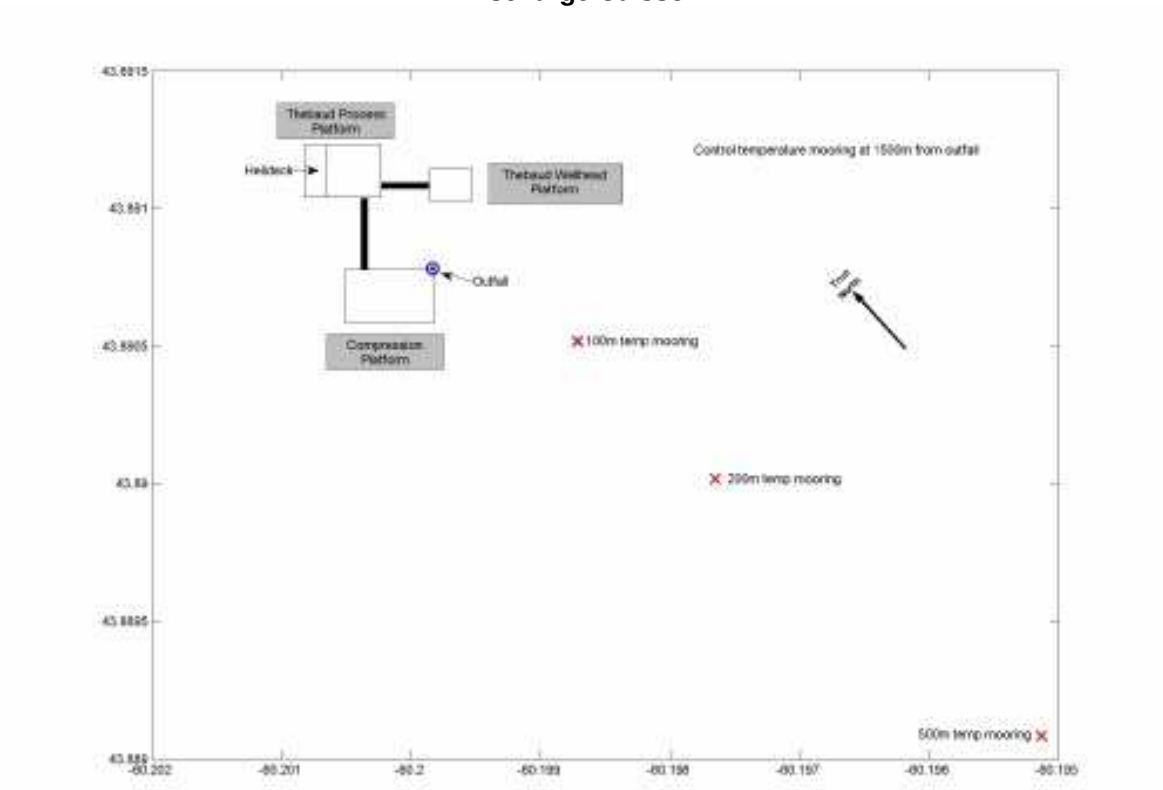
During a September field program, four moorings supporting temperature loggers were deployed at Thebaud for the purpose of collecting time series temperature data in support of the Compression Platform cooling water discharge thermal plume monitoring program.

Near-field moorings were deployed at nominal distances of 100 m, 200m and 500 m from the discharge caisson of the Thebaud Compression Platform along a bearing of approximately 175°T (Figure 9-1). A single far-field mooring was deployed as a control site 1,500 m from the discharge caisson along the same bearing. Coordinates for each mooring are presented in Table 9-1.

Table 9-9-1 GPS Co-ordinates of 2007 Grab Sample Locations

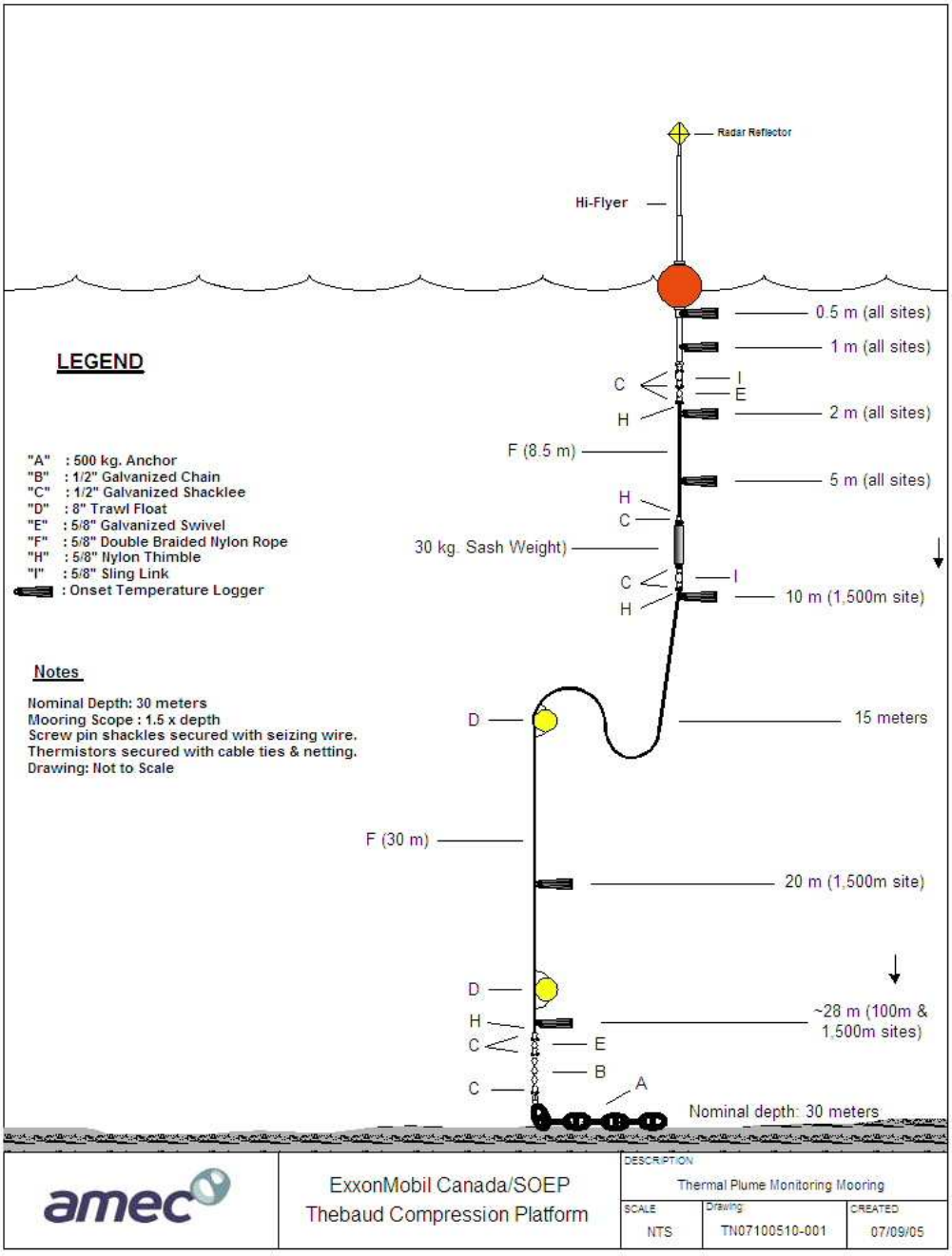
Range from Platform (m)	Bearing (°T) from Platform	Water Depth (m)	Latitude (North)		Longitude (West)		Datum
			Deg.	Dec. Min.	Deg.	Dec. Min.	
100 m	175	32	43	53.433	60	11.963	WGS84
200 m	175	33	43	53.417	60	11.900	WGS84
500 m	175	35	43	53.345	60	11.708	WGS84
1,500 m	175	30	43	53.087	60	11.031	WGS84

Figure 9-1 Diagram showing placement of Near-Field Thermistor Moorings relative to Discharge Caisson.



Temperature loggers (thermistors) were vertically spaced at depths of 0.5m, 1 m, 2 m and 5 meters at each of the 4 sites, with thermistors at 28 m depth at the 100 m and 1,500 m sites plus an additional thermistor at 20 m depth at the 1,500 m site. Figure 2 presents the mooring diagram showing vertical placement of the thermistors.

Figure 9-2 Mooring diagram showing placement of Temperature Loggers.



HOBO U22 Water Temp Prov2 and TidbiT v2 temperature loggers, manufactured by the Onset Computer Corporation, were set to record temperature values at 2 minute sampling intervals. Two minute intervals allowed for sufficient memory for a 60 day sampling program whilst providing adequate temporal resolution for detection of excess temperature of the cooling water plume against ambient temperatures. The stated accuracy of the thermistors is 0.2°C over a range of 0° to 50°C with a resolution of 0.02°C at 25°C.

The thermistors were deployed for a planned maximum duration of 60 days on September 9, 2007. Due to weather and operational restrictions for access to vessels, the recovery trip was postponed until early February 2008. During recovery of the 1,500 m mooring on February 9, the mooring parted below the sash weight resulting in loss of the lower 3 thermistors. The thermistor at 0.5m was also missing. The 100m, 200m and 500m thermistor mooring high-flyers were all missing from their respective locations representing a catastrophic loss to the measurement program (comment from vessel crew indicated all moorings were on site about 2 weeks prior to the recovery trip).

9.5 RESULTS

Excess temperature monitoring of the compression platform cooling water discharge above ambient seawater was not completed due to the loss of the near-field thermistors,

Data from the 1m, 2m and 5m control thermistors are presented below (Figure 9-3). Of note is the agreement between thermistors during well mixed conditions and the apparent solar heating captured by the 1m and 2m thermistors (Figure 9-4). These data suggest sound methodology in the approach to the program.

Figure 9-3 Time series temperature data for 1m, 2m & 5m thermistors at the Control Site.

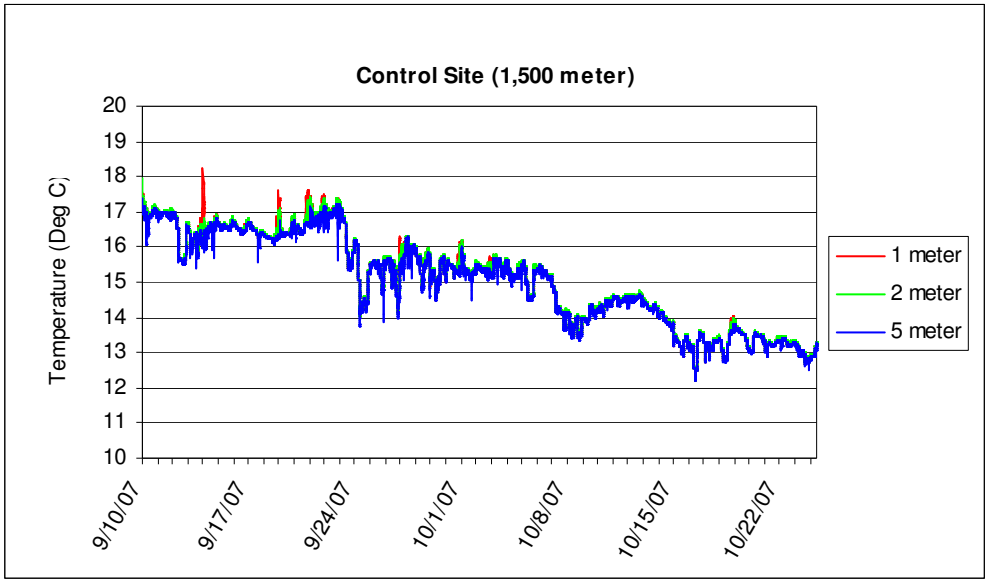
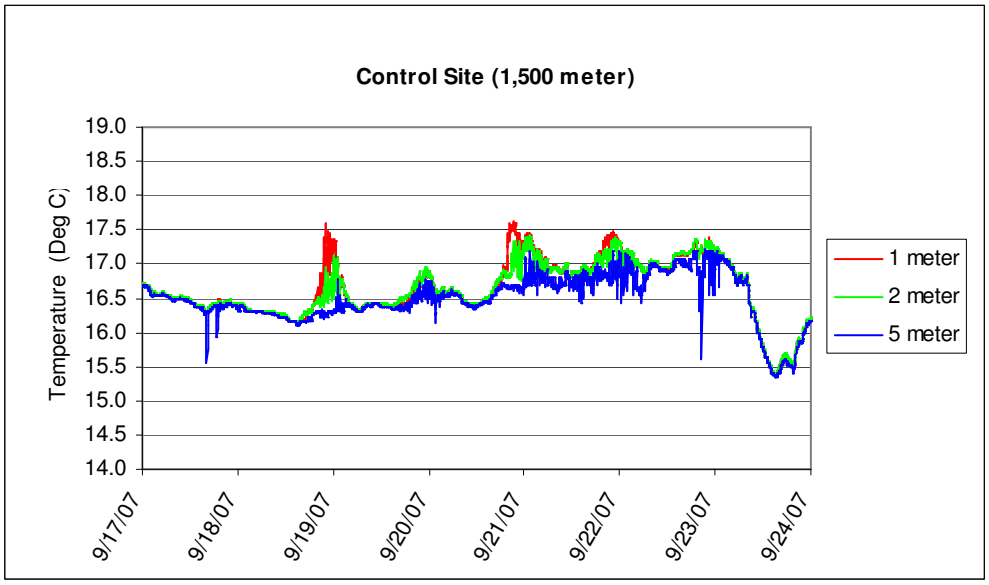


Figure 9-4 Time series temperature data from Sept. 17 to Sept. 24 showing periods of solar heating at the Control Site.



9.6 SUMMARY AND CONCLUSIONS

Verification of persistence and spatial distribution of excess temperature above ambient seawater resulting from discharge of seawater cooling medium from the Thebaud Compression Platform could not be determined due to the loss of the near-field thermistor moorings.

9.7 REFERENCES

[1] ExxonMobil Canada, 2006. Compression Project Environmental Review