Selected Scientific & Technical Reports

2024

Highlights from the Prince William Sound Regional Citizens' Advisory Council

Updated February 2024

Additional reports can be found here:

https://www.pwsrcac.org/resources/reports-documents/

Photo by
Jeremy Robida

PREVENTION

Review of Cathodic Protection Systems at the Valdez Marine Terminal

https://www.pwsrcac.org/document/review-of-cathodic-protection-systems-at-the-valdez-marine-terminal/

National Pipeline Services, LLC. April 2021.

This final report summarizes a review of cathodic protection (CP) of the crude oil piping at the Valdez Marine Terminal (VMT). It includes a review of the types of CP systems used at the VMT as well as Alyeska's methods for monitoring and testing the systems. The report found that it appears Alyeska has a very good corrosion and cathodic protection program overall, but there were some important discrepancies that need to be addressed.

Methodologies for Evaluating Defects in the Catalytically Blown Asphalt Liner in the Secondary Containment System at the Valdez Marine Terminal

https://www.pwsrcac.org/document/methodologies-for-evaluating-defects-in-the-catalytically-blown-asphalt-liner-in-the-secondary-containment-system-at-the-valdez-marine-terminal/

Craig H. Benson, PhD, PE, NAE. November 2022.

This report describes methods that can be used to evaluate the catalytically blown asphalt liner in the secondary containment systems at Valdez Marine Terminal and provides recommendations on the most suitable methods for assessment. The report also describes a statistical method that was developed to compute the total number of defects in a secondary containment liner with a specified degree of statistical confidence based on outcomes from inspection over a portion of the liner. The statistical methodology was also used to demonstrate how much area needs to be inspected to identify the defects in the liner.

Crude Oil Storage Tank 8 Floor and Cathodic Protection System Design Review

https://www.pwsrcac.org/document/crude-oil-storage-tank-8-floor-and-cathodic-protection-system-design-review/

Taku Engineering. June 2022.

This study reviewed preliminary design documents for the floor and cathodic protection (CP) system replacement as well as historical operating data for the Valdez Marine Terminal tank CP systems.

Secondary Containment Liner Integrity Evaluation, Valdez Marine Terminal

https://www.pwsrcac.org/document/secondary-containment-liner-integrity-evaluation/

Geosyntec Consultants, Inc. October 2018.
This report from Geosyntec Consultants provides recommendations for evaluating the integrity of the secondary containment systems at the Valdez Marine Terminal.

Review of Piping Inspection Program at the Valdez Marine Terminal

https://www.pwsrcac.org/document/review-of-piping-inspection-programs-at-the-valdez-marine-terminal/

Dynamic Risk Assessment Systems, Inc. November 2014.

This report assessed the current and planned inspection programs for crude oil transport piping sections at the Valdez Marine Terminal. It aimed to ensure that corrosion issues affecting piping integrity are identified, characterized, and resolved promptly. Given that a significant portion of the piping has not been internally inspected since construction, the report evaluates Alyeska's inspection programs in comparison to industry standards and practices.

Corrosion Survey of Valdez Marine Terminal

https://www.pwsrcac.org/document/2012-corrosion-survey-of-valdez-marine-terminal/

R. Heidersbach. December 2012.

The project objectives were to review recent corrosion-related projects and reports associated with the Valdez Marine Terminal, examine relevant corrosion control standards, assess Alyeska Pipeline Service Company procedures for compliance with guidelines, conduct on-site visits to verify corrosion control measures, and emphasize corrosion control's impact on hydrocarbon releases into the environment. The focus was on critical equipment such as crude oil piping systems, storage tanks, oily water piping systems, vapor recovery systems, above-ground storage tanks, and berth structures.

Future Iceberg Discharge from Columbia Glacier, Alaska

https://www.pwsrcac.org/document/future-iceberg-discharge-from-columbia-glacier-alaska-reports-1-to-5-and-final-report/

W. T. Pfeffer Geophysical Consultants. 2012-Final Report June 2015.

This study examined the current and future status of iceberg discharge from Columbia Glacier, situated in Prince William Sound. The glacier has been rapidly retreating since the early 1980s, with icebergs posing a potential hazard to ship traffic in the area. Drawing on historical glaciological research and recent data collection efforts, the study predicts that Columbia Glacier's tidewater retreat phase may continue for up to another 20 years. However, it suggests that icebergs discharged in the future will be smaller in size and number. Factors such as increased distance to the moraine shoal and rising water temperatures are expected to contribute to the degradation of icebergs before reaching the shoal, potentially reducing the risk to tanker traffic over the next two decades. Nonetheless, a new risk may emerge for other boat traffic in the inner Columbia Fjord as iceberg density declines.

PREPAREDNESS

PWS Tanker Oil Spill Prevention & Contingency Plan, Summary 1995-2020

https://www.pwsrcac.org/document/pws-tanker-oil-spill-prevention-contingency-plan-summary-1995-2020-2/

Nuka Research Planning Group LLC. March 2022.

This report is a history of the oil spill prevention and response plan for crude oil tankers operating in Prince William Sound. The report spans the first plan developed under then-new state requirements put in place in 1995, following the Exxon Valdez oil spill, up through the state-approved plan that was in place in 2020. The plan structure, commitments, owners, and content have changed in that time under both State of Alaska requirements and state-approved operator-initiated revisions.

Prince William Sound Out-Of-Region Oil Spill Response Equipment Survey

https://www.pwsrcac.org/document/prince-william-sound-out-of-region-oil-spill-response-equipment-survey/

Nuka Research Planning Group LLC. September 2022.

This report presents a survey of oil spill response equipment available from outside the Prince William Sound (PWS)/Gulf of Alaska region to supplement the response to an oil spill from a tanker covered under the PWS Tanker Oil Discharge Prevention and Contingency Plan (PWS Tanker Plan). The report examines the sources of out-of-region oil spill response equipment listed in the PWS shippers' contingency plans and associated agreements listed in those plans. It examines State of Alaska requirements for contractual access to out-of-region response equipment and compares those requirements to some of the agreements listed by the plan holders. The report also includes an inventory of equipment available from out-of-region, focusing on the feasibility of outfitting 14 nearshore task forces.

Review of the 2019 Alaska North Slope Oil Properties Relevant to Environmental Assessment and Prediction

https://www.pwsrcac.org/document/review-of-the-2019-alaska-north-slope-oil-properties-relevant-to-environmental-assessment-and-prediction/

Spill Science, LLC. March 2023.

This report is based on a lab analysis of Alaska North Slope crude oil that was collected in 2019. Environment and Climate Change Canada performed the physical and chemical tests on the sample and Dr. Merv Fingas interpreted the lab results. Dr. Fingas assessed properties that would influence the effectiveness of oil spill response measures including mechanical (e.g., booms, skimmers) and non-mechanical (e.g., dispersants) spill response measures.

Industry and Class Standards for Escort Tugboats

https://www.pwsrcac.org/document/industry-and-class-standards-for-escort-tugboats/

Little River Marine Consultants. January 2017.
Alyeska Pipeline Service Company transitioned marine services providers from Crowley Marine Services to Edison Chouest Offshore in July 2018. The marine services contractor provides escorts, tugs, oil spill recovery barges, and personnel for Alyeska's operations. Little River Marine Consultants developed a summary of industry standards for escort tugboats globally. This report outlines recognized standards from various organizations and includes supporting documents.

2023 Marine Bird Winter Surveys in Prince William Sound

https://www.pwsrcac.org/document/marine-bird-winter-surveys-in-prince-william-sound-2023/

Prince William Sound Science Center. June 2023.

Of the marine birds that overwinter in Prince William Sound (PWS), nine species and one species group were initially injured by the 1989 Exxon Valdez oil spill. This study, now in its third year, conducted marine bird and marine mammal surveys in under-surveyed areas in and around the PWS tanker escort zone. The survey was designed to complement the Exxon Valdez Oil Spill Trustee Council-funded Gulf Watch Alaska surveys conducted from 2007-2022 by the PWS Science Center. Final reports are also available from 2021 and 2022.

2022 Prince William Sound Forage Fish Observations

https://www.pwsrcac.org/document/2022-prince-william-sound-forage-fish-observations/

Prince William Sound Science Center. November 2022.

Researchers conducted aerial surveys of forage fish in Prince William Sound to identify areas where forage fish congregate. The aerial surveys allow for identifying forage fish schools that are in water too shallow for a survey vessel. The objective of the work is to map areas that are commonly used by forage fish and therefore understand the potential impacts of a spill. This report summarizes surveys conducted in June 2022, the fourth and final year of surveys sponsored by the Council. The report also includes combined summary data from the past ten years of surveys (2013-2022) to examine areas of consistent occupancy by forage fish.

Winter Species in Prince William Sound, Alaska 1989-2016 Final Report

https://www.pwsrcac.org/document/winter-species-in-prince-william-sound-alaska-1989-2016/

Prince William Sound Science Center. September 2016.

This report summarizes research on biological resources in Prince William Sound during winter since the 1989 Exxon Valdez oil spill. The search yielded 133 unique results documenting 188 species, including various zooplankton, fish, birds, and mammals. However, the list is not exhaustive, as certain species such as sea cucumbers, sea urchins, jellyfish, octopus, and some marine mammals were not documented in published studies. Despite this limitation, the bibliography serves as a valuable resource for identifying sensitive biological resources in PWS and informing the development of oil spill contingency plans.

Polar Compounds in Alaska North Slope Oil and Other Oils: A Literature Survey and Synthesis

https://www.pwsrcac.org/document/polar-compounds-in-alaska-north-slope-oil-and-other-oils-a-literature-survey-and-synthesis-february-2016/

Spill Science, LLC. February 2016.

Polar compounds found in oils, containing nitrogen, sulfur, or oxygen, pose challenges for measurement and characterization due to difficulties in quantification and separation. Despite technological advancements, separation remains problematic, leading to limited analysis of polar compounds in Alaska North Slope (ANS) oil. Highly polar compounds, due to their water solubility, are unlikely to be present in produced oils like ANS, while fewer polar compounds may be more soluble in oil. Comparisons between the aquatic toxicity of polar compounds and aromatic compounds, particularly polyaromatic hydrocarbons, indicate that polar compounds generally exhibit lower toxicity. Naphthenic acids, a type of polar compound, are more extensively studied and tend to be more toxic in their lower molecular weight forms, but may be less present in oils that have been in contact with water.

Dispersants, Salinity and Prince William Sound

https://www.pwsrcac.org/document/dispersants-salinity-and-prince-william-sound/

Merv Fingas, Environmental Technology Centre, Environment Canada. December 2004.

This paper summarizes the impact of water salinity on the effectiveness of chemical dispersion, particularly focusing on surfactants, the active ingredient in dispersants. Surfactants exhibit increased hydrophilicity with rising salinity, affecting the stability of dispersion droplets due to higher ionic strength in saline water. Beyond a certain salinity threshold, surfactant molecules may leave oil droplets, reducing dispersion stability. While freshwater dispersants are theoretically possible, their effectiveness would likely be lower due to decreased stability in less saline waters.

The Effectiveness of Corexit 9527 and 9500 in Dispersing Fresh, Weathered, and Emulsion of Alaska North Slope Crude under Subarctic Conditions

https://www.pwsrcac.org/document/the-effectiveness-of-corexit-9527-and-9500-in-dispersing-fresh-weathered-and-emulsion-of-alaska-north-slope-crude-under-subarctic-conditions/

Adam Moles, Larry Holland, and Jeffrey Short. April 2001.

The effectiveness of oil dispersants Corexit 9527 and Corexit 9550 in dispersing Alaska North Slope (ANS) crude oil into the water column was tested under various weather conditions. Results showed that dispersants dispersed less than 40% of fresh oil, none of the weathered oil, and were most effective in dispersing a stable oil/water emulsion at 10˚C. However, at typical temperature and salinity combinations found in Alaskan estuaries and marine waters, the dispersants were largely ineffective, dispersing less than 10% of fresh or weathered ANS crude oil in laboratory tests.

Characterization of Energy and Potential Contaminant Pathways in Subarctic Estuarine Habitats: Ecology of Tidal Flat Communities of the Copper River Delta, Alaska

https://www.pwsrcac.org/document/ltemp-ecology-of-tidal-flat-communities-of-the-copper-river-delta/

Sean P. Powers, Mary Anne Bishop, Erika Clesceri, Department of Marine Sciences, University of South Alabama, Dauphin Island Sea Lab. 2006.

Intertidal sand/mudflats play a crucial role in nearshore biological communities across Alaska, serving as a rich habitat for benthic invertebrates. These invertebrates are an important prey resource for various species of fish, crabs, birds, and marine mammals. The Copper River Delta and southeastern Prince William Sound (Orca Inlet) host one of the largest expanses of intertidal mud/sand flats, characterized by estuarine conditions that facilitate nutrient mixing from riverine, estuarine, and marine ecosystems. This report focuses on understanding the connections between riverine and oceanic influences and the nutritional baseline for mudflat food webs in these regions, utilizing stable isotopes of carbon and nitrogen to trace essential elements for growth.

Analysis of Federal and State Ballast Water Management Policy as it Concerns Crude Oil Tankers Engaged in Coastwise Trade to Alaska

https://www.pwsrcac.org/document/analysis-of-federal-and-state-ballast-water-management-policy-as-it-concerns-crude-oil-tankers-engaged-in-coastwise-trade-to-alaska/

Danielle Verna. January 2017.

The regulation of ships' ballast water aims to prevent or minimize the introduction of aquatic nonnative species. In the United States, both federal and state agencies, including the United States Coast Guard (USCG) and Environmental Protection Agency (EPA), regulate ballast water. However, there are instances of overlapping and conflicting regulations between federal and state agencies. For example, crude oil tankers engaged in coastwise trade were exempted from ballast water management activities by the National Invasive Species Act of 1996, but the EPA began regulating these vessels under the Clean Water Act in 2008. This paper reviews current and proposed federal and state ballast water regulations on the west coast of the United States, particularly focusing on vessels discharging to Prince William Sound, Alaska, such as tankers transferring crude oil from the Alyeska Terminal in Port Valdez.

Update: Analysis of Crude Oil Tanker Ballast Water Data for Valdez & Prince William Sound, Alaska

https://www.pwsrcac.org/document/updated-analysis-of-crude-oil-tanker-ballast-water-data-for-valdez-prince-william-sound-alaska-february-2016/
Danielle Verna. February 2016.

This report describes ballast water data reported by crude oil tankers arriving to Valdez and Prince William Sound, Alaska, from 2005 through 2015, as a vector of invasive species.

Characterizing Risk Associated with Vessel Fouling and Nonindigenous Species in Prince William Sound

https://www.pwsrcac.org/document/characterizing-risk-associated-with-vessel-fouling-and-nonindigenous-species-in-prince-william-sound/

Jeffery Cordell & Elizabeth Sosik, School of Aquatic and Fishery Science, University of Washington; Maurya Faulkner and Chris Scianni, California State Lands Commission. October 2009.

Assessing the risk of non-indigenous species (NIS) invasions associated with ship hulls involves characterizing vessel arrivals based on factors such as voyage history, time in port, vessel type, and shipping intensity among ports. Summarizing information about hull cleaning and maintenance practices of major vessel types can help evaluate the risk of introductions by fouling organisms among different vessels, routes, and ports. This approach can aid in identifying regions likely to contribute to NIS introductions and prioritize subsequent efforts targeting specific risk factors. Analyzing shipping patterns, hull maintenance practices, and the pros and cons of various hull fouling sampling methods can help prioritize more intensive and comprehensive sampling efforts.

RESPONSE

Port Valdez Weather Buoy Analysis 2019 – 2022

https://www.pwsrcac.org/document/port-valdez-weather-buoy-analysis-2019-2022/

Prince William Sound Science Center. September 2023.

This report summarizes three years of meteorological and oceanographic measurements made by two buoys deployed in Port Valdez, one adjacent to the Valdez Marine Terminal and one near the Valdez Duck Flats. Time series at each of the buoys were analyzed for seasonal, intra-, and interannual patterns.

Regional Stakeholder Committee (RSC) Resources

https://www.pwsrcac.org/rsc/

The Council created materials intended to help RSC members navigate the oil spill response organization and terms. The materials also assist RSC members to think about the kinds of local knowledge that they can bring to the response managers, such as local waterways, sensitive resources, food security concerns, or other issues.

Tanker Towline Deployment BAT Review

https://www.pwsrcac.org/document/tanker-towline-deployment-bat-review/

Haley C. Lane, Glosten. March 2020.

This report focuses on assessing technologies and methods for establishing an initial messenger line connection between a disabled oceangoing vessel and a responding vessel at sea for the purpose of connecting emergency towing gear. It emphasizes the crucial first step of passing a messenger line from one vessel to another. The report includes a summation of research on commercially available line-throwing devices, drones, and surface float lines, along with literature and regulatory review sections. It also presents relevant case studies from recent loss-of-propulsion events in the Aleutian Islands, Gulf of Alaska, and Canadian territorial waters off British Columbia, providing lessons learned for each case study. Additionally, the report evaluates the best available technology for emergency tanker towline deployment in Prince William Sound, considering the unique physical, geographical, and environmental characteristics of the area. Video summary: https://www.youtube.com/watch?v=yWFrjB952lY

Dispersants

The Council has sponsored what we believe is one of the most complete compilations of articles written on oil spill dispersant research. The latest literature database is updated through early 2023: https://www.pwsrcac.org/document/dispersants-literature-database-updated-february-2023/ (This database is available as a Microsoft Excel spreadsheet).

This report on dispersants and dispersant research is an update to the previous detailed summary, which was prepared in 2021, and covers the literature published since that review. Emphasis is placed on aspects that relate to Alaska and Prince William Sound. The report identifies and focuses on recent advances in all topics of dispersion, particularly dispersant effectiveness, toxicity, and biodegradation. https://www.pwsrcac.org/document/review-of-literature-on-oil-spill-dispersants-2021-2023/

The Council's position on the use of dispersants and supporting materials (updated in 2022): https://www.pwsrcac.org/programs/environmental-monitoring/dispersants/

Prince William Sound Dispersants Monitoring Protocol: Implementation and Enhancement of SMART (Special Monitoring of Applied Response Technologies)

https://www.pwsrcac.org/document/dispersants-monitoring-protocol-july-2016/
PWSRCAC Guidance Document. July 2016.
The main goal of dispersant monitoring is to assess effectiveness and potential adverse impacts, informing decisions on dispersant application. This document presents a dispersants monitoring protocol, expanding on the SMART protocol, with two levels of effectiveness monitoring and detailed biological monitoring. It includes pre- and post-spill monitoring activities to complement field testing during dispersant application and identifies existing long-term monitoring and environmental data for Prince William Sound. The protocol can guide the Unified Command in deciding whether to initiate or continue dispersant application, aiming to enhance decision-making within the existing response framework.

Ship Simulation and Mariner Study of the Maritime Implications for Tank Vessels Utilizing Potential Places of Refuge, Mid-Prince William Sound Alaska

https://www.pwsrcac.org/document/ship-simulation-and-mariner-study-of-the-maritime-implications-for-tank-vessels-utilizing-potential-places-of-refuge-mid-prince-william-sound-alaska/

Safeguard Marine, LLC. January 2017.

The study aimed to assess the suitability of mid Prince William Sound Potential Places of Refuge (PPOR) for tank vessels in distress, excluding PPOR Knowles Head Anchorage due to its current utilization by tankers. North Smith Island, Outside Bay, and McPherson were examined.

Ship Simulation Modeling and Mariner Study of the Maritime Implications for Tank Vessels Utilizing Potential Places of Refuge, Prince William Sound

https://www.pwsrcac.org/document/ship-simulation-modeling-and-mariner-study-of-the-maritime-implications-for-tank-vessels-utilizing-potential-places-of-refuge-prince-william-sound-alaska/

Safeguard Marine, LLC. July 2019.

The study assessed the safety of Potential Places of Refuge (PPOR) in Prince William Sound (PWS) to aid decision-making regarding distressed oil tankers. Identified by the Alaska Regional Response Team, PPOR serve as havens for vessels in distress across Alaska. While the Prince William Sound Subarea Contingency Plan designates 21 PPOR suitable for deep draft vessels, six are too far west from the Traffic Separation Scheme in PWS for use by oil tankers, and seven are already utilized by oil tankers, providing sufficient safety information. However, empirical data on the safety of the remaining eight PPOR for distressed oil tankers in PWS was lacking.

Observers' Report: Cold Water Dispersant Tests Ohmsett Testing Facility

https://www.pwsrcac.org/document/observers-report-mms-cold-water-dispersant-tests-ohmsett-testing-facility/

Elise DeCola, Nuka Research and Planning Group, Merv Fingas, Environmental Technology Centre, Environment Canada. May 2006.

This report outlines observations from four days of cold-water dispersant testing at the Ohmsett facility in February-March 2006, aiming to address concerns raised about earlier trials by the National Academies of Science and the Council. The Council observer team monitored several issues, including heating of oil, artificial weathering, use of booms, and uncontrollable natural factors. Concerns about test oils not reflecting those typically transported in Prince William Sound were not addressed. Additional concerns included the inability to derive effectiveness values without mass balance calculations, residual dispersant and surfactant impact, timing of dispersant application, and the dispersant-to-oil ratio exceeding recommended levels.

Oil Spill Dispersant Effectiveness Testing in Ohmsett

https://www.pwsrcac.org/document/oil-spill-dispersant-effectiveness-testing-in-ohmsett-february-march-2006/

Merv Fingas, Environment Canada, and Elise Decola, Nuka Research and Planning Group. May 2006.

This paper reviews recent dispersant testing at OHMSETT focused on measuring effectiveness on Alaskan oils at low temperatures, close to freezing. Ten tests were conducted, including five dispersant and five control tests. Initial dispersion was good, but subsequent observation revealed much of the oil resurfaced, with about half within one to two hours and most by the next morning. The testing method was evaluated in light of concerns raised in an earlier report, which identified 18 critical factors necessary for effective dispersant testing in tanks.

Weather Windows for Oil Spill Countermeasures

https://www.pwsrcac.org/document/weather-windows-for-oil-spill-countermeasures/

Merv Fingas, Environmental Technology Centre, Environment Canada. January 2004.

Oil spill countermeasures are significantly influenced by weather conditions, which can render some measures ineffective under adverse weather. A literature review was conducted to assess the performance of countermeasure techniques under varying weather conditions. Wind and wave height emerged as the most crucial factors affecting countermeasures, often needing separate consideration to examine specific weather effects. Currents and temperature also impact countermeasure effectiveness, with currents being critical for methods such as booms, while temperature primarily affects dispersants. Ice formation poses a challenge for most countermeasures.

Saline Layering in Prince William Sound

https://www.pwsrcac.org/document/saline-layering-in-prince-william-sound/

Prince William Sound Science Center, Musgrave Oceanographic Analysis. October 2010.

Using profiles of conductivity, temperature, and depth, this report includes an analysis of the mixed layer depth (MLD), potential energy of mixing, and salinity and temperature in the upper layers of Prince William Sound across different seasons and regions. Additionally, the potential energy of mixing to a depth of 10 meters was calculated, which is significant for dispersing oil. Results indicate that the MLD is shallowest in summer and deepest in winter. Seasonal potential energy mirrors the MLD, with higher values in summer and lower values in winter. Near-surface salinity is lowest in summer due to increased freshwater runoff, while near-surface temperature peaks in summer. In the periphery of the sound, the MLD is shallower, potential energy of mixing is higher, and salinity is lower compared to the central sound and Gulf of Alaska. Temperature differences between the periphery and central sound/Gulf of Alaska vary by season, being lower in winter and higher in summer.

Circulation in Port Valdez, Alaska measured by Lagrangian Drifter Experiments, towed acoustic Doppler current profiler and hydrographic profiles in June and September 2016 and March 2017

https://www.pwsrcac.org/document/circulation-in-port-valdez-alaska/

Prince William Sound Science Center. March 2018.

This report described and quantified currents within Port Valdez and addressed concerns about the potential dispersal of contaminants, such as spilled oil, within the fjord basin. The goals were to enhance understanding among the oil spill response community regarding the fate and transport of oil, provide decision-making information regarding chemical dispersant use, assist in prioritizing and implementing strategies for protecting sensitive areas, and contribute to the development and validation of models of oil movement and general circulation in Port Valdez.

Final Report: Hinchinbrook Entrance Wind and Wave Extremes

https://www.pwsrcac.org/document/hinchinbrook-entrance-wind-wave-extremes/

Tetra Tech Canada Inc. November 2018.

This study focused on weather conditions at Hinchinbrook Entrance and the impact on the feasibility of efficient and safe rescue operations by these tanker escort vessels. The study aims to define the frequency and duration of conditions termed “closure conditions,” during which time escort vessels would be unable to operate and tankers are prohibited from exiting Prince William Sound through Hinchinbrook Entrance.

Prince William Sound Oil Spill Recovery Optimization Analysis

https://www.pwsrcac.org/document/prince-william-sound-oil-spill-recovery-optimization-analysis/

Nuka Research and Planning Group, LLC. February 2017.

This study aimed to assess options for enhancing oil recovery by optimizing both open-water and nearshore on-water recovery systems. Using a combination of publicly available and custom-built oil spill response models, researchers evaluated the current optimization level of these systems and explored potential enhancements. The study focused on increasing the capacity of large, open-water recovery systems to encounter oil and improving the ability of smaller nearshore systems to recover oil. The findings from this study provide valuable insights for potential real-world modifications to enhance oil recovery efforts.

Escort Winch, Towline, and Tether System Analysis

https://www.pwsrcac.org/document/escort-winch-towline-and-tether-system-analysis/

Robert Allan Ltd. August 2012.

This study investigated the towing systems utilized on the escort tugboats within the Ship Escort Response Vessel System (SERVS) in Valdez, Alaska. The objective was to assess how these systems align with the current Best Available Technology in escort towing systems worldwide.

A Review of Best Available Technology in Tanker Escort Tugs

https://www.pwsrcac.org/document/a-review-of-best-available-technology-in-tanker-escort-tugs/

Robert Allan Ltd. November 2013.

This study evaluated the capabilities and performance of the SERVS escort tug fleet in comparison to the Best Available Technology (BAT) worldwide. The review aimed to assess how the existing SERVS tugs, particularly the ETT Class Voith Water Tractors and the PRT Class Azimuth Stern Drive tugs, align with current BAT standards. The report outlines the evaluation process and provides the assessment of the SERVS tug fleet based on the BAT criteria.

A Review of Best Available Technology for a Sentinel Tug Stationed at Hinchinbrook Entrance

https://www.pwsrcac.org/document/a-review-of-best-available-technology-for-a-sentinel-tug-stationed-at-hinchinbrook-entrance/

Robert Allan Ltd. January 2014.

This study focused on the requirements for a "Sentinel Tug" stationed at Hinchinbrook Entrance.

Non-Mechanical Response Gap Estimates for Two Operating Areas in Prince William Sound

https://www.pwsrcac.org/document/non-mechanical-response-gap-estimate-for-two-operating-areas-of-prince-william-sound-2008/

Nuka Research and Planning Group, LLC. April 2008.
Researchers developed a methodology to estimate the response gap in Prince William Sound, which is the window between the upper limits of the response system and the conditions at which Hinchinbrook Entrance is closed to laden tankers. This methodology compared response limits for dispersant and in-situ burning tactics to environmental conditions data from 2000-2005. Using a Response Gap Index, the authors estimated how often a specific response tactic would be effective in a particular operating area.

Response Gap Estimates for Two Operating Areas in Prince William Sound

https://www.pwsrcac.org/document/response-gap-estimates-for-two-operating-areas-in-prince-william-sounds-2007/

Nuka Research and Planning Group, LLC. February 2007.

The PWS Response Gap refers to the window between the maximum mechanical response capacity and established weather-based closure limits (such as 15-foot seas or 45-knot winds at Hinchinbrook Entrance). To quantify the Response Gap, historical datasets of environmental factors affecting the open-water mechanical response system in PWS were compiled. These datasets covered two operating areas: Central PWS and Hinchinbrook Entrance. Observations related to wind, sea state, temperature, and visibility (daylight and darkness) were included. A "hindcast" analysis was conducted to assess how often environmental conditions exceeded maximum response operating limits without reaching Hinchinbrook Entrance closure limits.

INJURY ASSESSMENT & RESTORATION

Coping with Technological Disasters – A User-Friendly Guidebook, Version 4

https://www.pwsrcac.org/document/coping-with-technological-disasters-a-user-friendly-guidebook-version-4/

Updated in 2021.

The human impacts of oil spills are not typically addressed in state and federal oil spill contingency plans. To help fill this gap, the Council developed a guide for communities and individuals on how to deal with technological disasters such as an oil spill. The Coping with Technological Disasters guidebook and appendices contains science-based strategies to help ease the invisible impacts of oil spills, and help local governments, small businesses, families, and individuals cope with these disruptions. Of note, Appendix F of the Guidebook is the Peer Listener Manual. This is a resource for those looking to provide peer support in the event of a technological disaster such as an oil spill. The latest revisions (2023) reflect the current understanding of peer-to-peer support and active listening.

Recovery Of a Subsistence Way of Life

https://www.pwsrcac.org/document/study-overview-recovery-of-a-subsistence-way-of-life/

Alaska Department of Fish and Game. 2021.

This report assessed how the subsistence harvest of natural resources has changed over time in Exxon Valdez oil spill impacted communities. Researchers analyzed subsistence harvest data collected from 1984 through 2014 in the communities of Cordova, Chenega, Tatitlek, Port Graham, and Nanwalek.

LTEMP 2022-2023 Summary Report

https://www.pwsrcac.org/document/ltemp-2022-2023-summary-report/

Owl Ridge Natural Resource Consultants. January 2024.

The Council's long-term environmental monitoring project (LTEMP) has gathered data on the presence of hydrocarbons in sediments and mussels in the region since 1993. This report summarizes data collected in 2022 and 2023. 30 years of data from this long-standing program is available upon request and archived in DataONE.

Sustainable Shipping: Regulatory Mandate Review

https://www.pwsrcac.org/document/sustainable-shipping-regulatory-mandate-review/

Nuka Research Planning Group LLC. June 2023.

As with all engines that burn fossil fuels, adverse health and environmental impacts arise when pollutants are released from vessels, ranging from respiratory illnesses to acid rain to climate change. The Council commissioned this report to summarize recent and potential future vessel air emissions requirements.

Examining the Effectiveness of Ballast Water Treatment Processes: Insights into Hydrocarbon Oxidation Product Formation and Environmental Implications

https://www.pwsrcac.org/document/examining-the-effectiveness-of-ballast-water-treatment-processes-insights-into-hydrocarbon-oxidation-product-formation-and-environmental-implications/

University of New Orleans. September 2023.

This study investigates the treatment process at the Valdez Marine Terminal to remove hydrocarbons from unsegregated ballast water. This report specifically looked at hydrocarbons of emerging concern, known as hydrocarbon oxidation products and heavy metals.

Effects of the April 2020 Oil Spill Detected in Study of Mussel Genes

Executive Summary: https://www.pwsrcac.org/document/executive-summary-of-effects-of-the-april-2020-oil-spill-detected-in-study-of-mussel-genes/

Lizabeth Bowen, William B. Driskell, Brenda Ballachey, James R. Payne, Shannon Waters, Eric Litman, Austin Love. March 2023.

On April 12, 2020, a minor oil spill was reported at the Valdez Marine Terminal in Port Valdez. An estimated 1,400 gallons (~34 barrels) of Alaska North Slope crude oil overflowed from an onshore sump well and subsequently reached the shoreline, creating slicks and necessitating a full-scale marine cleanup response. The Council initiated a special project to measure oil exposures and genetic response in shoreline mussels from this spill.

A Review of Literature Related to Human Health and Oil Spill Dispersants 2014-2018

https://www.pwsrcac.org/document/a-review-of-literature-related-to-human-health-and-oil-spill-dispersants-2014-2018/

Spill Science, LLC. April 2018.

Several human health studies have focused on dispersants, particularly Corexit 9500A, and their effects when used with oil. The Deepwater Horizon spill marked the first time that the effects of dispersants on human health were studied extensively and directly. This report summarizes the studies and their findings.

Toxicity of Chemical Dispersants in Alaskan Whales

https://www.pwsrcac.org/document/toxicology-of-chemical-dispersants-in-alaskan-whales-2014/

John Pierce Wise, Sr., Ph.D. University of Southern Maine. November 2014.

Whales, as air-breathing mammals that nurse their young, are crucial to marine ecosystems and are highly relevant for studying the effects of oil spills. Limited laboratory-based data exists on the toxicity of oil and dispersants in marine mammals, prompting efforts to assess the toxicity of Alaskan oil, dispersants, and chemically dispersed oil in whales. Research indicates that dispersants are cytotoxic and genotoxic to sperm whales, while humpback cells show no genotoxicity. Moreover, oil induces genotoxic effects in whale cells, with the addition of dispersants increasing oil toxicity.

Embryonic crude oil exposure causes cardiac hypertrophy and reduced aerobic performance in juvenile pink salmon and Pacific herring

https://www.pwsrcac.org/document/embryonic-crude-oil-exposure-causes-cardiac-hypertrophy-and-reduced-aerobic-performance-in-juvenile-pink-salmon-and-pacific-herring/

John P. Incardona, Mark G. Carls, Larry Holland, Tiffany L. Linbo, David H. Baldwin, Mark S. Myers, Karen A. Peck, Mark Tagal, Stanley D. Rice, and Nathaniel L. Scholz. January 2014.

The 1989 Exxon Valdez disaster had profound effects on pink salmon and Pacific herring embryos exposed to weathered crude oil in shoreline habitats across Prince William Sound. Research reveals that even transient exposure to trace levels of Alaskan crude oil can cause cardiac abnormalities in pink salmon and herring embryos, leading to permanent changes in heart anatomy and physiological performance. These findings suggest that the Exxon Valdez oil spill likely had a more significant impact on pink salmon and herring populations than previously recognized. Furthermore, the heightened sensitivity of herring embryos to polycyclic aromatic hydrocarbons indicates that delayed mortality due to developmental cardiotoxicity may have contributed to the catastrophic collapse of the Prince William Sound herring population.

Toxicity Effects of Dispersed Alaska North Slope Oil on Fish

https://www.pwsrcac.org/document/toxicity-effects-of-dispersed-alaska-north-slope-oil-on-fish-final-report-march-2013/
Centre for Offshore Oil, Gas and Energy Research; Bedford Institute of Oceanography Department of Fisheries and Oceans Dartmouth, Nova Scotia, Canada. March 2013.

This study focuses on how environmental conditions, such as water temperature and salinity, impact the toxicity of chemically and mechanically dispersed crude oil during accidental spills. It also investigates how oil spills affect local fish populations, considering the varying sensitivities of distinct species and stocks.

Ingestion and Effects of Dispersed Oil on Marine Zooplankton

https://www.pwsrcac.org/document/ingestion-and-effects-of-dispersed-oil-on-marine-zooplankton-january-2013/

Richard Lee, Skidaway Institute of Oceanography. January 2013.

This review addresses the ingestion and effects of dispersed oil on zooplankton and fish larvae, surfactant types used in dispersants, their potential effects on zooplankton, research gaps, and priority areas for future studies on the effects of dispersed oil on zooplankton.

Stability and Resurfacing of Dispersed Oil

https://www.pwsrcac.org/document/stability-and-resurfacing-of-dispersed-oil-summary-of-report/

Merv Fingas, Environment Canada. November 2005.
This report summarizes both experimental data and theoretical approaches to the phenomenon of resurfacing oil, which occurs after the initial dispersion of chemically dispersed oil. It outlines two primary processes contributing to this phenomenon: the destabilization of oil-in-water emulsions and the desorption of surfactants from the oil-water interface. The report provides examples of studies and models related to these processes, along with data from experiments and calculations.

Potential for Photo-enhanced Toxicity of Spilled Oil in Prince William Sound and Gulf of Alaska Waters

https://www.pwsrcac.org/document/potential-for-photoenhanced-toxicity-of-spilled-oil-in-prince-william-sound-and-gulf-of-alaska-waters/

Mace G. Barron. March 2000.

This report investigates the possibility of photo-enhanced toxicity of spilled oil in Prince William Sound and the surrounding Gulf of Alaska waters. Photo-enhanced toxicity refers to the increased toxicity of a substance in the presence of ultraviolet (UV) light compared to standard laboratory conditions with minimal UV exposure. Despite the lack of studies specifically examining the photo-enhanced toxicity of oil in Alaska waters, this evaluation suggests that there is a potential for such toxicity in Prince William Sound and the associated Gulf of Alaska waters.

Photo-enhanced Toxicity of Aqueous Phase and Chemically Dispersed Weathered Alaska North Slope Crude Oil to Pacific Herring Eggs and Larvae

https://www.pwsrcac.org/document/photoenhanced-toxicity-of-aqueous-phase-and-chemically-dispersed-weathered-alaska-north-slope-crude-oil-to-pacific-herring-eggs-and-larvae/

Mace G. Barron, P.E.A.K. Research, Mark G. Carls, Jeffrey W. Short, Stanley D. Rice, NOAA/NMFS, Auke Bay Laboratory. February 2002.

This study examined the photo-enhanced toxicity of weathered Alaska North Slope (ANS) crude oil to eggs and larvae of Pacific herring, as well as the relative toxicity of chemically dispersed and aqueous phase oil. Pacific herring are ecologically and economically significant in Prince William Sound and Gulf of Alaska waters and have shown sensitivity to ANS at low concentrations. The study aimed to assess whether ANS exhibited increased toxicity in the presence of UV compared to standard laboratory lighting conditions, and whether the dispersant influenced this toxicity.

Assessment of the Phototoxicity of Weathered Alaska North Slope Crude Oil to Juvenile Pink Salmon

https://www.pwsrcac.org/document/assessment-of-the-phototoxicity-of-weathered-alaska-north-slope-crude-oil-to-juvenile-pink-salmon/

Mace G. Barron, P.E.A.K. Research. December 2003

This study aimed to determine if weathered Alaska North Slope crude oil would exhibit phototoxic effects on juvenile pink salmon under conditions simulating short-term exposures to high levels of oil, potentially encountered during an oil spill, along with environmentally relevant levels of ultraviolet (UV) radiation in natural waters. The study concludes that pink salmon are at lower risk of photo-enhanced toxicity compared to early-life stages of other Alaska species.

Polynuclear aromatic hydrocarbons in Port Valdez shrimp and sediment

https://www.pwsrcac.org/document/polynuclear-aromatic-hydrocarbons-in-port-valdez-shrimp-and-sediment-january-2015/

Mark G. Carls, Larry Holland, Erik Pihl, Marilyn A. Zaleski, John Moran, and Stanley D. Rice. January 2015.

This study addressed concerns from subsistence shrimp fishers regarding the safety of shrimp caught in Port Valdez, where small amounts of crude oil hydrocarbons enter the waters from the terminal's ballast water treatment facility. The report focused on providing information about hydrocarbon levels found in shrimp harvested in Port Valdez. Conclusions from the report indicated that while hydrocarbons accumulate to the greatest extent in shrimp eggs, the overall levels of hydrocarbon tainting in shrimp muscle—the part typically consumed—are well below those considered to pose a human health risk. However, researchers suggested further investigation to determine whether the detected hydrocarbon levels in the eggs have any impact on the development of shrimp.

Tanker Pollutant Loading to the Prince William Sound Airshed

https://www.pwsrcac.org/document/tanker-pollutant-loading-to-the-prince-william-sound-airshed-december-2015/

Starcrest Consulting Group, LLC. October 2015.

This study assessed the decline in air pollution emissions from crude tankers due to the enforcement of federal and international regulations. The main regulation driving emission reductions in Prince William Sound is the International Maritime Organization's International Convention for the Prevention of Pollution from Ships Annex VI (MARPOL Annex VI) and its amendments. This includes the establishment of the North American Emissions Control Area (ECA). Prince William Sound falls within this ECA, which imposes restrictions on fuel sulfur content and sets advanced standards for oxides of nitrogen (NOx) for marine diesel engines installed on ships constructed on or after January 1, 2016. The study estimates the reductions in emissions resulting from the implementation of these regulations on the fleet operating in Prince William Sound.

Port Valdez Sediment Coring Program Final 2004 Monitoring Report

https://www.pwsrcac.org/document/sediment-coring-program-final-monitoring-report/

Mark A. Savoie, et al. Kinnetic Laboratories, Inc., Florida Institute of Technology, Department of Marine & Environmental Systems, TDI Brooks International, Inc. January 2006.

Sediment cores were gathered from eight locations near the Alyeska Marine Terminal (AMT), Port Valdez, and surrounding waters to trace the history of hydrocarbon contamination from various sources including the ballast water treatment plant discharge, AMT operations, tanker traffic, and other human activities.

Rock Slope Stability of the VMT

https://www.pwsrcac.org/document/rock-slope-stability-vmt/

Terry R. West and Kyu Ho Cho. September 2007.

The main aim of this project was to assess the stability of rock slopes at the Valdez Marine Terminal (VMT) during potential earthquake events. The analysis revealed that specific external loading conditions could lead to slope instability in certain areas. Recommendations were made to mitigate risks, including ensuring proper drainage above the rock slopes to prevent water ponding and infiltration, sealing cracks at the top of slopes, regularly cleaning and monitoring piezometers to measure pore pressures, installing additional rock bolts in areas of concern, and developing a contingency plan for increased pore pressure due to precipitation.

Variation in Zooplankton Community Composition in Prince William Sound across Space and Time

https://www.pwsrcac.org/document/variation-in-zooplankton-community-composition-in-prince-william-sound-across-space-and-time/

Smithsonian Environmental Research Center & Moss Landing Marine Laboratory. July 2022.

This report summarizes a genetic analysis of zooplankton in Prince William Sound. The researchers sought to understand how zooplankton communities varied between locations and through time. This information will help improve the Council's monitoring program for marine invasive species. Reports from previous zooplankton monitoring in 2017-2019 are available.

OTHER

Assessment of Risks and Safety Culture at Alyeska's Valdez Marine Terminal

https://www.pwsrcac.org/document/assessment-of-risks-and-safety-culture-at-alyeskas-valdez-marine-terminal/

Billie Pirner Garde. April 2023.

This report was initiated in June 2022, in response to safety concerns at the Valdez Marine Terminal (VMT) brought to PWSRCAC by current and former Alyeska employees. The purpose of the assessment was to reach a determination, based on the information provided to PWSRCAC, on whether there is a current level of unacceptable safety risk to the VMT, its workforce, the community of Valdez, and the environment. After reviewing all information available through the assessment, it is the author's conclusion that there currently is an unacceptable safety risk to the VMT, and consequently no reasonable assurance that the VMT is operating safely and in compliance with its regulatory requirements.

The Effectiveness of Citizen Involvement

https://www.pwsrcac.org/document/effectiveness-of-citizen-involvement/

Linda Robinson, PWSRCAC. June 2006.

This paper explores the evolution of citizen involvement in oil transportation, particularly in the context of the 1989 Exxon Valdez Oil Spill and the subsequent enactment of the Oil Pollution Act of 1990 (OPA 90). OPA 90 mandated industry funding for a citizens' group to oversee the Alyeska Pipeline Service Agency terminal and associated tankers, leading to the establishment of the Prince William Sound Regional Citizens' Advisory Council (PWSRCAC). Comprised of volunteers representing affected communities and interest groups, PWSRCAC has played a crucial role in shaping oil transportation policies and practices in the region.

Prince William Sound Risk Assessment Overview

https://www.pwsrcac.org/document/prince-william-sound-risk-assessment-overview-2005/

Dr. Martha Grabowski. 2005.

This document offers an exploration of risk assessment, with a focus on marine transportation, aiming to provide insights for a new or updated risk assessment in Prince William Sound. It begins with an overview of risk assessment science and a summary of maritime risk assessments conducted post-1996. The challenges inherent in assessing risk in distributed, large-scale systems are examined, particularly in the context of marine transportation. Considering these challenges, the document puts forth recommendations for conducting a comprehensive risk assessment specific to Prince William Sound.

Ways to Engage with PWSRCAC

1. **Sign up to receive PWSRCAC's newsletter, The Observer:** https://www.pwsrcac.org/newsroom/observer-newsletter/

2. **Attend PWSRCAC's technical committee meetings.** All regular committee meetings are open to the public and advertised in advance. We welcome your participation.

Committee	Project Manager Contact
Oil Spill Prevention and Response	Jeremy Robida (jeremy.robida@pwsrcac.org) Roy Robertson (robertson@pwsrcac.org) Linda Swiss (swiss@pwsrcac.org)
Terminal Operations and Environmental Monitoring	Sadie Blancaflor (mercedes.blancaflor@pwsrcac.org)
Scientific Advisory	Danielle Verna (dverna@pwsrcac.org)
Port Operations and Vessel Traffic System	Joe Lally (joseph.lally@pwsrcac.org)
Information and Education	Maia Draiper-Reich (Maia.Draper-Reich@pwsrcac.org)

3. **Attend PWSRCAC's Science Night.** This event is held annually in December to highlight scientific research taking place within our region. A virtual option is available. Contact Danielle Verna (dverna@pwsrcac.org).

4. **Volunteer for the Council.** Are you familiar with oil spill planning or response, marine science or engineering, journalism, mass communication or public relations? We need committee volunteers with knowledge in these areas! See our website for more information: https://www.pwsrcac.org/outreach/volunteer-information/