

Alaska's 2010 Integrated Report – EVOS Beaches 4b Rationale
April 26, 2010

(1) The problem causing the impairment.

Background: On March 24, 1989 the T/V Exxon Valdez discharged approximately 11 million gallons of crude oil into Prince William Sound (PWS).

Historical activities included responders using mechanical recovery, dispersants, and in-situ burning to clean up the spill on the water and beaches. Cleanup of oiled shoreline from 1989 to 1992 consisted of sediment removal, tilling, and bioremediation.

In 1996, the Department of Environmental Conservation (DEC) determined that 23 of the Exxon Valdez beaches and shoreline were “water quality limited” (impaired) from petroleum products; the waters, however, were not placed on the 303(d) list because of the restoration efforts specified in the Exxon Valdez Restoration Plan and also it was believed that a TMDL process would not improve upon the efforts of the Exxon Valdez Trustee Council (Council).

Impairment: DEC water quality standards require surface waters and adjoining shorelines to be virtually free from floating oil, sheen, or discoloration. In addition, there may be no concentrations of petroleum hydrocarbons in shoreline or bottom sediments that cause deleterious effects to aquatic life. This standard protects the designated use for growth and propagation of fish, shellfish, other aquatic life and wildlife, as well as other designated uses for water supply, recreation and harvesting for consumption of raw mollusks or other raw aquatic life.

There is no on-going loading from the T/V Exxon Valdez occurring in PWS. Lingering oil remains in the intertidal zone. In addition, impacts to aquatic life are demonstrated. Injured aquatic life resources include birds (e.g., Kittlitz’s Murrelets), fish (e.g., Pacific Herring), and marine mammals (e.g., sea otters). A complete list of impacted resources is available on the Council web site at: <http://www.evostc.state.ak.us/Recovery/status.cfm>

(2) Proposed implementation strategy and supporting pollution controls necessary to achieve water quality standards, including the identification of point and nonpoint source loadings that when implemented assure the attainment of all applicable water quality standards.

Overall Strategy

The Council was formed to guide the use of over \$900 million for restoration activities from a civil settlement for oil spill damages. The DEC Commissioner serves as one of the state trustees, ensuring settlement monies are expended to

further restore the injured resources. Other trustees include: Alaska's Attorney General, Alaska Department of Fish and Game Commissioner, US National Oceanic and Atmospheric Administration Alaska Director, a US Department of Agriculture representative, and a US Department of Interior representative. The Council serves to protect and assess injuries to the natural resources from the spill as provided by the Clean Water Act (CWA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

In 1994 the Council established its mission to restore Prince William Sound and the Gulf of Alaska to the healthy, productive, world-renowned ecosystem that existed before the spill. This mission statement and process for implementing the mission, is articulated in the Exxon Valdez Oil Spill Restoration Plan (1994). The Restoration Plan includes specific objectives for addressing the injury to the intertidal zone.

The Council's objective of addressing impacts to the intertidal zone clearly aligns with DEC's responsibility to improve and protect water quality. The Council has the authority, the responsibility and the funding to ensure their objectives are achieved. The adaptive management cycle described in the Restoration Plan provides a strategy to address injured resources.

The Council has annually funded approximately \$6.4 million in proposals to further the Council's mission for the past 6 years. Each proposal is peer reviewed and recommendations given by a scientific panel, public advisory committee, Council staff, science director, and executive director. The Council then decides which proposals receive funding. Over 1300 studies have been funded. As one of the trustees, DEC's Commissioner reviews proposals to ensure they meet the Council's restoration objectives. To a large degree, the restoration objectives overlap with many of DEC's responsibilities including working to ensure state waters attain their designated uses by meeting water quality standards.

Current actions related to water quality

Among the proposals funded in 2007 (2008 projects) by the Council is a project which will refine the area where oil remains. The project 070801/Michel - *Assessment of the Areal Distribution and Amount of Lingering Oil in Prince William Sound and the Gulf of Alaska* will produce maps showing the probability of lingering oil. Attachment A includes a short summary of the project. Complete details can be found at: http://www.evostc.state.ak.us/Projects/ProjectInfo.cfm?project_id=1559.

DEC will use information from this study to refine the locations, including the 23 beaches originally listed, where the lingering oil is resulting in continued impairment.

A second project funded by the Council in 2007 (2008 projects), 070836/Boufadel - *Factors Responsible for Limiting the Degradation Rate of Exxon Valdez Oil in Prince William Sound Beaches* is designed to provide an overall understanding of the fate and transport and provide guidance as to how to accelerate the disappearance of lingering oil present in the subsurface. Attachment A includes a short summary of the project. Complete details can be found at:

http://www.evostc.state.ak.us/Projects/ProjectInfo.cfm?project_id=1609

DEC will combine the information in the two studies to help identify options for achieving water quality standards.

In addition to the above studies, on March 17, 2008, the Council approved three (3) projects focused on addressing the impacts to aquatic life from the lingering oil:

1. 080839/Hollmen - *Evaluating Injury to Harlequin Ducks (*Histrionicus histrionicus*) Caused by Sublethal Hydrocarbon Exposure in Prince William Sound Using Species-Specific Cell Lines* (scheduled for completion Sept. 2008);
2. 080759-A/Rosenberg - *Harlequin Duck Population Dynamics in Prince William Sound: Measuring Recovery from the Exxon Valdez Oil Spill* (scheduled for completion April 2009) ; and
3. 070808-A/Ballachey - *Nearshore Synthesis: Sea Otters and Sea Ducks* (scheduled for completion April 2009) will further identify the current wildlife exposure of lingering oil in the intertidal zone, helping to define when water quality standards will be met.

This combination of work will help assist DEC to more clearly identify the impacted areas that still exist as a result of the spill (i.e., those areas that are still impaired) and what viable actions could be taken to address the lingering oil, ensuring water quality standards will ultimately be achieved. Until the scientific research is completed, identifying which specific options should be implemented is not effective. The adaptive management approach to achieve water quality standards is a cornerstone of the implementation strategy.

(3) Estimate or projection of the time when water quality standards will be met.

The results from the reports will be used to establish further restoration actions and a more precise timeframe for identifying when water quality standards may be met, including removal of the impairment to the designated use for the growth and propagation of fish, shellfish, other aquatic life and wildlife. The final reports for Project 070801 and Project 070836 have not been

made available through the Trustee Council; however, their findings are summarized in to 2010 *Final Report to Trustee Council on Recent Lingering Oil Studies*.

Progress toward meeting standards has occurred. For example, one project “Recovery Monitoring and Restoration of Intertidal Oiled Mussel (*Mytilus trossulus*) Beds in Prince William Sound Impacted by the *Exxon Valdez* Oil Spill” (# 94090) cleaned twelve (12) mussel beds that were still impacted to reduce hydrocarbon exposure to mussels, higher trophic level consumers and human subsistence food users. The project removed oiled mussels, replaced the sediments underlying the mussels with clean sediments, and replaced mussels into clean sediments. Hydrocarbon levels in the original sediments removed had decreased by more than 50% within a few weeks.

A second project, Chenega Shoreline Restoration (#98291) treated five (5) cobble-boulder armored shoreline segments in the vicinity of the village of Chenega Bay. Visual observations and physical measurements showed removal of the surface oil with no measureable oil or surfactant escapement to the water column or physical damage to the intertidal biota.

(4) Reasonable schedule for implementing the necessary pollution controls.

There is no on-going point or non-point source loading to the impaired beaches or adjacent water as a result of the T/V Exxon Valdez, hence there is no need for “pollution controls.” Rather, DEC is evaluating the current extent of the impairment, the hindrances to recovery, and will establish and implement (most likely through the Council or through the reopener provisions in the Exxon Valdez Consent Decree) any appropriate methods to enhance the recovery timeframe. Section 7 provides a status update.

(5) Schedule for monitoring milestones for tracking and reporting progress to EPA on the implementation of the pollution controls.

The Council meets on a regular basis and receives reports of progress on the above mentioned projects. Project proposals are received annually starting approximately in February with projects funded on the federal fiscal year.

Projects 070801 and 070836 report quarterly. Project goals are as follows:

070801/Michel - *Assessment of the Areal Distribution and Amount of Lingering Oil*

June 2007: Develop field sampling plan- completed progress report available

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September 2007: Conduct field sampling – completed, progress report available

December 2007 – Refine probability model – completed, progress report available

April 2009 – Submit draft final reports – submitted to EVOS Trustees Council, but not published

070836/Boufadel - *Factors Responsible for Limiting the Degradation Rate of Exxon Valdez Oil*

June 2007 – Prepared modeling effort- completed progress report available

September 2007 – Selected sites and conducted field analysis- completed, progress report available

December 2007 – Conduct winter sampling- completed, progress report available

June 2008 –Conduct additional sampling- completed, progress report available

Dec. 2008 – Conduct additional sampling- completed, progress report available

March 2009 – Refine and complete beach hydrodynamics and solute transport model complete- completed, progress report available

April 2010 - Submit draft final report

DEC will continue to report progress on these EVOS beach-related projects to EPA as a part of the biennial Integrated Report. Up-to-date activities on Council actions are available on the Council’s web site on an on-going basis (www.evostc.state.ak.us).

(6) A commitment to revise as necessary the implementation strategy and corresponding pollution controls if progress towards meeting water quality standards is not being shown.

The State of Alaska is committed to restoration, including ensuring water quality standards are met, as a result of the T/V Exxon Valdez oil spill. As a key member of the Council, DEC believes no other organization has the financial ability and scientific rigor to achieve the restoration needed. The Council annually reviews progress of Council-funded work and typically requests new proposals. The Council ensures both their commitment to evaluating the status of injured resources and their plans for recovery are being implemented.

In addition, the Consent Degree with Exxon that was reached as a result of the spill contained a reopener provision. The reopener allows the governments to seek additional funding for unforeseen damages not covered by the original settlement. The State of Alaska and the United States are pursuing remediation of lingering oil on the Exxon Valdez Beaches via the re-opener clause in the settlement.

(7) Progress as of 2010 Integrated Report.

At the time of the 2010 Integrated Report, neither final report for projects 070801/Michel – *Assessment of the Areal Distribution and Amount of Lingering Oil in Prince William Sound and the Gulf of Alaska* or 070836/Boufadel – *Factors Responsible for Limiting the Degradation rate of Exxon Valdez Oil in Prince William Sound Beaches* have been made available through EVOSTC; however, a *Final Report to Trustee Council on Recent Lingering Oil Studies* has been made available.

The *Report on Recent Lingering Oil Studies* summarizes findings related to distribution and degradation of lingering oil. Project 070801 generated a model of oil shoreline distribution using data collected in 1999, 2001, 2003, 2006, and 2007. The model was validated in 2008 through field testing. The model predicts moderate or heavy oiled residues at greater than 15% frequency of oiled pits, at the 90% positive predictive value threshold at 52 sites, totaling 2.62 kilometers. Project 070836 conducted microcosm studies that identified oxygen availability as the limiting parameter affecting biodegradation. The natural rate of degradation of oil was found to be between zero and four percent per year, with only a five percent chance of the value being four percent. Study of oiled shoreline identified two layers within the sediment, an upper highly permeable oxygenated layer and a lower anoxic layer with low permeability. Modeling suggested that the dissolved oxygen concentration in the lower layer was too low to sustain aerobic degradation of lingering oil. 2009 field work identified effective in-situ remediation techniques involving injecting nutrients and dissolved oxygen into oiled sediments. The report concludes that 50 beach segments totaling about 2.5 kilometers would contain oil and that oil can be further biodegraded using in-situ remediation techniques. Pilot studies assessing the effectiveness of the remediation techniques and the extent to which employment of these techniques is warranted are recommended.

The EVOSTC has proposed narrowing the focus of restoration efforts in response to diminishing monies left from the original settlement. The proposed focus areas are lingering oil, long-term monitoring of marine conditions, harbor protection and marine restoration and herring. Upon completion of research and the resolution of the Reopener provision, the council will evaluate the need for active remediation. .

Because the studies cited in section 6 were not available to DEC and the general public prior to the Integrated Report public notice, and DEC has not has the opportunity to review the results in detail, DEC is not proposing to change the extent and locations of impaired waterbody designations for the 2010 Integrated Report.

Attachment A

070801/Michel - *Assessment of the Areal Distribution and Amount of Lingered Oil*

The proposed study is to develop and implement a statistically rigorous field study and spatial modeling analysis to produce maps showing the probability of lingering oil in areas of Prince William Sound and the Gulf of Alaska that were affected by the Exxon Valdez oil spill. We will also estimate the area and volume of oiled sediments in these areas as of 2007. Sediment samples will be analyzed to fingerprint the source of the oil residues, characterize them as to the degree of weathering and risk to exposed biota, and determine treatability using bioremediation. The results will provide key data for use in developing more detailed remediation plans and priority areas for remediation. The probability maps will allow researchers to identify locations where oil persists with much greater precision, leading to more sensitive studies of the long-term effects of the lingering oil on biota in the spill-impact regions.

070836/Boufadel - *Factors Responsible for Limiting the Degradation Rate of Exxon Valdez Oil*

This proposal will provide important data for explaining the cause of the lingering oil in many of the Prince William Sound beaches affected by the 1989 Exxon Valdez oil spill. Because biodegradation of oil occurs at the oil-water interface, limitations occurring in the vicinity of that interface are hypothesized to be the primary reason for the lingering oil. In this study, we propose to investigate the two major sources of limitation: (1) environmental limitations, which involve nutrient concentrations (nitrogen, phosphorus, and dissolved oxygen) and their transport to the oil-water interface, and (2) the existence of an impenetrable layer or “skin” on the oiled sediment, which inhibits the bioavailability of oil. This often occurs when oil is stranded in the subsurface. The latter will be assessed by use of Scanning Electron Microscopic (SEM) examinations of oiled sediment. The effects of hydrodynamics will be assessed using tracer studies and 2-D or 3-D physics-based modeling of solute (i.e., nutrient) transport through the beach matrix. Hydrodynamics studies are important to understand the delivery (i.e., transport) of limiting nutrients to the oil-water interface. Extensive measurement of nutrient concentrations on PWS beaches will also be conducted to ascertain the extent of nutrient limitations on the biodegradation process. To our knowledge, this is the first rigorous study that addresses how the hydrodynamics of PWS beaches relate to the potential of bioremediation in relieving the aforementioned limitations. The proposed research will provide important inputs to an overall understanding of the transport and fate of oil in the PWS beaches and will provide guidance on how to accelerate the disappearance of the lingering oil present in the subsurface.