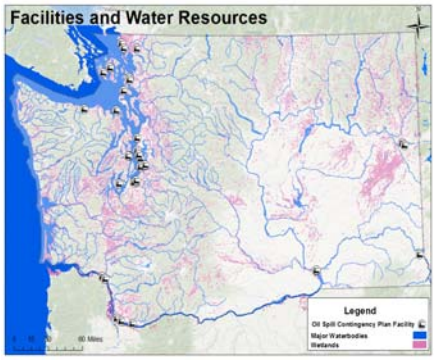
Source: Dr. Bruce Hollebone, Environment Canada, workshop presentation

Source: Bill Jahelka, Western Canada Marine Response Corporation, workshop presentation



Source: Linda Pilkey-Jarvis, WA Dept of Ecology, workshop presentation

Source: Randy Mikula, Kalium Research, workshop presentation

Alberta Oil Sands Workshop

for

Washington State Department of Ecology, the Regional Response Team 10 and the Pacific States/British Columbia Oil Spill Task Force

April 16 and 17, 2013

Seattle, WA

The Center for Spills in the Environment

University of New Hampshire

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1.0 INTRODUCTION

High global oil prices and increasing demand in the United States and worldwide have made the development of significant petroleum resources in Alberta, Canada economically viable. The size of the oil sands resource in Alberta requires refinery additional refinery capacity beyond what is currently available in the Midwest. In addition, there is a need to access shipping ports to deliver the petroleum to markets in the Far-East. Oil Sands Products (OSP) are already being transported to the Northwest via pipelines, ships and rail. Increased development of this Canadian resource requires preparation for potential spills by improving contingency plans and training and identifying response needs for future events.

The purpose of this workshop was to provide a basic education about OSP: What is it, where does it come from, what are its characteristics, and how is it transported? In addition, the workshop provided information for potential spill response from case studies of recent response actions and natural resource impacts.

The Washington Department of Ecology contacted the University of New Hampshire's Center for Spills in the Environment (CSE) to conduct a workshop for relevant State and Federal agencies on the important issues related to OSP characteristics, transportation and response planning. The CSE focuses on issues related to hydrocarbon spills. It is known nationally for its independence and technical excellence in the areas of environmental engineering, ocean engineering and marine science. CSE and its NOAA-funded sister center, the Coastal Response Research Center (CRRC), has conducted numerous workshops bringing together stakeholders including spill response and environmental restoration professionals, industry experts, researchers and federal and state agencies. For this training, CSE assembled a group of technical experts that could provide the participants with the knowledge required to better understand the unique characteristics of OSP and plan for potential spills of the product.

2.0 ORGANIZATION AND STRUCTURE

The training was held at the NOAA Sand Point Facility in Seattle Washington on April 16th and 17th, 2013. The first day of the workshop was an open forum which provided information to a broad group of stakeholders from the region. The second day of the workshop was a working session for response practitioners to focus on issues related to potential OSP spill scenarios. Task groups were given four potential scenarios to test the current understanding of OSP and identify future information and other needs. Breakout groups on each environment had participants with diverse backgrounds. A group leader

facilitated the discussion and a note taker recorded relevant information for presentation at a plenary session.

The body of this report provides a summary of the technical information presented in the training sessions. Section 12.0 summarizes the answers to the questions provided by the breakout groups. The appendices provide:

- the agenda for the training session;
- the attendance list;
- the technical presentations;
- summary notes from the plenary sessions;
- notes and presentations from the individual breakout sessions.

3.0 OVERVIEW OF OIL SANDS DEVELOPMENT IN ALBERTA

Randy Mikula, Ph.D. (Kalium Research; Edmonton, Alberta) provided an overview of mining and the environmental issues related to the extraction and processing of OSP. The Canadian oil reserves in Cold Lake, Athabasca and Wabasca are estimated to be 170 billion bbl. Canada is third in the world in terms of petroleum reserves and the United States is currently the largest importer of Canada's OSP. The 25 year forecast suggests that total production out of Western Canada could surpass 6 mmbpd by 2035, which indicates there will need to be significant increases in transportation capacity to handle this reserve. The current transportation capacity has the ability to handle approximately 3.6 mmbpd. Proposed expansions to the Gulf and Northwest will address significant portions of this need:

- Keystone XL 700,000 bpd
- TMX expansion 590,000bpd
- Northern Gateway 530,000bpd
- CN shipment to BC

Typically, OSP consists of 73% sand, 12% bitumen, 10% fines and 5% water. [N.B., This data and all of that presented below is contained in the presentations given at the training. See the appendix for these documents.] The large percentage of abrasive materials means that OSP requires significant processing near the mining sites to prepare it for transportation to refineries, either locally or at a distance. The mining operations are conducted in two ways: surface mining and *in situ* mining. Both processes use very large amounts of water. In surface mining, the OSP is removed by mining machines and moved to locations where it is crushed, and mixed with water to remove the bitumen. The resulting mine tailings are transported to large tailing ponds where fines are allowed to settle and consolidation occurs. Water

usage is significant, 2 to14bbl. per 1bbl. of bitumen recovered. From an environmental perspective, surface mining, including the large tailing ponds, results in major disturbances to the landscape. Regionally, the current extent of disturbance is ~600km,^{2} with tailing containment about ~180km^2.

The attempt to reduce water usage and speed restoration of land areas has led to the development of several methods of enhanced water recovery. The dry stackable tailings process is increasing the reuse of water (up to 70%) and allowing the potential restoration of tailing ponds sites to boreal forests to occur more quickly. The dry stackable tailing process utilizes the addition of chemical additives to consolidated tailings and release water. However the additions of these additives have raised the issue of potential toxicity to surrounding water bodies. Spreading thin layers of tailings over large areas has shown promise to speed consolidation. New technology, using centrifuges, has been shown to reduce the volume of the tailings and increase water reuse to near 80%. These new methods are decreasing tailing storage space requirements and will speed restoration potential.

The *in situ* mining process also requires extensive water use and is highly energy intensive. In the *in situ* process, steam made from saline groundwater is injected into deep oil sands deposits. Using steam assisted gravity drainage (SAGD), the head reduces the bitumen's viscosity so that it can be pumped from the ground like conventional crude oil. The water is then separated from the extracted material and recycled.

There is a significant energy input associated with the *in situ* extraction method. The standard extraction process requires huge amounts of natural gas. Currently, the oil sands industry uses about 4% of the Western Canada Sedimentary Basin natural gas production. By 2015, this may increase by 2.5 times.

According to the National Energy Board of Canada, it requires about 1,200 cubic feet (34 m^3) of natural gas to produce one barrel of bitumen from *in situ* mining operations and about 700 cubic feet (20 m^3) for those where gas and bitumen are extracted. Since a barrel of oil equivalent is about 6,000 cubic feet (170 m^3) of gas, this represents a large gain in energy. That being the case, it is likely that Alberta regulators will reduce exports of natural gas to the United States in order to provide fuel for the oil sands processing. As gas reserves are exhausted, however, oil upgraders will probably turn to bitumen gasification to generate their own fuel. The conversion of the bitumen to synthetic natural gas is a (136 m3) net gain of 4,800cu ft.

4.0 CHARACTERISTICS OF OIL SANDS PRODUCTS

To understand how OSP might react in the environment it is important to understand its physical and chemical characteristics. An overview of the characteristics of OSP was presented by Heather Dettman, Ph.D. of CanmetEnergy (Government of Canada). Bitumen is the extra heavy crude oil that remains in the geologic formation after *in situ* biodegradation processes occur. Approximately 50% of bitumen boils at temperatures below 524°C/975.2°F. Due to the biodegradation process, only the large organic acid molecules remain as part of the bitumen. These molecules have the high boiling points (>70wt% 524°C/975.2°F) and a low Total Acidic Number (TAN) of 3mgKOH/g material (3wt% in oil). This compares with vinegar which has 5% acetic acid and a TAN of 47KOH/g material.

In order to move bitumen efficiently through transmission pipelines, other petroleum products must be added to dilute it. These diluted bitumen products are called Oil Sands Products (OSP). Dilbit (diluted bitumen) is created by adding naphtha-based oils including natural gas condensate. While approximately 75wt% of the condensate has a low boiling point of 204.2°C/399.2°F, the overall boiling point of the dilbit remains high at 524°C/975.2°F. This is important because it means a small fraction <20wt% will evaporate rapidly during a spill, but the remaining fraction will not. The slower evaporation of the remaining fraction reduces the potential air quality issues for responders and the public. Synbit is made by diluting bitumen by using synthetic crude oil (syncrude) from refineries. Like dilbit, synbit maintains a high boiling point for the majority of the material.

Dilbit and synbit that is transported through pipelines must meet certain specifications for viscosity, density and acidity. In order to meet these specifications, the bitumen requires diluent by lighter oils, 30% for dilbit and 50% for synbit by volume. Both must meet a TAN of ~1.9KOH/g material with less than 3.9wt% sulfur.

Internal corrosivity in pipelines can occur as result of water, sediments, organic acids or sulfur contained in the oils or OSP. Water becomes important if the sludge in which it is contacted settles, accumulates and increases at a given location. If water soluble organic acids are present, corrosivity is increased. OSP is generally low in water soluble organic acids due to the extensive washing that occurs during the sediment removal process instituted immediately after extraction. The washing not only reduces the organic acids, but also removes mud and sand that might normally be abrasive to the pipeline. Organic acids in OSP or other crudes can cause corrosion if they become concentrated; this can occur at high temperatures in the refinery process. In pipelines, rail cars and ships these high temperatures, 280°C/392°F do not occur as the dilbit and synbit do not need to be heated to flow.

Some bitumen has been shipped without diluent in rail cars. This requires heating in order to fill and empty the cars. The high temperatures required to breakdown the bitumen and release acids are not achieved during this process.

Sulfur is contained in most crudes, OSP and diluents. If released, the acidic sulfides may react with iron to form iron sulfides. In order for this to occur, sulfur in the OSP would need to be exposed to high temperatures, (350°C/662°F) along with high pressure catalysts that are part of the refinery process. These conditions do not usually occur in pipelines, ships or rail cars.

In summary, research conducted as early as 1995, and more recently, on Alberta OSP have shown the material to be low in corrosivity.

5.0 TRANSPORTATION OF OIL SANDS

A panel of oil sands transportation experts discussed west coast the rail, pipeline and sea corridors currently utilized to move OSP. Panelists provided information on equipment, safety programs and response planning.

5.1 Rail transportation

Justin Piper of BNSF Railways reported that their system has moved mostly crude oil through their system to date, with only a small percentage being OSP transported to the U.S, (0.65%). There was a 300% increase in crude transport in 2011-2012, with no accidental releases. In 2012, there were 16 non-accidental releases averaging 3 gal. per release related to shipper related issues. In 2012 there were 3,632 shipments of light sweet crude to Washington and 1,557 to Oregon. In 2012 BNSF achieved an accident rate of 1.88/million train miles, a record for their system.

Petroleum unit trains normally contain up to 80-100 tank cars; each car has a 28,000 gallon capacity. They are constructed of 7/6 inch steel and have standard safety relief valves. Cars are typically owned, maintained and inspected by the transporter and expected to be a 40 year asset. The rail companies conduct additional inspections when the cars become part of a train. All cars are built to U.S. standards as specified in 49CFR174.

The safety program employed by BNSF has four parts: 1) community training; 2) emergency preparedness; 3) accident prevention and; 4) emergency response. The community training involves either in-person or online training for local emergency responders. Annually 3-5,000

people are trained nationwide. The emergency preparedness program involves development of an overall plan with appendices that define local response plans and environmental sensitive areas. Geographical response plans for water response that have computer linkage have been developed for specific important environmentally sensitive areas like the northwest, Mississippi River, and rail specific locations like the Columbia River, Colorado River and Glacier National Park (Flathead River) for example.

The accident prevention program utilizes onboard sensors, wayside detectors to determine break or wheel problems, and engineering systems to improve track systems. The emergency response program involves an incident response command that includes all hazardous responders, operations personnel and contractors in one unified team. The team has available GIS with identified sensitive features, preplaced equipment and responder locations to streamline response actions. Preplace equipment for hazardous spills in the northwest is located in Pasco, Seattle and Spokane Washington.

5.2 Pipelines

Michael Davies of Kinder Morgan provided background information on the current transportation of petroleum through the system, future expansion plans and the safety systems in place to prevent or respond to spills. The Trans Mountain Pipeline System (TMPL) is 715 miles long between Edmonton and Burnaby with connections to Anacortes and Ferndale in Washington (Puget Sound System). The current capacity of the pipeline is 300,000bpd with an expansion to 890,000bpd proposed to meet west coast and Far East demand. TMPL currently has 10-20 year contracts for 700,000bpd of that capacity in place. The system currently has one berth for ships at the western end of the pipeline. The current proposal is to increase that port to three berths for oil tanker transport.

Upgrades to the Puget Sound System will increase the capacity from 170-225bpd. The throughput on the pipeline to the Puget Sound system was 47% of the capacity in 2012; Burnaby and Westridge represented 28% and 21% respectively. The composition of the shipments in 2012 was: light crude 45%, heavy 22%, syncrude 17% refined products 16%.

The Westridge sea terminal currently has one berth and services 5 tankers and 2 barges per month. With the expansion to three berths the port could service up to 35 tankers and 2 barges per month. This would represent an increase in marine traffic in the system from 3 to 14%, a potential 350 additional ship calls per year.

The Kinder Morgan emergency response plan meets all of Washington State standards. The plan includes an incident command structure and field operations manuals for response actions. The program includes annual training and exercises to implement the plans. The TMPL has preplaced equipment and maintains contracts with spill response contractors Marine Spill Response Corp (MSRC), Witt O'Brien and National Response Corp NRC (by the end of the year).

The products transported meet all of the standards for temperature, density and viscosity as defined by Tariff 88. TMPL has been transporting dilbit since 1980 with no spills or operational issues.

5.3 Vessels

Dick Lauer of Sause Brothers provided an overview of the barges transporting petroleum products in the northwest inland and coastal waters. Barges are of two different sizes for coastal transport: 40-120,000 barrels for lower Columbia and Puget Sound and; 80-180,000 barrels for the ocean class. All of the barges are double hulled with vapor recovery systems.

For safety purposes the first responders are part of the barge crew. The barges are made so that the double hull can be utilized to balance the load should instability occur during transit.
The barge type that currently services the Kinder Morgan facility in Westridge is a 90,000 barrel vessel.

6.0 FATE AND BEHAVIOR OF SPILLED OIL SANDS PRODUCTS IN THE MARINE AND FRESHWATER ENVIRONMENTS

Bruce Hollebone, Ph.D. of Environment Canada provided the current information on the behavioral factors affecting OSP and the chemical changes which may occur when it is spilled in the environment. These changes, collectively referred to as weathering, are the physical, chemical and biological processes that affect the oil released into the environment. Weathering is one of the major drivers of oil behaviour (what it does in the environment?), fate (where it goes?), persistence (how long it lasts?) and effects (what it impacts?). The primary weathering processes are:

- Evaporation
- Photo-oxidation
- Water uptake and emulsification
- Particle interactions and sedimentation

- Dispersion
- Biodegradation

There are 12-13 types of OSP and they differ slightly in how each reacts in the environment based on its specific properties. Evaporation is the best known weathering process. It is a physical process where molecules leave the liquid phase, but are not changed chemically. It is normally a rapid process whereby light and medium crudes may lose 40-75% by weight over two days. OSP however, will lose 15wt% (dilbit) to 20wt% (synbit) in a few hours, but then only ~20wt% over ten days. The initial loss due to evaporation is important to understand for air quality and safety purposes for the first responders and residents in proximity to the spill.

Dissolution and solubility are minor factors (ppb to ppm levels) with respect to oil behavior, but they can impact biota and their habitats. The concentrations of the individual compounds in OSP that dissolve into water are a function of mixing energy, temperature, concentration and time.

Photo-oxidation of OSP increases the density of the remaining product and tends to increase the amount of water uptake and emulsion formation. The uptake of water during emulsification increases density and greatly increases viscosity. As a result, it changes the way OSP is transported and how it sticks to other objects. Entrained water may persist for a long time in the environment. Currently, models for photo-oxidation and emulsification are not well developed.

Particle interaction with OSP can occur in several ways and depends on the location or source of sediment. Suspended particles become adsorbed to oil and increase its density, often causing it to sink. In turbulent areas, such as surf zones or rivers with rapid currents, oil can be dispersed into small droplets where emulsification and sediment interactions occur simultaneously. These combined actions may result in tarball formation and sedimentation. Recent information from the Kalamazoo spill has shown that increased temperature may decrease the viscosity of oil allowing to be released from bottom sediments. Models for dispersion and sediment interaction are being developed.

Temperature affects many OSP properties (e.g., density and viscosity). Temperature also affects rates of weathering processes (e.g., evaporation and adsorption/sedimentation). Natural dispersion of OSP can occur if there is enough mixing energy in the water column to cause droplets to break away from the slick. Little is known about the mixing energies needed to disperse OSP, but it is less likely to occur once the lighter fractions such as the diluent have evaporated.

Biodegradation of the organic compounds of OSP will likely occur from weeks to months to years depending on conditions. Aerobic biodegradation is a much faster process than anaerobic biodegradation

with nutrients and electron acceptors being the limiting factors. Microbes attack the smaller chain alkanes first followed by the unalkylated aromatics. Factors such as dispersal, burial by sediments, water quality and temperature all affect how rapidly and effectively biodegradation occurs.

There are many open questions that need to be answered in order to better predict or model how heavy oils or OSP react after a spill. The change in dilbit chemistry and behavior due to evaporation of the diluent still is not well known. The dispersion of OSP in water requires more knowledge of the droplet size, the rise time and the re-coalescence of the droplets. The interactions with sediments and the resuspension and remobilization potential are also questions that need further study. Little is also known of the impacts or long term persistence of OSP in the environment. More research also needs to evaluate the dissolution of OSP, so that bioavailability and toxicity can be established for biota present in the water column and the sediments.

7.0 THE ENBRIDGE OIL SPILL CASE STUDY (KALAMAZOO RIVER, MICHIGAN) INCLUDING RESPONSE TECHNOLOGIES FOR OSP

The Enbridge/Kalamazoo OSP spill on July 25, 2010 was a result of a ruptured pipeline. Mr. Ralph Dollhopf, EPA onsite coordinator involved with the incident presented an overview of the response for the estimated 843,000 to 1,000,000 gallon spill.

The impacted area is a 40 mile meandering river segment. During the time of the spill, the river was at the 25 yr. flood stage, which resulted in significant inundation to areas of the flood plain. The river also has numerous oxbows, islands and wetlands all which complicated the response effort. The Ceresco Dam also on the affected segment, tended to trap oil in the upstream impoundment. Initially, there was substantial confusion regarding the spill among Enbridge employees. Thus, substantial amounts of OSP were discharged adjacent to the river before the flow was stopped and the State and Federal agencies were notified. The initial notifications did not specify that the spilled oil was OSP. Hence, this further complicated the initial response. This confusion emphasized the need for excellent communication between the transportation company's cleanup contractors, state and federal responders, and local communities during any future spills.

During the first 40 days after the spill, there was an initial remedial operation plan that included responding to the potential public health hazard that might have been caused by the benzene diluent (30%) in the air. An extensive air monitoring program was conducted during the first 30 days to protect cleanup workers. These responders utilized respirators for the first 9 days. Voluntary evacuations were

undertaken for 60 residences in the immediate area. The USEPA also initiated a process to assess the amount and location of shoreline oiling, using a river adaptation of the NOAA Shoreline Cleanup Assessment Technique (SCAT). This provided a unified method for assessment and data collection that could be used for developing a cleanup strategy. The SCAT process also provided a systematic management process for the cleanup. Following the initial cleanup efforts, a SCAT reassessment of river segments was completed to determine if the areas were sufficiently clean. During the first few weeks 740,000 gals were recovered.

After the initial cleanup and SCAT reassessment, the remediation strategy turned to the overbank areas in the floodplain. The remediation of these areas was driven by a new methodology: the Shoreline Overbank Assessment Technique (SORT). SORT used a USGS inundation model to provide the guidance for identifying and assessing the locations for remediation. The SORT method was initially used in 2011 and then as ReSORT in 2012 to revisit areas that needed further action. An overall outcome of this remedial process was development of a data management system that could be employed for future spill scenarios in freshwater systems.

Because the majority of the OSP spilled is dominated by heavy oil fractions, there was a significant effort in 2011 and 2012 to remediate the submerged oil in the river. The remediation team had a difficult time identifying the location of the submerged oil. The initial identification of submerged oil areas was done by coring, water jets and long poles (poling) in 18 priority locations. Oil recovery was conducted in the spring and fall of 2011 to remediate these locations.

To improve the recovery of submerged oil, the team used a number of techniques with varying success. These included: oil low pressure sediment flushing, pressure with stingers, dredging, aeration, surface collectors, absorbent pads, pom-poms and sheen corralling.

The Scientific Support Coordination Team developed a new strategy for 2012 focusing on the submerged oil. The strategy involved:

- Reassessing all submerged oil locations;
- Minimizing ecological impacts related to recovery;
- Utilizing natural transport and sediment traps as the primary low impact method of oil capture (allowing for natural habitat recovery during the long term)

In 2012, the remediation team conducted some additional scientific studies:

- *Net Environmental Benefits Analysis (NEBA) Study*. This study weighs the risks of leaving oil in place compared to removal activities.

- *Submerged Oil Quantification Study*. This is a stratified random coring study, including all the geomorphic units in the river, to develop a valid estimate of the amount of oil present.
- *UV Epiflourescence Microscopy Study*. This study attempts to understand the structure of oil and mineral aggregates formed.
- *Biodegradation Study*. This study is focused on determining the effects of natural biodegradation on the OSP.

The results of these studies will contribute to the knowledge base for future river-based spills. The NEBA will provide a framework for evaluating the net benefits of future removal actions. The biodegradation study will provide significant knowledge regarding the potential value of biodegradation as part of an overall cleanup strategy for OSP spills.

8.0 BURNABY OIL SPILL CASE STUDY

The Burnaby oil spill at Westridge occurred on July 25th 2007. Bill Jahelka of the Western Canada Marine Response Corporation (WMRC) reported on their response to this dilbit spill. The spill was estimated to be 232,000 liters (1400 barrels) and the response by WMRC was rapid with the first skimmer being placed around the spill within an hour. Aerial photos showed that some oil did get beyond the main skimmer however.

WMRC employed a variety of skimmers including skimmer vessels to capture the bulk of the oil. This process took five days. The oil that reached the shore line was cleaned by using Corexit 9580 A as a cleaning agent and then washing the oil into the adjacent boomed shallow water. This oil was then captured using skimmers and vacuum trucks. This process took two months.

Crab traps with sorbent material were utilized to determine if submerged oil was present. No submerged oil was detected. A monitoring program was conducted for eighteen months to insure no oil remained. The cleanup captured 210,000 liters of the 232,000 spilled.

This cleanup resulted in several findings applicable to future spill responses:

- Diluted bitumen did not sink in this situation (minimal wave action and wind, warm temperatures, clear salt water);
- Response equipment worked well during both containment and recovery;

- Shoreline equipment (low pressure deluge, passive recovery) in combination with Corexit was effective;

- Excellent response network support and rapid response resulted in an effective recovery.

10.0 ASSESSING NATURAL RESOURCE IMPACTS FROM THE ENBRIDGE PIPELINE SPILL INTO THE KALAMAZOO RIVER

As part of the Enbridge/Kalamazoo cleanup, the resource trustees initiated a Natural Resource Damage Assessment (NRDA) to determine the value of the natural resources lost or damaged as a result of the OSP spill. Jessica Winter (NOAA), a member of the NRDA team, reported on the activity to date, including ongoing trustee's data collection.

The Oil Pollution Act of 1990 (OPA 90) and the subsequent regulations, established the requirement to assess the damages from oil spills and make the public whole for the loss of any natural resources and natural resource services. Damage assessment requires that the natural resource trustees are chosen from among the responsible natural resource agencies in the area. The NRDA then proceeds through a stepwise process that includes:

- An initial resource assessment to determine whether injury to public trust resources has occurred.

- Trustees quantify injuries and loss of services and identify possible restoration projects using economic and scientific studies to compensate for the injuries and losses. In assessing the losses the trustees must evaluate the spatial extent of the injury, severity and duration.

- These impact assessment studies are used to develop a restoration plan and potential compensation for loss or impairment from the time of injury to recovery.

- The final step is to implement restoration and monitor its effectiveness, including adjustments, if required.

For the Enbridge/Kalamazoo spill, eight trustees, including two tribes, were designated to oversee the NRDA process. In discharging their responsibility, the trustees are conducting an assessment to determine what resources might have been impacted and identify the potential injuries. The trustees are coordinating with the response agencies to determine what information had been previously collected as part of the remediation process that might be useful in the NRDA process. Gaps were identified that

would be needed to quantify the injury. Data from the literature or studies from similar environments can be utilized to provide insight into the river's baseline ecosystem.

The trustees initiated a number of studies to fill the data gaps necessary to determine the extent of injuries. These studies took into account: the nature of the oil spilled, the identified locations of oil damage, and impacts related to the remediation itself. The studies included:

- The extent of oiling in the floodplain habitats;
- Vegetation surveys to determine the extent of oiling and potential invasive species expansion;
- Erosion issues related to the remediation;
- Fish kills and ongoing monitoring surveys for status and trends;
- Fish tissue surveys to assess potential exposure and sub-lethal health issues;
- Abundance and diversity of macroinvertebrates impacted by the sinking oil and cleanup process; (The cleanup process has the potential to impact habitat (e.g., sediment and vegetative cover)).
- Mussel shell surveys to further assess the impacts of the spill and remediation on these populations;
- Chemistry studies of source OSP, water, sediment and biota;
- Wildlife recovery studies using animals treated at rehabilitation center and;
- Human use studies to determine the loss of the river for human recreation for two years.

As these studies are completed and the impacts analyzed, the trustees will determine if any additional data gaps exist and then initiate the restoration and compensation phases of the NRDA. Reviewing the findings of these studies will be helpful to understanding response actions for any future OSP spills in in Northwest. Data from 2012 indicates that the fish community in Talmadge Creek is showing some recovery, but changes in habitat due to the cleanup are affecting the type of community that is there. In the Kalamazoo River there is still lower diversity and abundance at some sampling locations. The macroinvertebrate community in the Kalamazoo appears healthy while the community in the Talmadge is not as healthy, suffering in part from habitat changes due to the cleanup activities.

11.0 POTENTIAL AREAS OF IMPACT AND RESOURCES AT RISK FROM OSP IN PACFIC STATES AND BRITISH COLUMBIA

The first day of the Pacific States/British Columbia training session provided an overview of the nature of OSP, the transportation issues associated with it, its potential impacts in the event of a spill, and information from case studies for strategies that might be employed to cleanup an OSP spill. On the second day, the working session, Linda Pilkey-Jarvis and Danielle Butsick of Washington Department of Ecology provided an initial overview of the status of the potential transportation corridors (rail, pipeline and shipping) and petroleum facilities used to handle OSP, and the potential resources that might be at risk. This presentation demonstrated the information available to responders in the region and how it could be utilized in response planning.

Northwest shipping trade is closely allied with Asia. The increase in available OSP as discussed will increase the number of ship calls in the area. Waterways carry diverse vessel traffic in inshore waters making the potential for accidents possible. There are six pipelines in the area which carry petroleum products. Oil terminals are primarily located in water bodies and transfer oil across docks or through pipelines. Grays Harbor has three new proposed terminals and another is proposed for the Columbia River. Four railroads cross the area including BNSF, Union Pacific, Columbia Basin and Cascade and Columbia River Railroad, the most significant being BNSF.

There are significant tools available for Pacific States oil spill responders including:

- Environmental Sensitivity Maps (ESI);
- Environmental Response Management Application (ERMA) for Puget Sound- an online GIS tool with static and real time data for responders;
- Washington State Coastal Atlas providing public access, natural resource and sensitive habitats.

By using these tools and other available data and overlaying this information with transportation corridors and facilities, it is possible to identify the potential resources at risk. It is understood that not all environmental data is incorporated into the tools at this time, but they are being improved over time. Important resources include:

- Rivers, streams and sole source aquifers;
- Priority species habitats;
- Threatened and Endangered Species;

- Public access and recreation;
- Tribal Resources (subsidence, cultural, economic natural).

The Department of Ecology is using all of these tools to develop response plans for various potential spill scenarios. Plans are updated annually.

12.0 BREAKOUT GROUP DISCUSSIONS OF OSP RESPONSE STRATEGIES

The Organizing Committee developed four scenarios to be addressed by the participants that represented potential transportation and facility risks in the region. Workshop participants were distributed into one of four breakout groups based on their experience and expertise. Each breakout group had a Group Leader (facilitator) and a Recorder (note taker). The spill scenarios included: Vessel – Marine (North Puget Sound- Salish Sea); Train- Inland River (Kalama area); Pipeline-Inland (Ferndale area) and; Facility-Marine (March Point Refinery dock).

Each of the groups was given five questions to direct their discussion:

1. For your scenarios, what would the response be now?
2. What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these OSP scenarios?
3. What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).
4. How does Contingency Planning need to change to accommodate an OSP spill?

By discussing and answering these questions, the groups were able to evaluate current readiness for an accident and also recommend and prioritize actions that should be taken to better prepare response agencies for future contingencies.

12.1 Vessel - Marine

Group members:

Gary Shigenaka, NOAA (Group Lead)
Carol Bua, Tidewater Barge Lines
Tom Callahan, WA Maritime Cooperative
Brendan Cowan, San Juan County, Dept. of Emergency Mgmt.
CPT Scott Ferguson, U.S. Coast Guard, Sector Puget Sound
Kurt Hansen (via WebEx), U.S. Coast Guard, Sector Puget Sound
Bruce Hollebone, Environment Canada
Julie Knight, Islands' Oil Spill Assn.
Dick Lauer, Sause Bros. Ocean Towing
Mike Moore, PMSA
Linda Pilkey-Jarvis, Washington Dept. of Ecology
Charlie Watkins, UNH Center for Spills in the Environment (Recorder)

Scenario:

> **At 0130 on April 14th, a laden tug and barge carrying 85,000 barrels of oil sands product transited southbound out of Rosario Strait and crossed over Lawson Reef. Low tide was 4.94 feet at 0122. Due to the relatively high speed of the vessel when it struck the reef, both layers of the double-hulled barge were damaged. This resulted in a release of approximately 60,000 barrels of oil sands product into the waters of Puget Sound. Weather on-scene has been mild storm conditions with 35kt winds from the south and 5-7ft swells. High tide this morning was 6.09 feet oat 0848; low tide will be .92 feet at 1543 this afternoon. Initial reports mentioned a significant sheen around the vessel. Notifications were made and unified command formed.**

The Group indicated that the current approach to respond to this spill would be similar to that of a crude oil spill. This would require the establishment of a full Incident Command Center to oversee all activities. The Environmental Unit (EU) would need to immediately establish an air monitoring and safety program to protect the public and establish the safety protocol for the responders. During early aspects of the response, the resources at risk and the extent of the spill needs to assessed. The Group recognized the need to identify the characteristics of the OSP spilled beyond the MSDS. This would greatly assist in establishing safety protocols and determining cleanup strategies. Specifically

it was determined that knowledge of the diluent and the characteristics of the OSP would be central to the response action.

The Group identified several technical and logistical issues that would need to be addressed for this spill. A significant question for responders is whether the OSP will sink in the choppy seas or if it will float and be easier to recover as at Burnaby. The cleanup of shoreline is important in this narrow channel area. What is the most effective method? The question of whether dispersants would work or in-situ burning might work was also discussed.

From the perspective of logistics the availability of benzene air monitoring equipment is important. Available safety equipment for responders for the appropriate thresholds is important to have on scene. Training of local responders is necessary as part of the planning process. It was also the consensus that having an effective method of communication to the public is a high priority to provide the correct information and avoid misunderstandings. There is a need to better understand issues of toxicity and seafood safety. Current toxicity information is not adequate, including safe levels in food.

In order to prepare for OSP spills in the future there is an immediate need for equipment inventories and locations for response planning. Lessons learned from previous spills are important to make available to responders to improve future responses and reduce missteps. To improve communication, developing accurate and concise messaging material about oil sands would be helpful for those charged with communicating to the public and the media. In the longer term, there needs to be a better understanding of the implications of cross border issues to improve communication and response. There is a need for more research on the OSP response methods including:

- Dispersants,
- *In situ* burning,
- Surface washing agents for shoreline cleanup,
- Modeling to assist with OSP behavior.

To improve contingency planning for future marine spills additional protocols should be developed for air monitoring, surface and subsurface responses. More information on transportation of OSP needs to be part of the planning, and OSP response actions need to be incorporated into drills so that responders have the knowledge and experience to provide timely and effective response to OSP spills.

12.2 Train - Inland River

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Holly Robinson, Maritime Fire & Safety Assn. (MFSA)

Calvin Terada, U.S. EPA, Reg. 10

Jessica Winter, NOAA ORR ARD

Jeff Smith, University of Washington (Recorder)

Scenario Train – Inland River:

> **As a result of a long period of wet weather in the Kalama, WA area, a series of landslides has begun occurring in the steeper areas along the banks of the Columbia River. A unit train consisting of 120 cars each carrying 600 barrels of undiluted bitumen oil was transiting a rail line that runs adjacent to the river, when it was derailed by a landslide. Three tank cars are off the tracks at river mile 79 (45.963121,-122.811828). At least one is known to be compromised and leaking oil into the Columbia River. Initial reports estimate at least 600 barrels are in the water. Based on volume observed, it is likely that the other two derailed cars are leaking as well. The river is flowing at 200,000 cubic feet per second (flowing**

toward Kalama) and is approximately 50ft. deep in this area. Notifications were made and unified command was formed.

The group determined that the response would need to include both surface and subsurface cleanup given the nature of OSP. To effectively respond would require the ability to track the subsurface plume effectively given river flows of 200,000cu.ft./sec. Because the River serves as a water source it would be extremely important to identify the existence of water intakes and make determinations as to whether the intakes need to be shut down.

Resource Trustees would need to be contacted to identify the potential resources at risk in the area of this spill. This knowledge could be utilized to prioritize response activities. The resources would include not only surface and water column species, but also bottom dwelling species, and those in adjacent wetland and floodplains. Information on the bathymetry of the area would be important to identify likely areas of deposition for subsurface oil.

It is assumed that the railroad would provide cleanup contractors and be responsible for source control and recovery of the rail cars. They would also be responsible for air monitoring networks in this scenario.

There is a need to provide accurate information to the public about this spill. This would include information on any known toxicity issues and the closure of any fisheries. There is a lack of knowledge locally of the most effective methods of response to an OSP spill. Thus, there is a need to understand lessons learned from previous OSP spills.

High priority information needs in the near future include: Where is the submerged oil recovery equipment located in the region for deployment; who has the expertise to handle this type of spill and where are they located and; what are the strategies to protect water intakes from submerged and surface spills.

Informational needs of medium priority include knowledge of sampling and initial surveillance monitoring techniques that are effective for OSP spills. A greater understanding of effective containment and recovery techniques for OSP and also what are their limitations. More information on the toxicity of Class V would be important research to have available to help with planning and response. Longer term research priorities include effective long term monitoring strategies, well developed case studies for previous spills and understanding the fate and transport of OSP spills in freshwater environments.

New contingency planning (Northwest Area Committee) will occur during 2014. As part of the planning there is a need for developing fact sheets on OSP similar to NOAA's. A task force should be assembled to incorporate planning for OSP spills into the Contingency Plan. As part of the planning process it would be important to develop a list of experts who could be utilized during an OSP response including those with expertise in resources at risk and those with knowledge of bathymetry and river processes. Assembling information and reports from previous spill OSP response efforts and best available technology for submerged oil containment and recovery in freshwater would assist responders in planning and training.

12.3 Pipeline - Inland

Group Members:

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Shayne Cothern, Washington Dept. of Natural Resources
Ralph Dollhopf (via WebEx), US.EPA.
Chris Field, US.EPA, Region 10
Randy Mikula, Kalium Research
Kathy Weed, National Response Corp
Joe Inslee, NOAA/University of Washington (Recorder)

Scenario Pipeline – Inland

> **At 0430 on April 16th, the pipeline control center notices a pressure decrease in the 16" line as it is transferring a batch of oil sands products to the receiving refinery. This triggers a SCADA system alarm, which prompts control center personnel to order the pump station to be shut down. Emergency shutdown procedures are initiated and the pipeline is isolated between block valves. The pressure continues to drop in the line section adjacent to Tennant Lake in Ferndale, WA. Local 911 receives a report of oil in the marsh area around Tennant Lake as well as several calls from residents of a nearby subdivision reporting a strong petroleum odor. The pipeline initiates a response. Notifications are made and unified command is formed.**

Group C discussed in detail how a response to OSP in a wetland adjacent to a leaking pipeline would occur. The response as discussed followed protocol of a heavy oil spill, but with a significant concern for air quality concerns related to the diluent. There was concern whether there are available air quality

monitors to address health and safety concerns. Primary response contractors for this spill were identified and it was suggested that these contractors would have the equipment and monitors to enter the site. It was noted that at the Kalamazoo spill the responders wore respiratory protection for nine days.

The spill into the wetland would bring significant challenges to the cleanup process. These challenges would include access to the area, establishing an effective containment system and then cleaning up the OSP without destroying habitat, and if there is enough equipment that can be mobilized quickly and efficiently. The ability to monitor and respond to sinking oil was deemed to be the biggest challenge for responders. One question raised that is germane to all of these cleanup scenarios is who will be responsible for deciding the response net environmental decision? Is there an adequate protocol and information to make those decisions?

Community relations are an important aspect of the response to this spill. The stigma of OSP means that outreach needs to be aggressive and factsheets need to be developed which present clear and accurate information about the product. Continued outreach must occur throughout the cleanup process to keep the public informed about the progress of the response and any restoration efforts. It is also important to identify if any tribal interests might be impacted by the spill and insure the tribes are kept informed. It is assumed that tribes would be designated Trustees as part of any NRDA process and on scene when any ESA issues are being addressed as part of the cleanup.

The most significant challenges facing responders to the spill include: accurate product information about the OSP and diluent; obtaining the needed air monitoring equipment to protect the public and responders; effective cleanup methods in the wetland and; effectively finding and recovering the sunken oil. It was felt that was a need to identify methods and equipment that might be effective for recovering oil on the surface or bound to the sediment. Are there lessons to be learned from the Kalamazoo spill that would improve the net cost-environmental benefit of a wetland river cleanup?

Information needs to improve response to an inland pipeline spill were prioritized by <12 months, 2-3 years and 4+ year timeframes. Short term informational needs were based on better understanding the nature of OSP, diluents and the potential air and health and safety issues that need to be addressed with an OSP spill. In the 2-3 year time frame more information is required on:

- Chronic toxicity
- Case studies on net-environmental benefits and restoration
- OSP sinking factors and timing

- Effectiveness of dispersants on OSP
- Weathering data for OSP

In the longer term, more information on the detection of sunken OSP and recover tactics is essential. The development of toxicity and behavior models would also be helpful for future OSP spills. An understanding of any groundwater impacts related to inland spills would also be important to decision makers.

The revision of contingency plans to address OSP product spills must include information about diluents and the actions required to address these products in the air and water. As the diluents change this information may need to be revised. Identification of the type and location of clean up and air monitoring equipment needs to be included in the plan updates. Sections on subsurface oil containment and recovery will need to be added to the plan. Identification of OSP cleanup and restoration expertise should also be identified.

12.4 Facility - Marine

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Chris Stadiem, Marine Spill Response Corp (MSRC)
Ruth Yender, NOAA ORR ERD
Jim Flood, UNH Center for Spills in the Environment (Recorder)

Scenario Facility – Marine

> **On April 16th, a tank barge is on the outside berth at the March Point refinery dock offloading oil sands product into tanks 24 and 25. The facility is located in Skagit County. The weather is relatively calm until approximately 0047, when a high-intensity storm comes through the area, compromising the boom placed around the transfer site. As crews rush to shut down the transfer, the pump on the tank barge**

suffers a catastrophic failure and spews crude oil onto the deck and into the water. The boom traps some of the oil, but the majority escapes. Winds are driving the oil east, towards Padilla Bay.

The Marine Facilities Task Group indicated that the response to the marine facilities OSP spill would be similar to other heavy oils but the volatiles from the diluent might evaporate faster. Health and safety response will also be similar to other heavy oil spills except that because of public concerns about OSP there is a need to be proactive about public outreach and public health issues.

There are a variety of response options to the spill including booming, skimming and possibly burning. Dispersants are not allowed in the Bay. A net benefit analysis would be important in deciding on the response. There is potential for OSP to be stranded intertidally and resuspended. Intertidal cleanup would potentially be an issue in this water body; Corexit is not an option for cleaning as it was utilized for the Burnaby spill.

In the future the Group identified the need for more definitive information on the characteristics of dilbit and synbit products. Case studies should be compiled to understand: spill response and the effectiveness of the actions; public perception and how to provide better public outreach and; develop a common terminology for OSP spill response. There is a real need to understand the health effects of various dilbit/synbit products beyond MSDS information.

Models need to be developed to better predict the fate and transport of OSP in the marine environment. This includes information on sinking and weathering. OSP products also should be added to the ADIOS database for use by responders. Data and/or case studies on the use of dispersants, *In situ* burning and other alternative measures should be compiled for use by decision makers and responders.

13.0 SUMMARY OF BREAKOUT GROUP DISCUSSIONS

There were several consistent recommendations made by the breakout groups. They included actions that should be taken to improve near term and longer term OSP spill response and update Contingency Plans for marine, rail, pipeline and shoreline facilities. These recommendations include:

- In the near future, develop better communication between agencies, the private sector, the OSP industry, tribes and communities to improve response times and make important information more readily available.
- As studies are completed, improve our understanding of the human health and safety issues associated with an OSP spill; in the short term ensure that responders are equipped with the right equipment to monitor the safety of communities and responders.
- Obtain and disseminate information about OSP characteristics (i.e., toxicity, behavior, components) as they become available. Industry has an important role in providing this information.
- Compile case studies and information about effective responses to OSP spills in fresh and marine environments. Update the area plan with information on monitoring capability and protocols;
- In the near future, identify the equipment to assess and cleanup potential subsurface spills that are potentially significant in an OSP spill; in the longer term identify tactics to address potential subsurface spills.
- Better understand the fate and transport of OSP in the environment.
- Better understand the net environmental tradeoffs in order to make cleanup decisions in a variety of environments including subsurface.
- Understand the acute and chronic toxicity associated with OSP in the environment and particularly for threatened and endangered species.
- Identify experts associated with OSP response, environmental impacts and important habitats and incorporate them into revised Contingency Plans.
- Use drills to test the readiness of people and equipment to respond to an OSP spill in a variety of environments.

14.0 APPENDICES

- The agenda for the training session;
- Attendance list;
- Technical presentations;
- Summary notes from the plenary sessions;
- Notes and presentations from the individual breakout sessions.

Center for Spills in the Environment

Oil Sands Products Forum

NOAA Sand Point Facility (Building 9)
Seattle, WA

April 16, 2013

AGENDA

8:00 AM	**Registration & Continental Breakfast**
8:30 AM	**Welcome & Introductions** Nancy Kinner, *Center for Spills in the Environment (CSE)* Dale Jensen, *Washington, Department of Ecology (WAECY)* Sarah Brace, *Pacific States British Columbia Oil Spill Task Force* CDR Bob McFarland, *United States Coast Guard (USCG)* Chris Field, *US Environmental Protection Agency (USEPA)*
8:45 AM	**Background and Goals** Nancy Kinner, *CSE*
9:00 AM	**Participant Introductions**
9:20 AM	**Oil Sands Overview and Natural Resource Development** Randy Mikula, *Kalium Research*
	Group Discussion
10:05 AM	**Break**
10:15 AM	**Characteristics of Oil Sands Products** Heather Dettman, *Canmet Energy*
	Group Discussion
11:00 PM	**Panel: Transportation of Oil Sands Products** Rail: Justin Piper, *BNSF Railway* Pipeline: Michael Davies, *Kinder Morgan* Vessel: Richard Lauer, *Sause Bros, Inc*
	Group Discussion
12:00 PM	**Lunch**
1:00 PM	**Fate, Behavior & Modeling of Spilled Oil Sands Products (Freshwater & Marine Environments)** Bruce Hollebone, *Environment Canada*
	Group Discussion

2:00 PM **Enbridge/Kalamazoo Case Study including Response Technologies for Oil Sands Products**
Ralph Dollhopf, *U.S. EPA FOSC*

Burnaby Spill Case Study
Bill Jahelka, *Western Canada Marine Response Corporation*

Group Discussion

3:45 PM **Assessing Natural Resource Impacts from the Enbridge Pipeline Spill into the Kalamazoo River**
Jessica Winter, *NOAA ORR, Assessment & Restoration Division*

Group Discussion

4:30 PM **Wrap Up**

5:00 PM **Adjourn**

Center for Spills in the Environment

Oil Sands Products Working Group

NOAA Sand Point Facility (Building 9)
Seattle, WA

April 17, 2013

AGENDA

8:00 AM	**Continental Breakfast**
8:30 AM	**Recap and Clarifying Questions (from Day 1)**
9:15 AM	**Potential Areas of Impact and Resources at Risk from Oil Sands Products in the Pacific States** Linda Pilkey-Jarvis and Danielle Butsick, *Washington Dept of Ecology*
10:00 AM	**Goals and Format for Day 2 (Practitioners only) (Breakout Groups by Spill Scenario)**
	Break
10:15 AM	**Breakout Groups: Session 1**

Breakout Questions:

- For these scenarios, what would the response be now?
- What issues/challenges would the response face (e.g., for the environmental unit, logistics, human dimensions, health & safety) that are unique to these oil sands products spill scenarios?
- What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize these needs/answers (i.e., which address in 12 months, 2-3 years, 4+ years).
- How does Contingency Planning need to change to accommodate an oil sands products spill?

12:00 PM	**Working Lunch in Groups**
1:00 PM	**Breakout Group Session II**
2:30 PM	**Breakout Group Reports**
3:30 PM	**Conclusions and Next Steps**
4:00 PM	**Closing Remarks**

Center for Spills in the Environment

Oil Sands Products Forum

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WELCOME

Oil Sands Products Forum

April 16, 2013

Center for Spills in the Environment

Oil Sands Products Forum

April 16, 2013

Nancy E. Kinner
Center for Spills in the Environment
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Center for Spills in the Environment

Logistics

- Fire exits
- Restrooms
- Dining: breakfast, lunches and snacks
- Shuttle to/from Silver Cloud Inn
- Logistical questions see Kathy Mandsager or other CSE staff

Thank You!

- Washington State Dept. of Ecology
- Regional Response Team (RRT) 10
- Pacific States/British Columbia Oil Spill Task Force

Organizing Committee

- Organizing Committee (OC) members:
  - Sarah Brace, Oil Spill Task Force
  - David Byers, WA ECY
  - Josie Clark, USEPA
  - Lance Lindgren, USCG
  - Robert McFarland, USCG
  - Heather Parker, USCG
  - Linda Pilkey-Jarvis, WA ECY
  - Michael Schoonover, USCG
  - Gary Shigenaka, NOAA
  - Calvin Terada, USEPA

Center for Spills in the Environment

5

Overview

- Thanks for coming/participating in workshop
  - Sequester impact
  - WebEx challenges
- Center for Spills in the Environment (CSE)
  - History and mission
- How we got to today's meeting?
- Today's agenda

Center for Spills in the Environment

6

Webex Challenges

- State your name when speaking
- Use microphone in room
- Please do not multi-task
  - No cell phones/email during sessions
- If on Webex or phone line, be on mute unless speaking

Center for Spills in the Environment

7

Center for Spills in the Environment (CSE)

History

Center for Spills in the Environment

8

CSE

- Located at University of New Hampshire (UNH) since 2003
- Focus on hydrocarbon-based spills
- Center activities:
  - Facilitate workshops
  - Address range of spill-related topics with ALL Stakeholders
  - Provide educational opportunities
- CSE constituencies:
  - Government, industry, NGOs, academia

Center for Spills in the Environment 9

Why UNH?

- Excellence in marine science, ocean engineering and environmental engineering
- No oil production or refining in NH
- Reputation as independent, honest broker

Center for Spills in the Environment 10

Why CSE?

- NOAA partnership with UNH on Coastal Response Research Center (CRRC)
  - Exclusively NOAA concerns
  - NOAA funding only
- CSE is "sister center" to CRRC that addresses:
  - Non-NOAA spill-related issues
  - Non-NOAA funding

Oil Sands Products

Oil Sands Products Meetings

- Lots of confusion about names:
  - Dilbit, synbit, tar sands, oil sands
  - What is it? What's the difference?
- We are using Oil Sands Products (OSP)
  - More general
  - Broader classification
  - Stay tuned for more

Center for Spills in the Environment

13

Background to OSP Meetings

- OSP development in middle of North America
  - Alberta, Canada
- Demand for energy at coasts and overseas is great
- Movement of OSP:
  - Pipelines
  - Railways
  - Vessels

Center for Spills in the Environment

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Goals of OSP Forum

- Basic Education about OSP
  - What is it?
  - Where does it come from?
  - What are its characteristics?
  - How is it transported?
- OSP Spill Response
  - Fate, behavior and modeling of spilled OSP
  - Case studies
  - Assessing natural resource impacts

First CSE OSP Meeting

- 2 day training in northern New England in anticipation of OSP shipments to Irving Terminal in New Brunswick, Canada
  - December 2012
  - Maine Dept. Environmental Services and Region 1 USEPA
  - WA ECY represented
- WA ECY and RRT 10 decide to have similar meeting

Northwest OSP Meeting

- Two days:
  - Day 1(Today): OSP Forum (practitioners and stakeholders)
    - Goals:
      - Information from experts on:
        - Oil sands mining and refining
        - OSP composition
        - Fate and behavior of spilled OSP
        - Case studies of OSP (and related products) spills
  - Day 2(Tomorrow): OSP Working Group (practitioners)
    - Goals:
      - Practitioners focus on response to potential OSP spills
      - Scenarios to determine response, challenges, needs, required Contingency Plan modifications

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Workshop Agenda: Tuesday AM

9:20 AM	**Oil Sands Overview and Natural Resource Development** Randy Mikula, *Kalium Research* Group Discussion
10:05 AM	**Break**
10:15 AM	**Characteristics of Oil Sands Products** Heather Dettman, *Canmet Energy* Group Discussion
11:00 PM	**Panel: Transportation of Oil Sands Products** Rail: Justin Piper, *BNSF Railway* Pipeline: Michael Davies, *Kinder Morgan* Vessel: Richard Lauer, *Sause Bros, Inc* Group Discussion
12:00 PM	**Lunch**

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18

Workshop Agenda: Tuesday PM

1:00 PM	**Fate, Behavior & Modeling of Spilled Oil Sands Products (Freshwater & Marine Environments)** Bruce Hollebone, *Environment Canada* Group Discussion
2:00 PM	**Enbridge/Kalamazoo Case Study including Response Technologies for Oil Sands Products** Ralph Dollhopf, *U.S. EPA FOSC* **Burnaby Spill Case Study** Bill Jahelka, *Western Canada Marine Response Corporation* Group Discussion
3:45 PM	**Assessing Natural Resource Impacts from the Enbridge Pipeline Spill into the Kalamazoo River** Jessica Winter, *NOAA ORR, Assessment & Restoration Division* Group Discussion
4:30 PM	**Wrap Up**
5:00 PM	**Adjourn**

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After Forum

- **Workshop website>>**
  http://crrc.unh.edu/workshops/oil_sands_washington/index.html
- **Presentations**
- **Workshop report**
- **Other steps discussed in today's closing plenary**

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Facilitation Pledge

- I will recognize and encourage everyone to speak
- I will discourage side conversations
- I commit to:
  - Being engaged in meeting
  - Keeping us on task and time
  - Being neutral, fair, kind, and faithful to the process
- Stop me if I am not doing this!

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Opening Remarks

- **Dale Jensen,** *WAECY*
- **Sarah Brace,** *Pacific States/British Columbia Oil Spill Task Force*
- **CDR Bob McFarland,** *USCG*
- **Chris Field,** *USEPA*

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Participant Introduction

- Name
- Affiliation
- Expertise

Oil Sands/Tar Sands Overview: Resource Development

Randy Mikula

oilsands@shaw.ca

KALIUM Research

Introduction :

- The oil sands geology
- The resource and reserve: Surface mining and in-situ
- Environmental Issues associated with oil sands development
  - Energy Balance
  - Water Use
  - Toxicity

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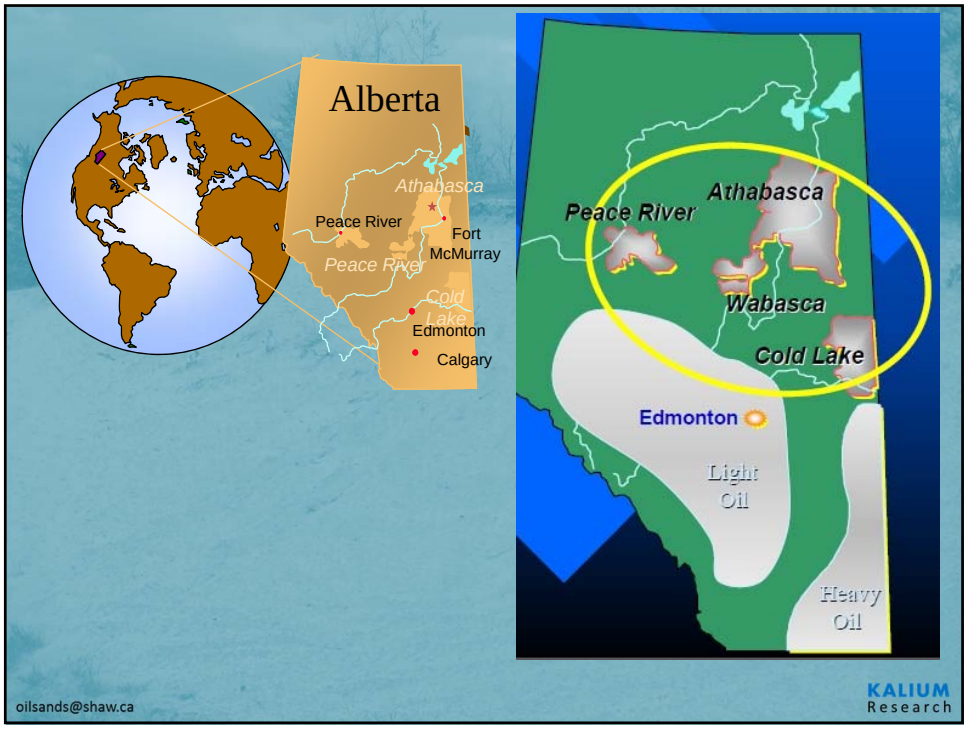
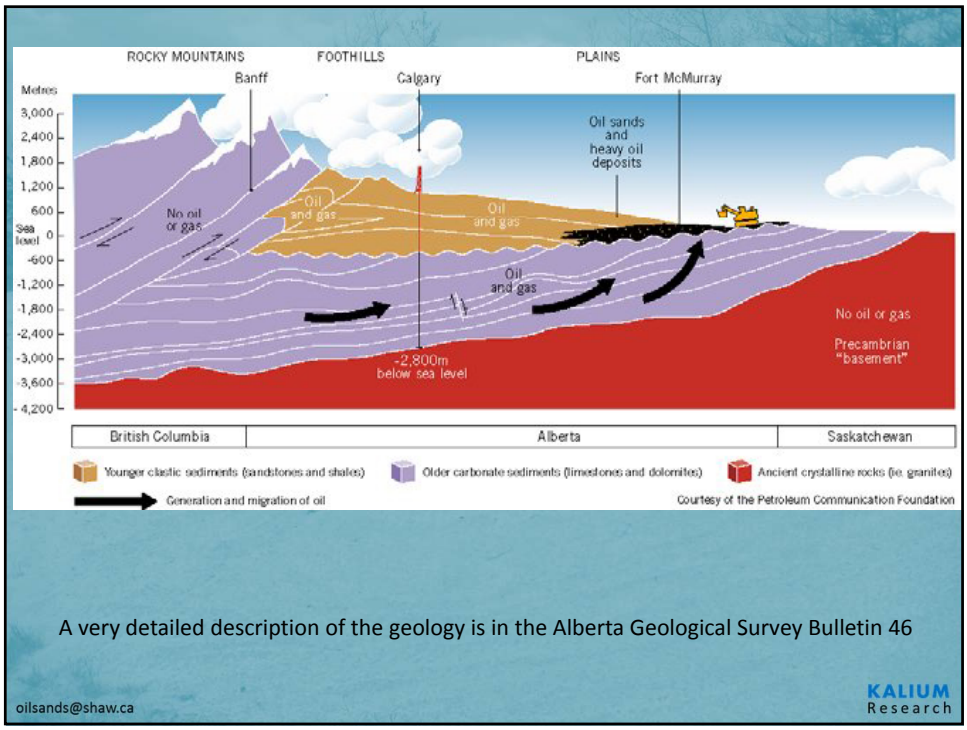
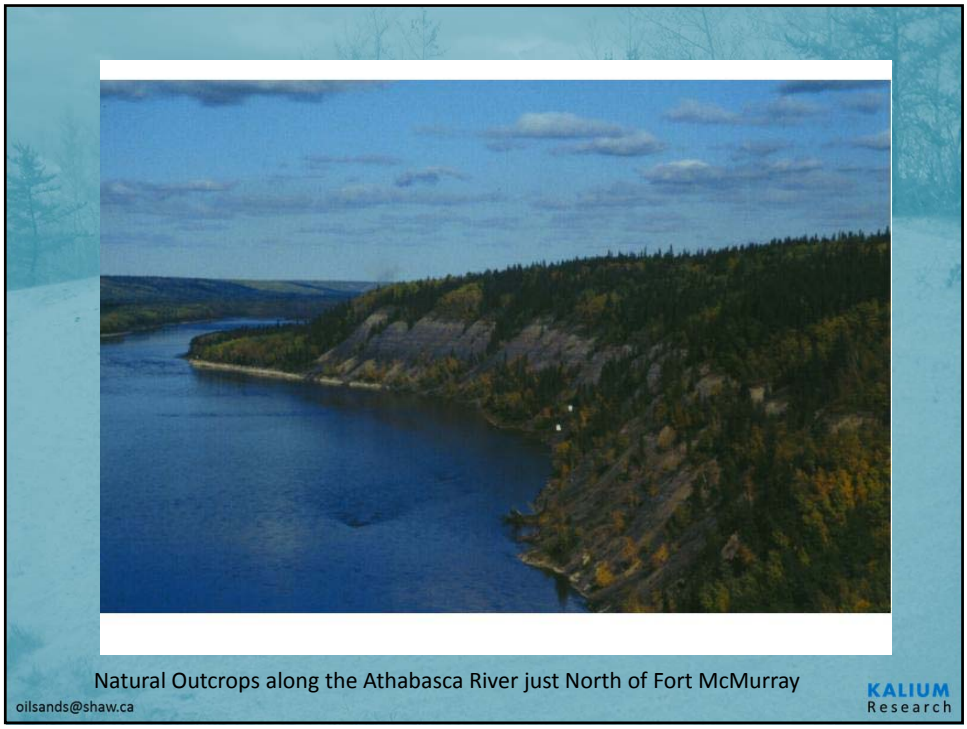
KALIUM Research


Alberta
Athabasca
Peace River
Fort McMurray
Peace River
Cold Lake
Edmonton
Calgary
Athabasca
Peace River
Wabasca
Cold Lake
Edmonton
Light Oil
Heavy Oil
oilsands@shaw.ca
KALIUM Research


ROCKY MOUNTAINS
FOOTHILLS
PLAINS
Banff
Calgary
Fort McMurray
Metres
3,000
2,400
1,800
1,200
600
Sea level
0
-600
-1,200
-1,800
-2,400
-3,000
-3,600
-4,200
Oil sands and heavy oil deposits
No oil or gas
Oil and gas
Oil and gas
Oil and gas
No oil or gas
Precambrian "basement"
-2,800m below sea level
British Columbia
Alberta
Saskatchewan
Younger clastic sediments (sandstones and shales)
Older carbonate sediments (limestones and dolomites)
Ancient crystalline rocks (ie. granites)
Generation and migration of oil
Courtesy of the Petroleum Communication Foundation
A very detailed description of the geology is in the Alberta Geological Survey Bulletin 46
oilsands@shaw.ca
KALIUM Research



Natural Outcrops along the Athabasca River just North of Fort McMurray

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Natural Outcrop along the Athabasca River, Tar Island, Just Upstream of the Suncor Mine

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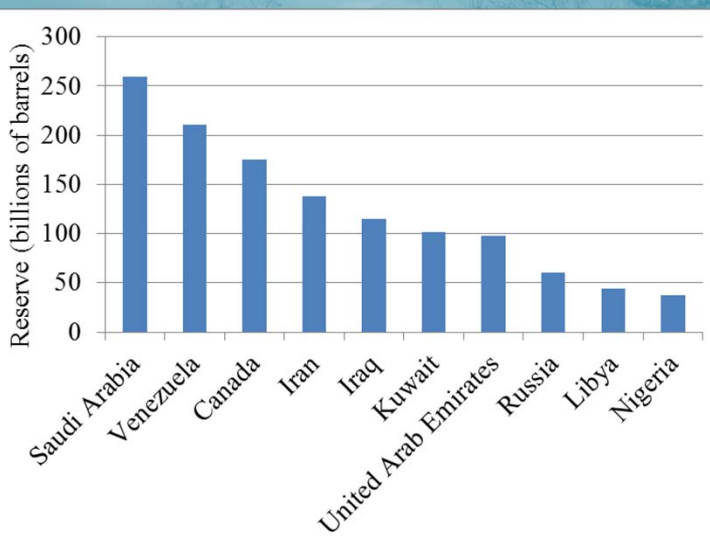

Canadian Reserves on the world stage: since 2002 Canada has been the biggest exporter of oil to the United States

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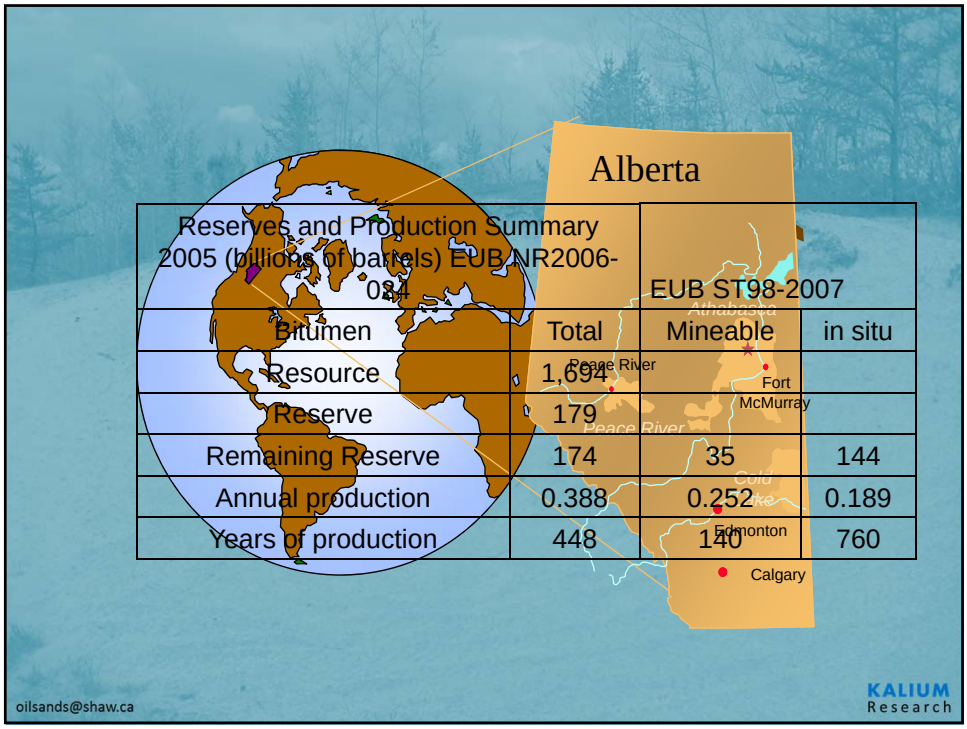

Reserves and Production Summary 2005 (billions of barrels) EUB/NR2006-034	EUB ST98-2007		
Bitumen	Total	Mineable	in situ
Resource	1,694		
Reserve	179		
Remaining Reserve	174	35	144
Annual production	0.388	0.252	0.189
Years of production	448	140	760

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Reserves and Production Summary 2009 (ERCB ST98-2010) in billions of barrels			
Bitumen	Total	Mineable	in situ
Resource	1,805	131	1,674
Reserve	176	38	138
Remaining Reserve	170	34	135
Annual Production	.544	.302	.246
Years of Production	312	113	553

Approximately a 20% production increase in 2 years; 27 fewer years to reclaim

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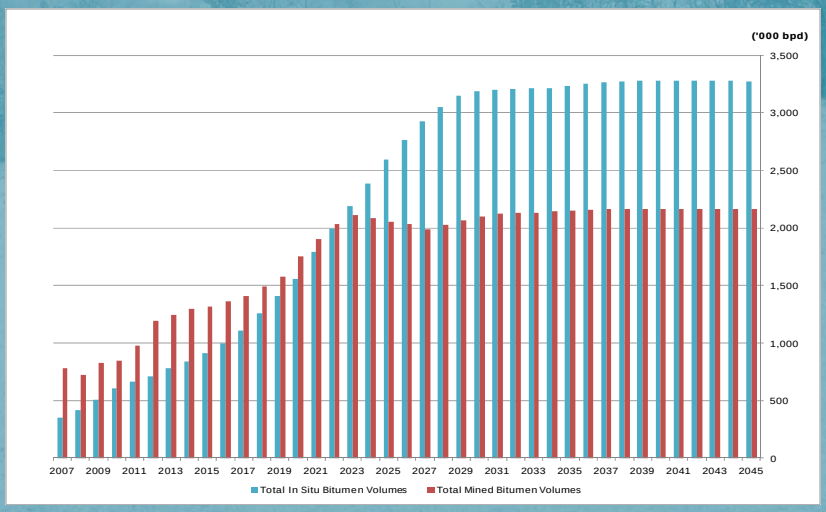
Western Canadian Oil Sands Potential



All of CERI's research is publically available at www.ceri.ca

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Oil Sand Composition

•Oil sand consists of Mineral (sand, fines, clays), Bitumen, and Water (with soluble salts).

"Typical Composition" is
Mineral 85 %
Bitumen 10%
Water 5%

Heavy Oil

Definitions in terms of physical properties
(UNITAR –on heavy crude and tar sands 1998 No.1998.039)

Crude	Maximum viscosity, mPa s	Gravities °API (S.G. = 141.5/(131.5-°API)
Light	1- 1000	20-40
Heavy	1000 - 10,000	10-20
Tars	10,000 –100,000	<10

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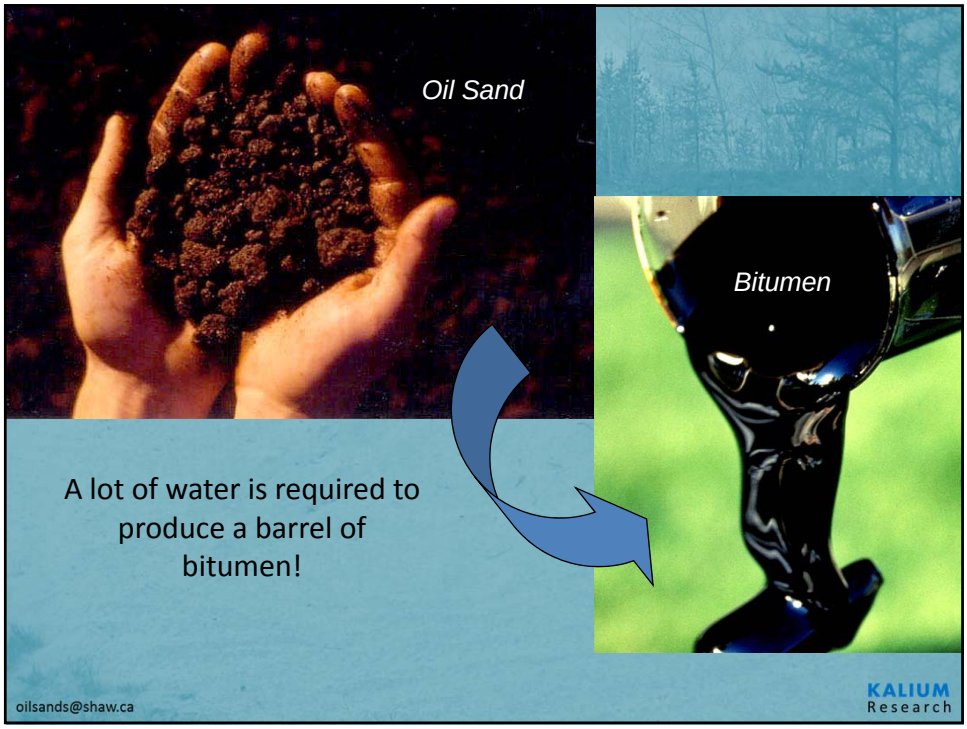
Oil Sand
Bitumen
A lot of water is required to produce a barrel of bitumen!
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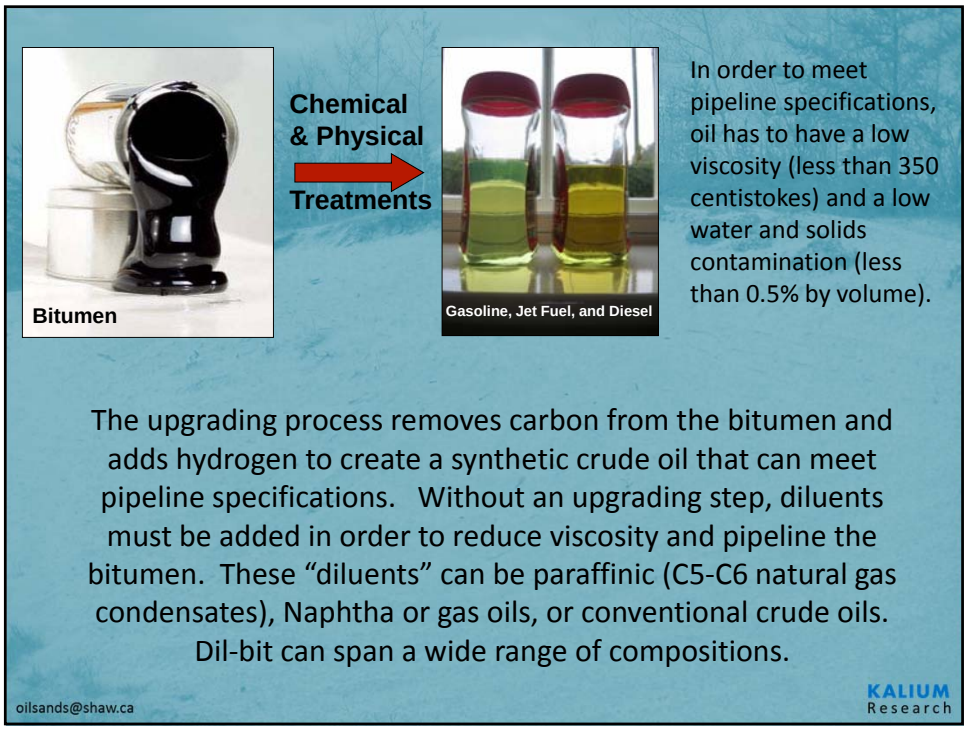
Bitumen
Chemical & Physical Treatments
Gasoline, Jet Fuel, and Diesel
In order to meet pipeline specifications, oil has to have a low viscosity (less than 350 centistokes) and a low water and solids contamination (less than 0.5% by volume).
The upgrading process removes carbon from the bitumen and adds hydrogen to create a synthetic crude oil that can meet pipeline specifications. Without an upgrading step, diluents must be added in order to reduce viscosity and pipeline the bitumen. These "diluents" can be paraffinic (C5-C6 natural gas condensates), Naphtha or gas oils, or conventional crude oils. Dil-bit can span a wide range of compositions.
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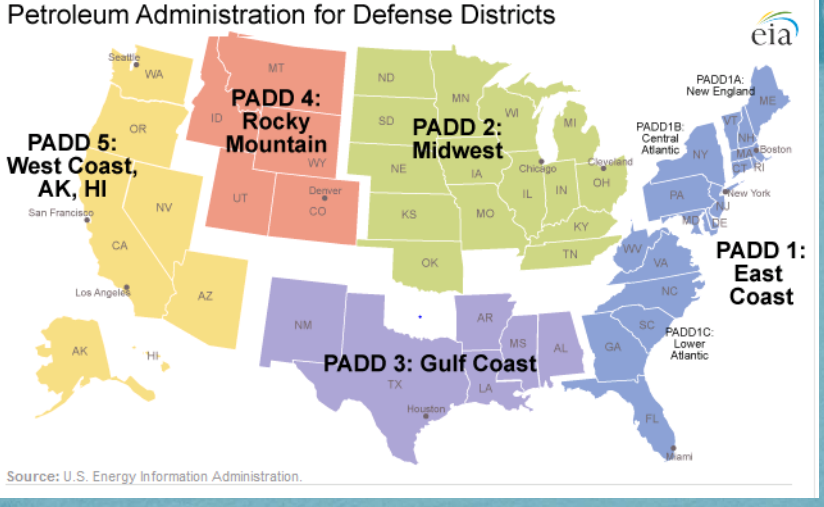
KALIUM Research

PADD regions enable regional analysis of petroleum product supply and movements

Petroleum Administration for Defense Districts



Source: U.S. Energy Information Administration.

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2011 Facts about Canadian Crude

Production:

• Western Canada (AB,BC,SK,NWT) Conventional LIGHT Crude	561,929 bbls/day
• Western Canada (AB,BC,SK,NWT) Upgraded Bitumen	846,112 bbls/day
• Western Canada (AB,BC,SK,NWT) Condensate (C5+)	128,498 bbls/day
• Western Canada (AB,BC,SK,NWT) Conventional HEAVY Crude	421,618 bbls/day
• Western Canada (AB,BC,SK,NWT) Non Upgraded Bitumen	758,919 bbls/day
• Eastern Canada (NF/LAB,ON) Conventional LIGHT Crude	271,778 bbls/day
• Total 2011 Production of Crude Oil and Equivalent	2,988,854 bbls/day

Exports:

• PADD I (74% Light, 26% Heavy)	171,182 bbls/day
• PADD II (21% Light, 79% Heavy)	1,439,447 bbls/day
• PADD III (12% Light, 78% Heavy)	111,358 bbls/day
• PADD IV (17% Light, 83% Heavy)	213,709 bbls/day
• PADD V (61% Light, 39% Heavy)	167,295 bbls/day
• Non-US (67% Light, 33% Heavy)	35,261 bbls/day
• Total US (28% Light, 82% Heavy)	2,138,260 bbls/day

Imports:

		% of Capacity
• Atlantic Canada Conventional Crude	333,990 bbls/day	(80%)
• Quebec Conventional Crude	298,775 bbls/day	(84%)
• Ontario Conventional Crude	52,836 bbls/day	(15%)
• Total Canadian Imports	685,560 bbls/day	

CERI bbs@shaw.ca All of CERI's research is publically available at www.ceri.ca

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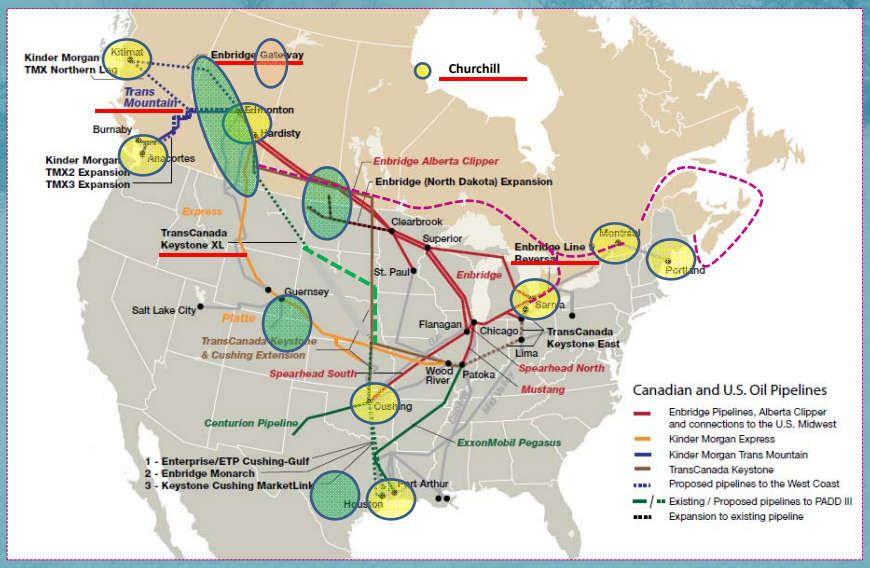
Options for Canadian Crude By Pipeline



Source: Canadian Association of Petroleum Producers, *Crude Oil Forecast, Markets & Pipelines*, June 2011

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KALIUM Research

No nation can long be secure in this atomic age unless it be amply supplied with petroleum . . . It is the considered opinion of our group that if the North American continent is to produce the oil to meet its requirements in the years ahead, oil from the Athabasca area must of necessity play an important role.

J. Howard Pew (GCOS 1960's)

oilsands@shaw.ca

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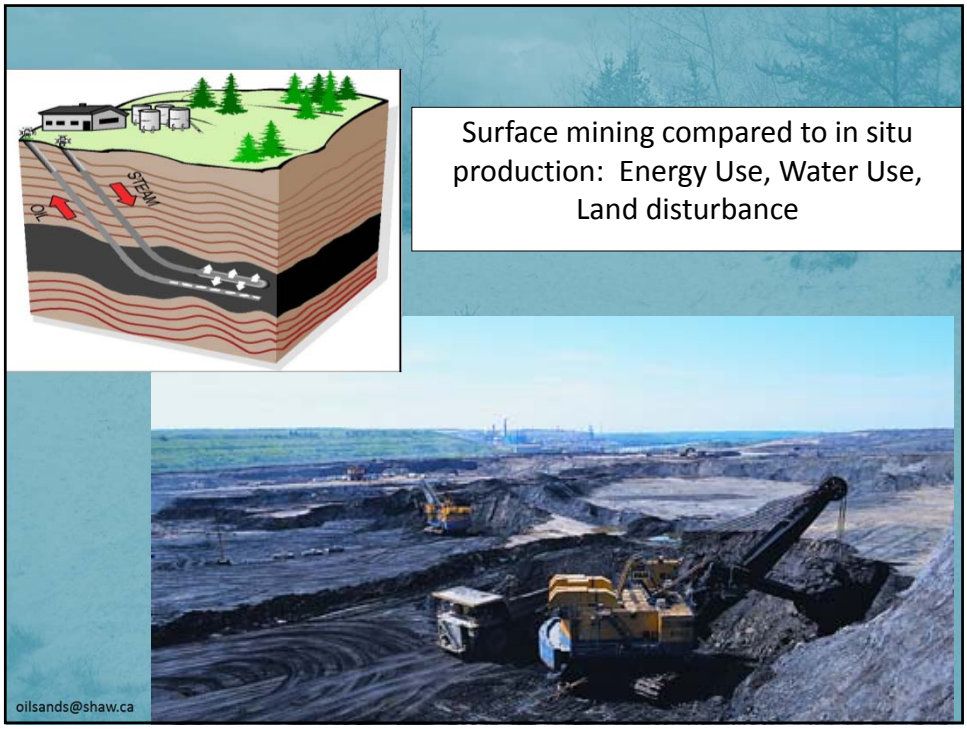
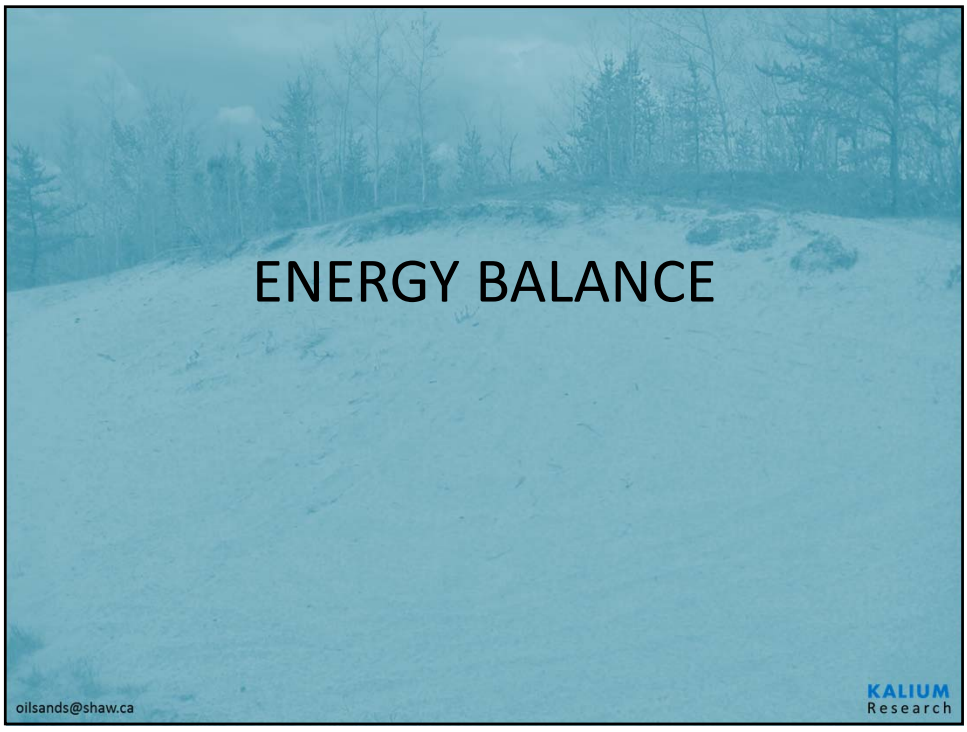

STEAM
OIL
Surface mining compared to in situ production: Energy Use, Water Use, Land disturbance
oilsands@shaw.ca


ENERGY BALANCE
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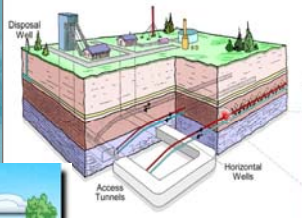
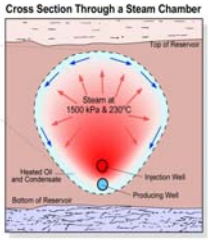
KALIUM
Research

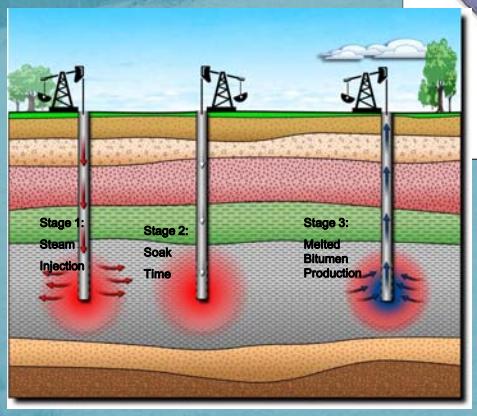
Diagrammatic Representation of the Underground Test Facility for Bitumen Extraction Using the Steam Assisted Gravity Drainage (SAGD) Process



Cross Section Through a Steam Chamber



Diagrammatic Representation of the Cold Lake Plant for Bitumen Extraction Using Cyclic Steam Stimulation (CSS)



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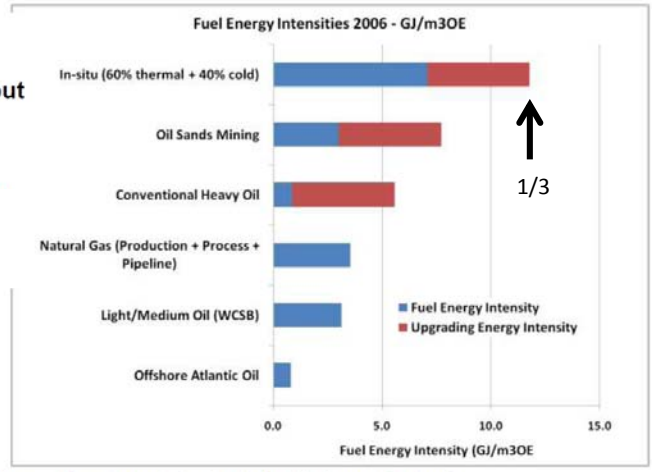
Courtesy Fran Hein, ERCB

KALIUM Research

1 m^3OE ~ 40 GJ
So 10 GJ/m^3OE ~
Is about 25% of the input energy in the product
1 GJ/m3OE ~ 2.5%



Source: Clearstone et al - An Air Quality Impact Study of Canada's Oil and Natural Gas Industry – October, 2008

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LAND DISTURBANCE

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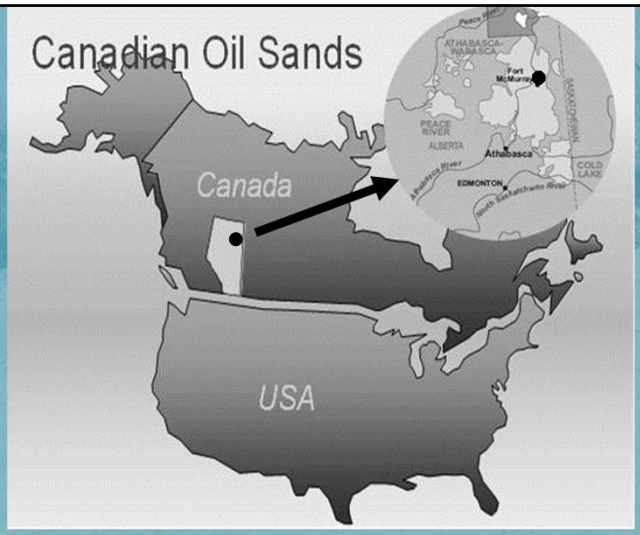

The area occupied by the circle is approximately 400,000km^2, and the area of the oil sands resource (in white) is approximately 141,000km^2. Currently land disturbance due to oil sands development is about 600km^2, with tailings containment about 180km^2.

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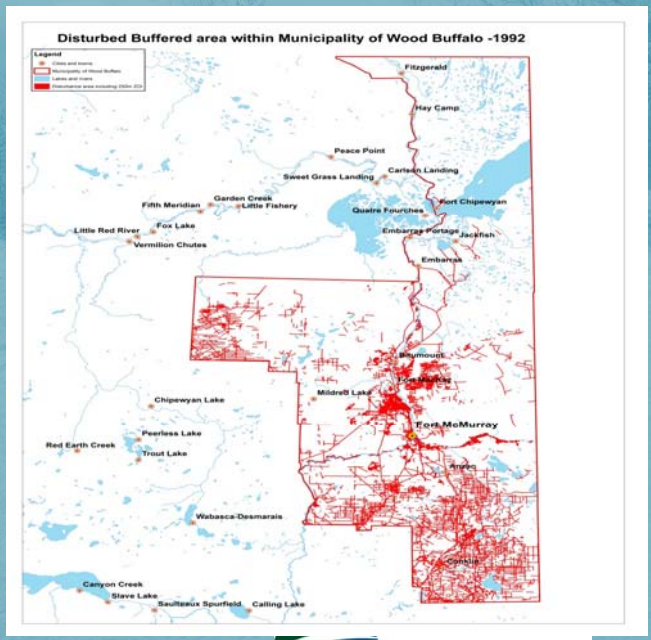
KALIUM Research



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MSES Management and Solutions in Environmental Science

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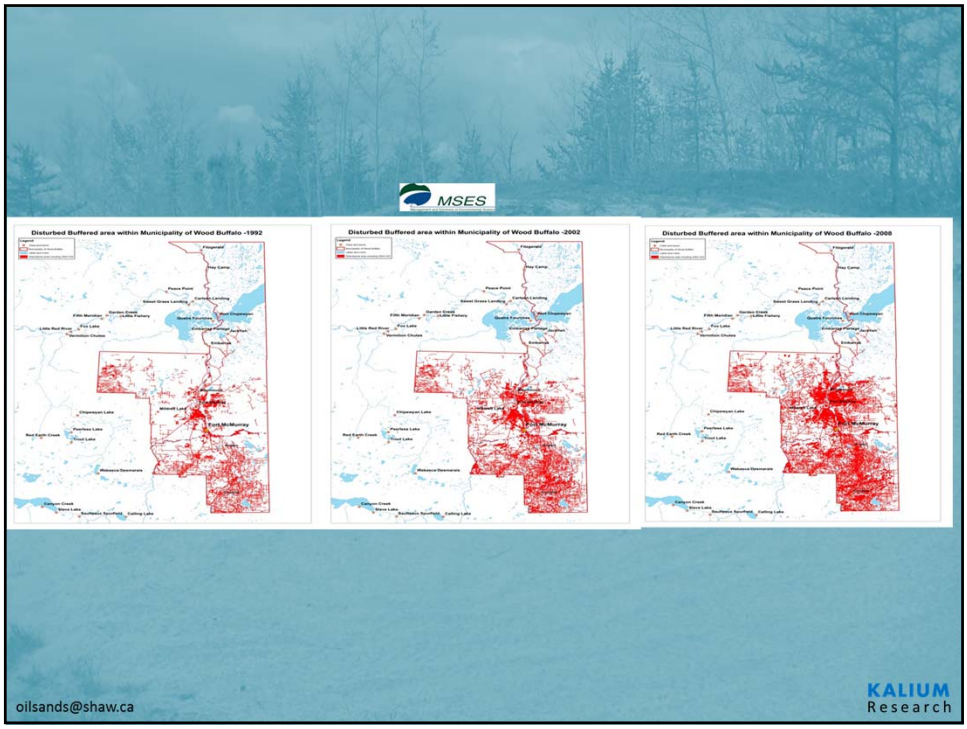
MSES
Disturbed Buffered area within Municipality of Wood Buffalo -1992
Disturbed Buffered area within Municipality of Wood Buffalo -2002
Disturbed Buffered area within Municipality of Wood Buffalo -2008
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KALIUM
Research


WATER USE
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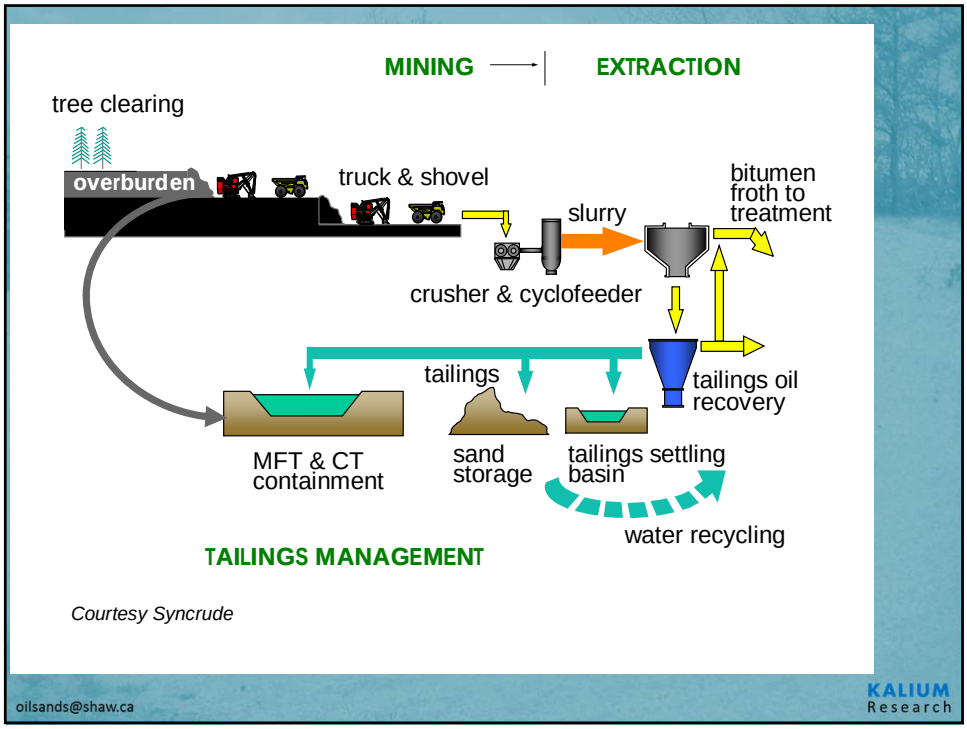
Research


MINING
EXTRACTION
tree clearing
overburden
truck & shovel
slurry
bitumen froth to treatment
crusher & cyclofeeder
tailings
tailings oil recovery
MFT & CT containment
sand storage
tailings settling basin
water recycling
TAILINGS MANAGEMENT
Courtesy Syncrude
oilsands@shaw.ca
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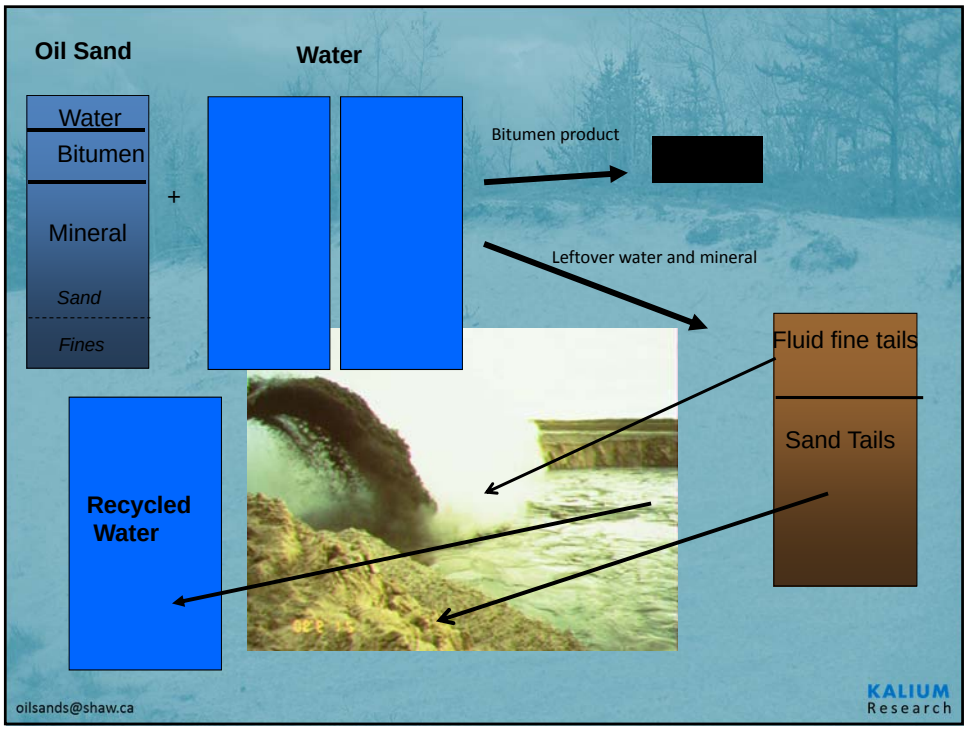
Oil Sand
Water
Water
Bitumen
Mineral
Sand
Fines
+
Bitumen product
Leftover water and mineral
Fluid fine tails
Sand Tails
Recycled Water
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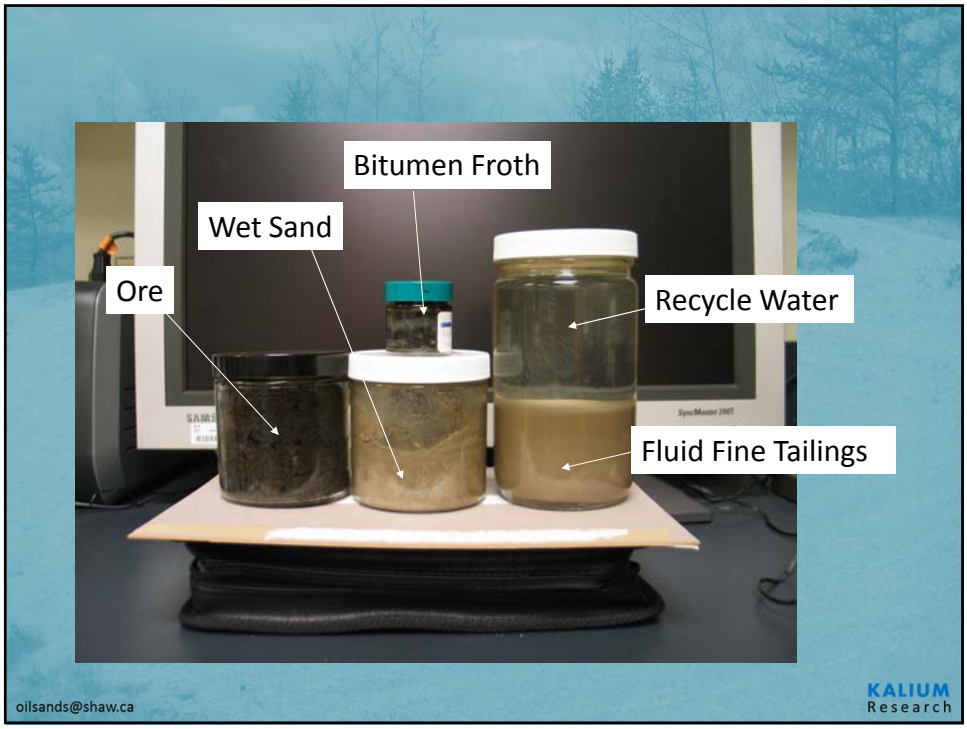
KALIUM Research


Bitumen Froth
Wet Sand
Ore
Recycle Water
Fluid Fine Tailings
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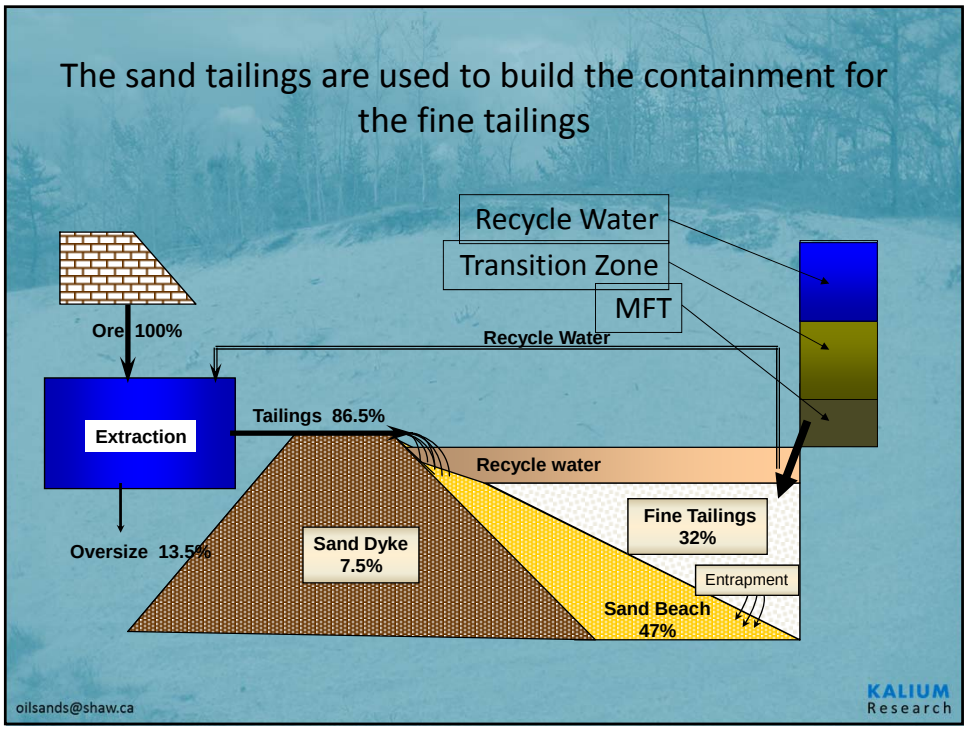
Research


The sand tailings are used to build the containment for the fine tailings
Recycle Water
Transition Zone
MFT
Ore 100%
Recycle Water
Extraction
Tailings 86.5%
Recycle water
Fine Tailings 32%
Entrapment
Sand Beach 47%
Sand Dyke 7.5%
Oversize 13.5%
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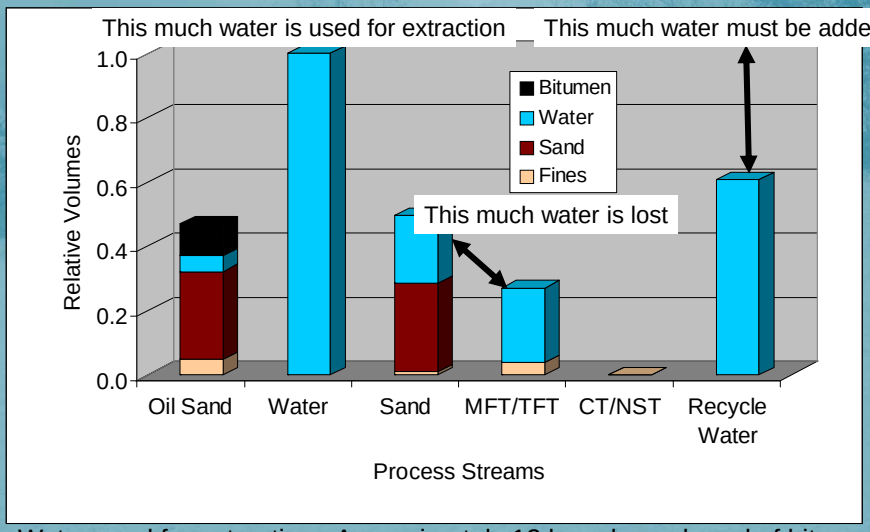
KALIUM
Research



Water used for extraction: Approximately 12 barrels per barrel of bitumen
Water Recycled: Approximately 70%
Water lost to tailings: Approximately 4 barrels per barrel of bitumen

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(this is for a typical ore)

KALIUM Research

The tailings containment structures are some of the largest man made features on the planet.

Dry stackable tailings technology is one way to reduce the volume of the accumulated fluid fine tailings. Dry stackable tailings implementation will allow for reclamation of the boreal forest, and reduce the water requirement from the Athabasca river.

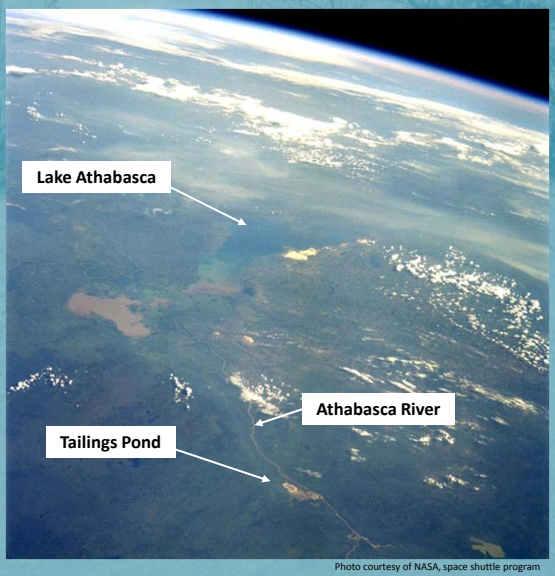

Photo courtesy of NASA, space shuttle program

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KALIUM Research

Tailings research at CETC-Devon: Minimizing the Environmental Impact of Oil Sands Development

oilsands@shaw.ca

KALIUM Research

Aerial photo from approximately 1987 when the "best available technology" was water capping of the accumulated fluid fine tailings or sludge.

CT/NST technology promised to increase water re-use from 75% to over 80%, but now even this improvement on the "best available technology" proposes to have an end pit lake containing leftover fluid fine tailings or MFT.

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KALIUM Research

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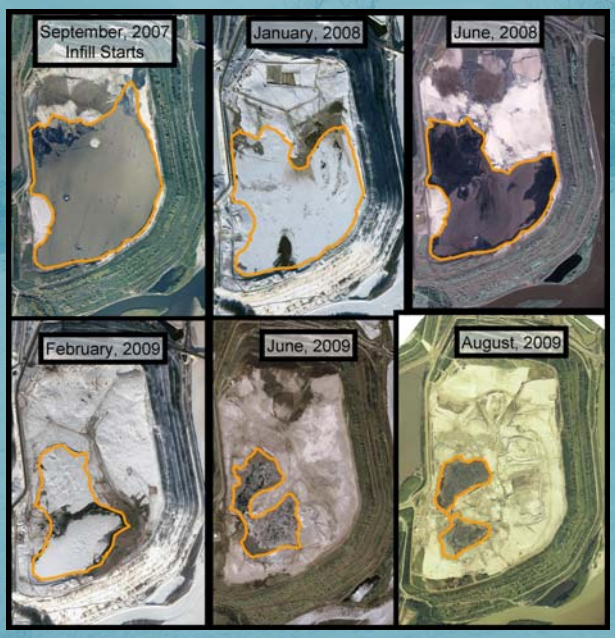
KALIUM Research



Suncor Pond 1
Reclamation

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KALIUM Research

Suncor Pond 1 September 2010 (Wapisiw Lookout)

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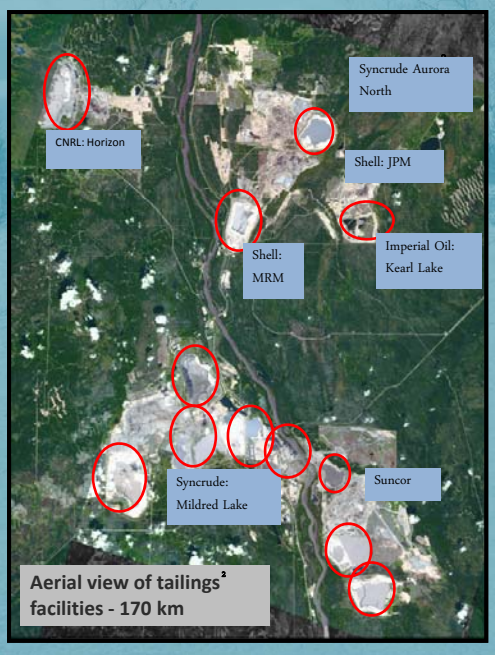
KALIUM Research

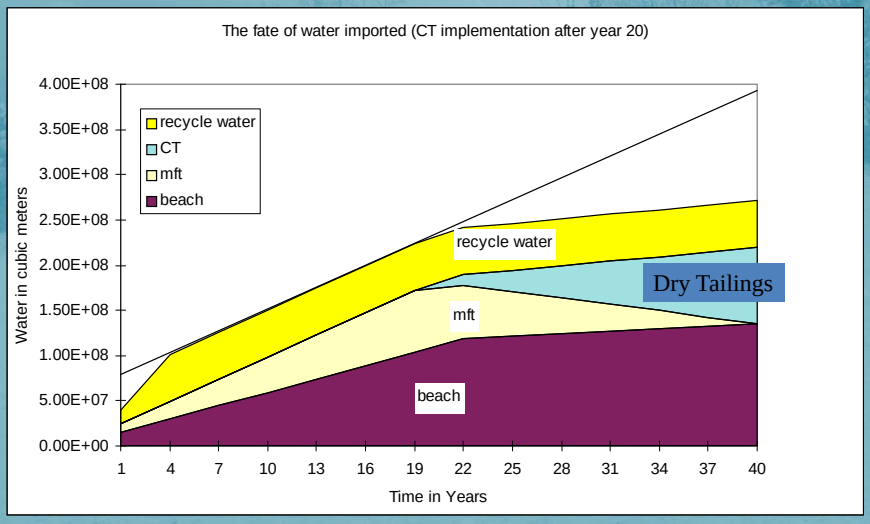


Aerial view of tailings[2] facilities - 170 km

oilsands@shaw.ca

Slide courtesy Alan Fair IOSTC 2012, Edmonton

KALIUM Research



Storage volume limitations will drive new tailings technologies as much as water availability. Without the implementation of some other dry stackable tailings technology, long term storage volumes could become unsustainable.

oilsands@shaw.ca

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A VARIETY OF DRY STACKABLE TAILINGS TECHNOLOGIES ARE BEING COMMERCIALLY IMPLEMENTED

oilsands@shaw.ca

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Centrifuge 2010
oilsands@shaw.ca


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Research

October issue of Alberta Oil Magazine

A new standard in fluid fine tailings dewatering:
Syncrude Centrifuge Pilot cell #3

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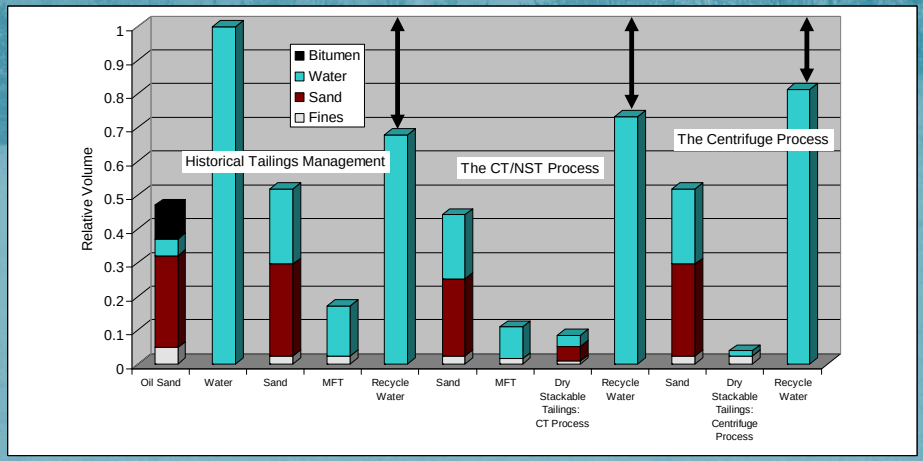

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The arrow marks Mildred Lake, adjacent to Syncrude's tailings pond; the Mildred Lake Settling Basin.

The Department of Fisheries and Oceans routinely harvests game fish from this lake to restock a sport fishing lake south of Fort McMurray (Lac La Biche)

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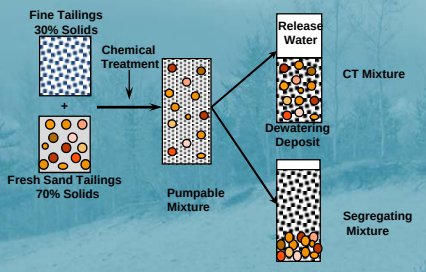

With the correct recipe, CT or NST is pumpable, but rapidly releases recycle water, leaving a trafficable surface for reclamation of the boreal forest. Without the correct recipe, the mixture will segregate, leaving a fluid material unsuitable for reclamation.

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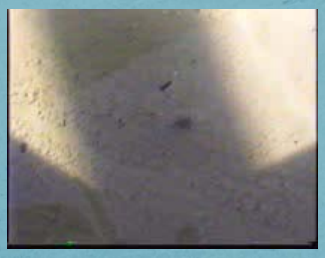
SUMMARY

Several tailings management options are commercialized or have been demonstrated at close to commercial scale. Although progress has been slower than anyone would like, mined out areas are becoming available and are being utilized to implement a variety of stackable tailings technologies.

Water conservation by the use of "dry stackable tailings" management options will have significant implications for the recycle water chemistry, possibly offering the opportunity to improve water quality from an environmental perspective.



Water bugs and goldfish in composite tailings release water

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CHARACTERISTICS OF OIL SANDS PRODUCTS

Heather D. Dettman

Center for Spills in the Environment – Oil Sands Products Forum
Seattle, Washington
April 16, 2013

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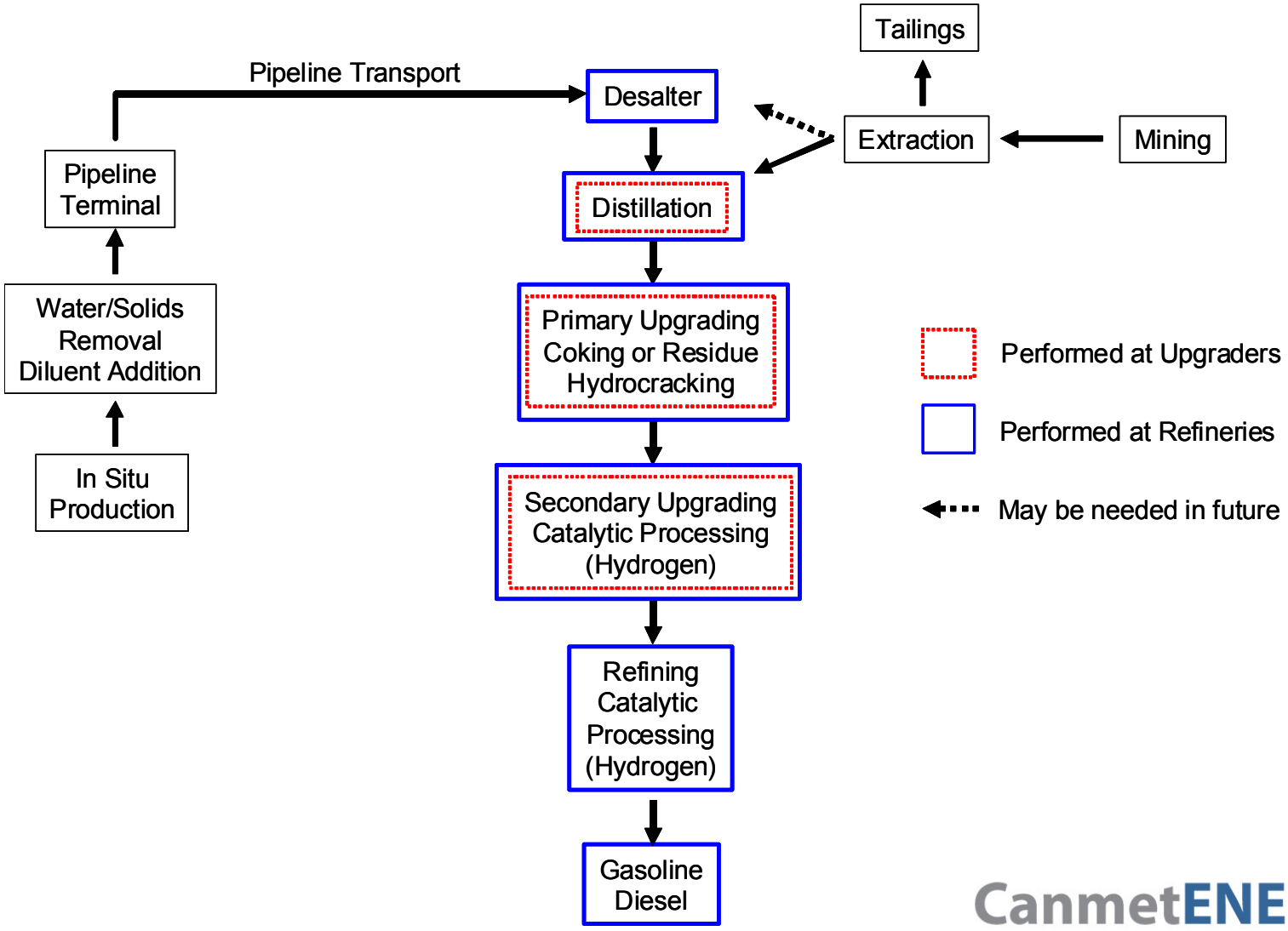
Natural Resources Canada | Ressources naturelles Canada

Canada

Simplified "Oil Sands to Motor" Value Chain



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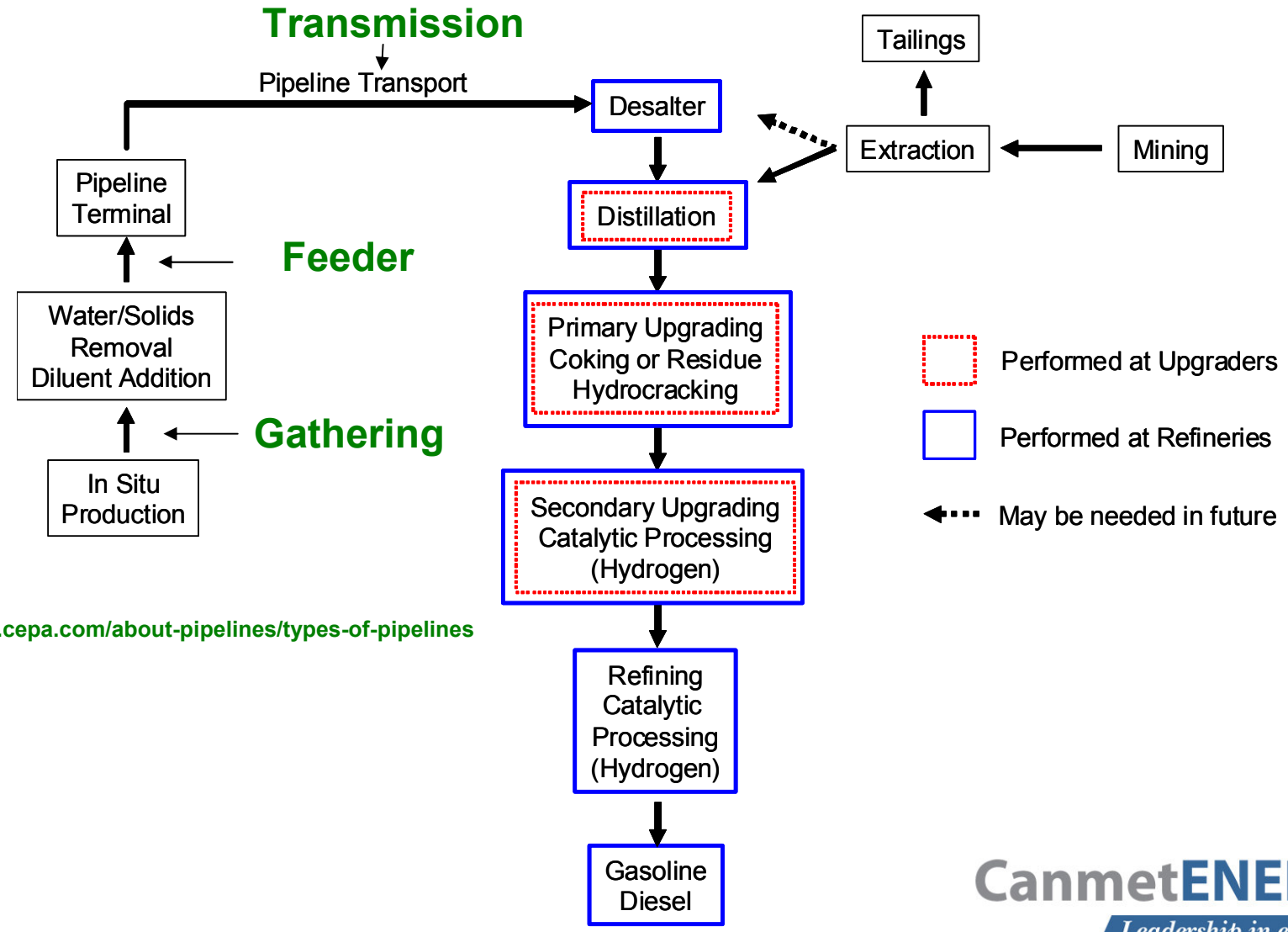
Pipeline Definitions



http://www.cepa.com/about-pipelines/types-of-pipelines

What Is Bitumen?

- Bitumen is the "extra heavy" crude oil that remains after the biodegradation of oil in Northern Alberta
  - Initial boiling point is 204°C/399.2°F
  - Approximately 50wt% of the oil boils at temperatures below 524°C/975.2°F
  - Biodegradation has resulted in organic acids being left behind in the oil
    - Total acid number (TAN) is 3mg KOH/g which corresponds to an organic acid content of 3wt% in the oil
      - Organic acid species in bitumen are relatively large molecules with 70wt% boiling above 524°C/975.2°F
      - [By comparison, vinegar for our salads is 5wt% acetic acid which corresponds to a TAN of 47mg KOH/g (by calculation)]

What Is Used to Dilute the Bitumen?

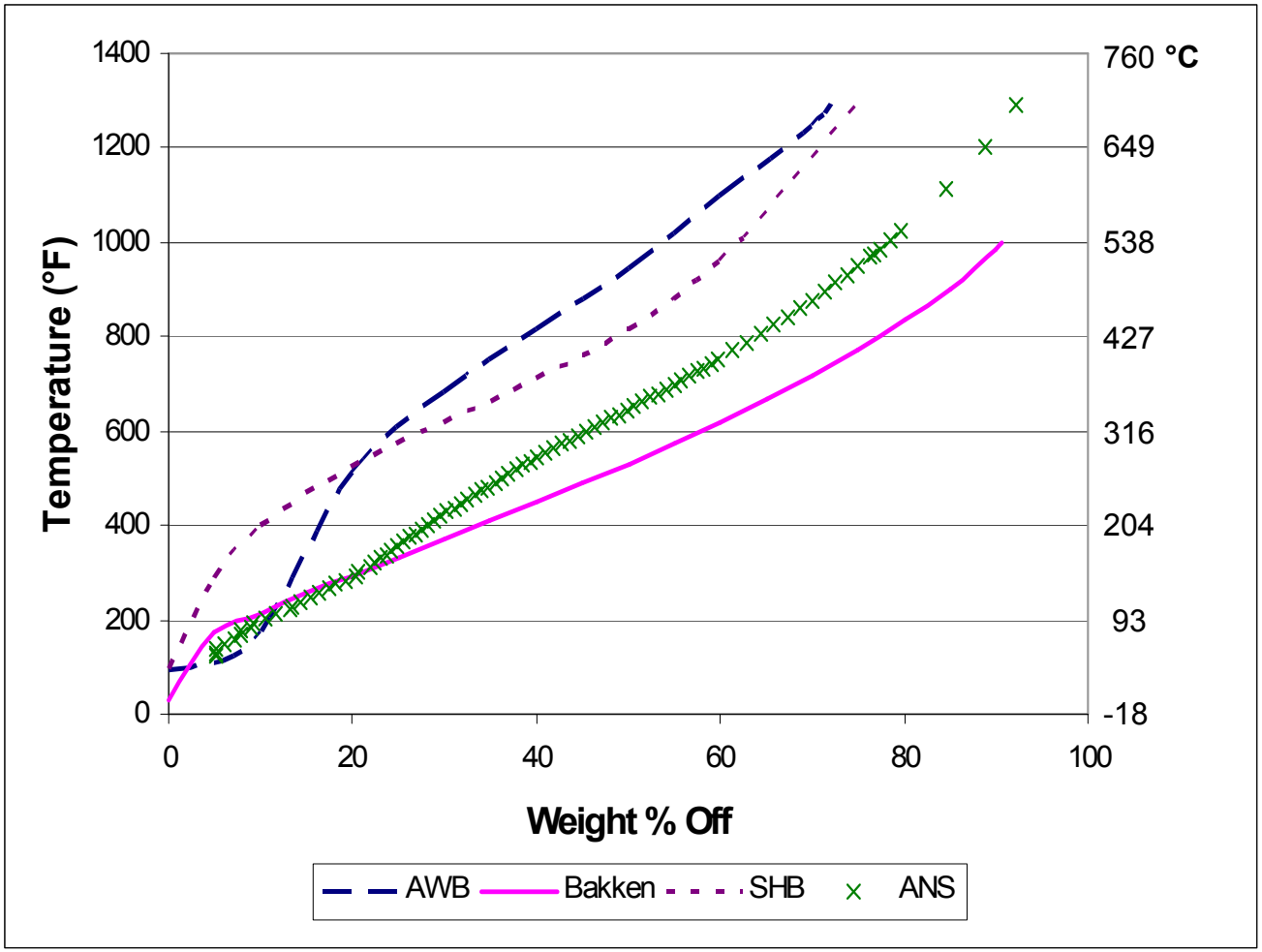
- Diluent such as CRW condensate to make "dilbit"
  - "Naphtha"-based oil which can include natural gas condensate
    - Natural gas condensate is the "liquid" that is produced with natural gas where the lowest boiling component is butane which boils at -0.5°C/31.9°F
  - Approximately 75wt% of the condensate boils at temperatures less than 204°C/399.2°F
  - Final boiling point is approximately 524°C/975.2°F
- Synthetic crude oil, an upgraded product from an upgrader/refinery, can also be used to make "synbit"
  - Less than 50wt% of the synthetic crude oil boils at temperatures less than 204°C/399.2°F
  - Final boiling point is approximately 524°C/975.2°F

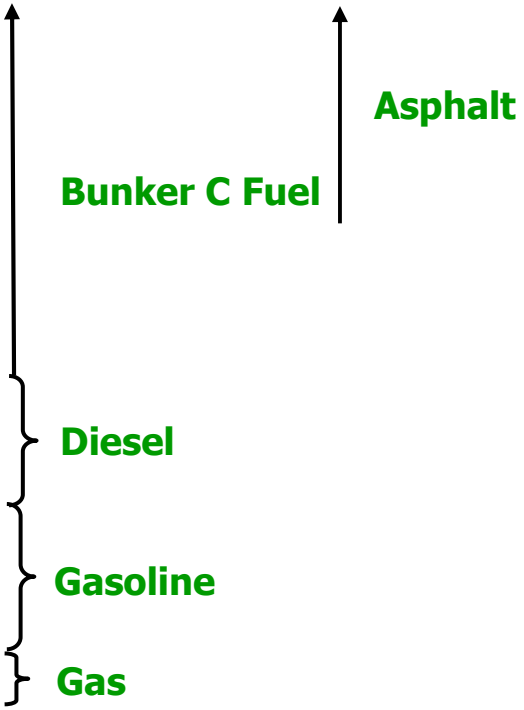
Dilbit and Synbit Definition

- Bitumen is diluted with light oil to meet transmission pipeline specifications for density and viscosity
  - Needs 30% by volume of diluent for dilbit
  - Needs 50% by volume of synthetic crude oil for synbit
- Characteristics of dilbit/synbit are in the range of
  - TAN value of 1.6mg KOH/g
  - Sulfur content of 3.9wt%

For composition information for Alberta transmission pipeline commodities, see http://www.crudemonitor.ca/

Boiling Ranges of Petroleum Products





Access Western Blend Dilbit (AWB) Surmont Heavy Blend Synbit (SHB)
Bakken and Alaskan North Slope (ANS) are included for comparison

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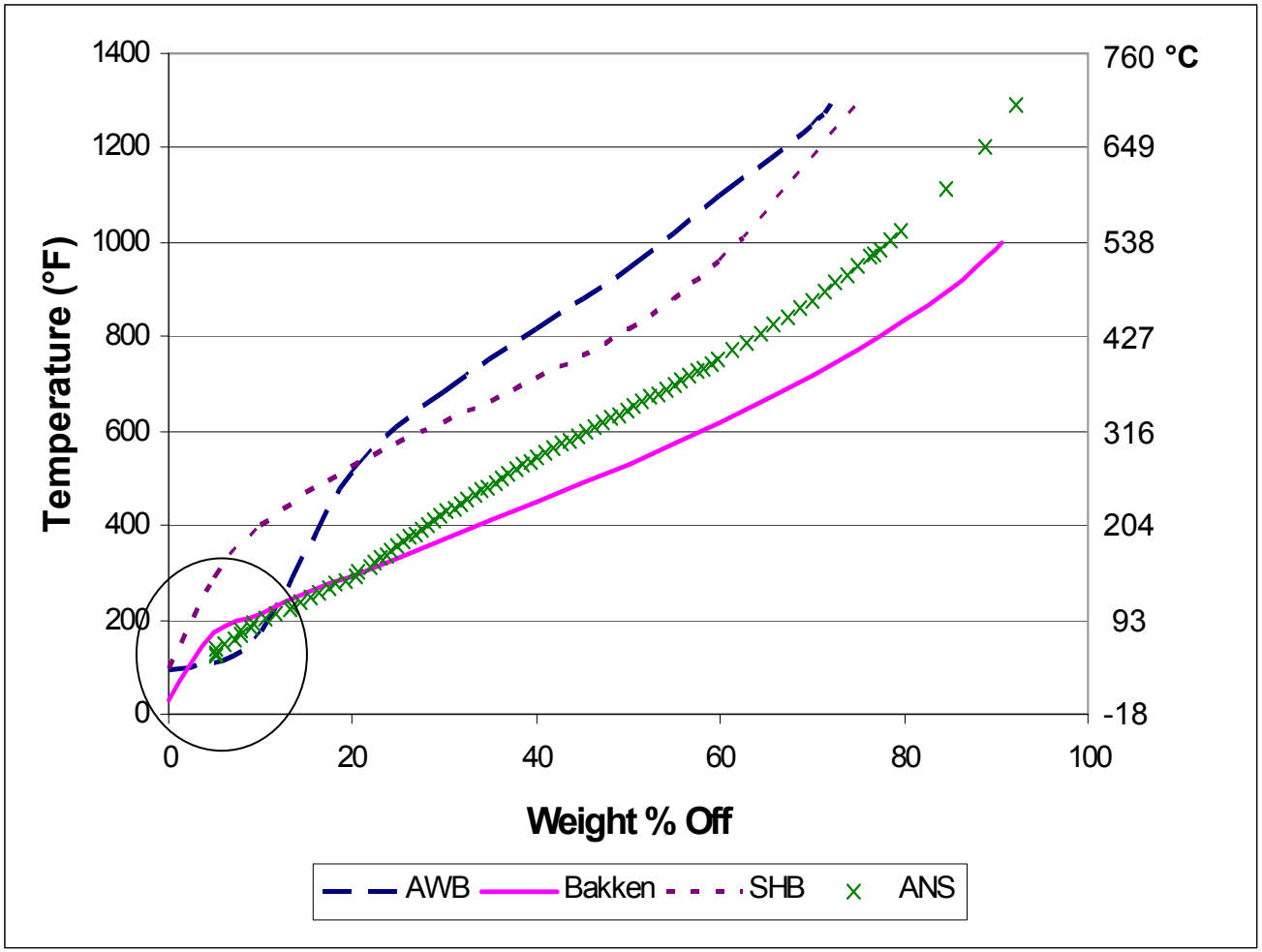
"Light" Crude Does Not Mean "Good for You" Crude!



	Benzene Content (%)
Dilbit	0.03 - 0.3
Synbit	<0.5
Bakken	0.1 - 1.0
ANS	0.3

Access Western Blend Dilbit (AWB) Surmont Heavy Blend Synbit (SHB)
Bakken and Alaskan North Slope (ANS) are included for comparison

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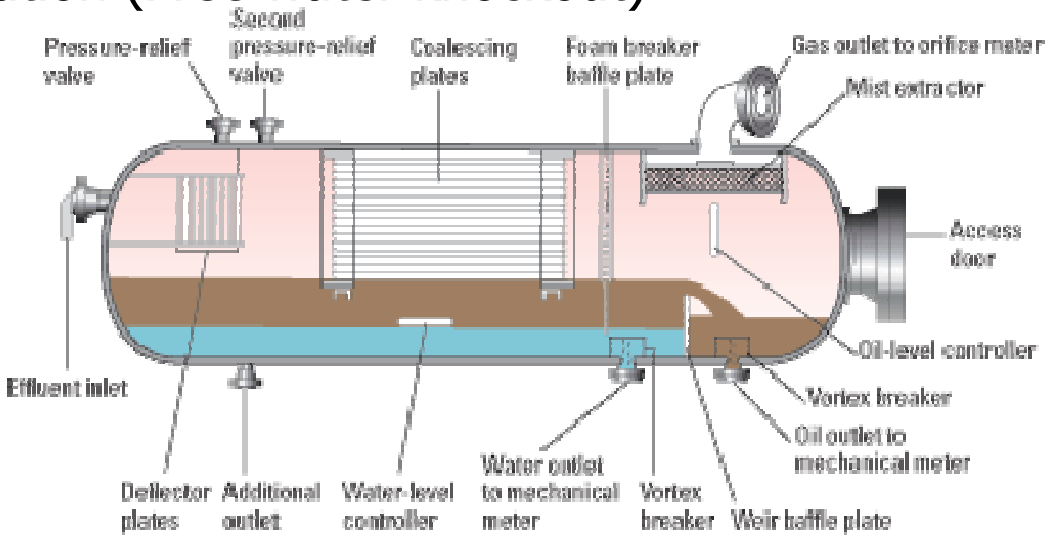
Transport of In Situ Production

- For example, steam-assisted gravity drainage (SAGD) produces an oil-water mixture that comes out of the ground at approximately 230°C (446°F)
- For transportation by transmission pipeline:
  - Water and solids have to be removed
  - Final transmission pipeline specifications for dilbit/synbit require:
    - Density @ 15°C/59°F ≤ 940 kg/m^3
    - Viscosity @ pipeline temperature ≤ 350cSt
    - Basic sediment & water content (BS&W) ≤ 0.5% by volume
- For transportation by train, oil sands products are shipped either as diluted bitumen or as pure bitumen

Sediment and Water Removal

- Sediment (mud and sand) and water are removed in two steps:
  - Floatation (Free water knockout)



Schlumberger website - http://www.glossary.oilfield.slb.com/DisplayImage.cfm?ID=630

  - Dehydration/gravity separation/emulsion breaker (Heater treater)

What Can Cause Internal Transmission Pipeline Corrosion

- Water is a key component that can cause corrosion in all types of pipelines for all types of commodities (i.e. light, heavy, or oil sands products)
  - Oil-wet pipelines have negligible corrosion rates
  - If sludge starts to settle out, then water contents can increase at that location and the pipe can become water-wet
  - Water corrosivity can be increased if water-soluble organic acids are present
    - For oil sands products, the content of water-soluble organic acids in the oil is very low due to extensive washing with hot water during production, and the use of floatation during the dewatering process

Are Oil Sands Products More Corrosive Than Other Crudes?

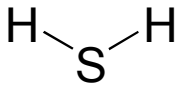
- Due diligence work performed in 1995 indicated that all oil commodities being transported in Alberta transmission pipelines had low corrosivity under pipeline conditions
- Current understanding of possible contributions of organic acid, sulfur, and sediment contents to oil corrosivity under pipeline conditions support the earlier results; new measurements show that oils sands products have similar results to those of other crudes
- Industry experience has been consistent with these results
- Useful references are at http://www.nrcan.gc.ca/pipeline/6698

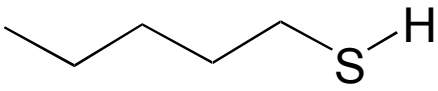
When Can Organic Acids in Crudes Cause Corrosion?

- Organic acids (also called "naphthenic acids") in crude oils can cause corrosion if they get concentrated
  - This can occur in a refinery during distillation at temperatures above their boiling points which are generally temperatures greater than 200°C/392°F
    - For bitumen, initial boiling point of its organic acids is 280°C/536°F
- Global crude corrosivity in refineries also depends upon organic acid size and structure
  - Bitumen has been found to have relatively low corrosivity under refinery conditions despite its high TAN value [Dettman *et.al.* CORROSION/2012, paper no. 01326 (Houston, TX:NACE 2012, pp.1-15]

What about Sulfur?

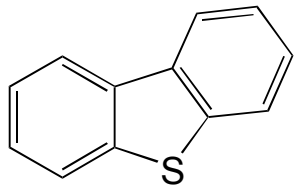
- Acidic sulfides like hydrogen sulfide (H_2S) and mercaptans can interact with iron to form iron sulfides

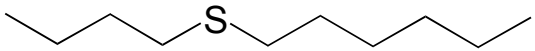




- Similar to most crudes, diluent and thermally-treated bitumen (i.e. SAGD production) can contain H_2S

- However, most of the sulfur in oil sands products is bound in hydrocarbon structures that require refinery processes including heat (i.e. over 300°C/572°F), high pressure hydrogen, and catalysts to remove it





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What about Sand?

- All crude oils come out of the ground so can contain sediment (mud, sand, salts)
  - Sediment carried by the oil-water mixture is separated from the oil by the floatation of the oil from the water, and gravity separation of solids
  - Once the oil sands product meets pipeline specification for BS&W, the remaining sediment in the oil is in the size range of silt (mud) to very fine sand

    [http://en.wikipedia.org/wiki/Particle_size_(grain_size)]
  - As sand particles are very small and are low in concentration, erosion is not a concern in transmission pipelines

Conclusions

- Oil sands products being transported out of Alberta by transmission pipelines
  - Are petroleum products that consist of blends of extra heavy oil (bitumen) and light oil (diluent or synthetic crude oil) to make dilbit or synbit, respectively
  - Meet quality specifications for density, viscosity, and basic sediment and water (BS&W) content
  - Are not more corrosive than other crudes

Oil Sands Products Forum & Working Group

BNSF Railway – Crude Oil Transport

April 16th, 2013

Justin Piper, CHMM
Manager, Hazardous Materials Field Operations & Emergency Response
BNSF Railway

Content

1. BNSF Railway – The System
2. Hazardous Material Transportation
3. Emergency Planning/Preparedness
4. Accident Prevention
5. Emergency Response

BNSF RAILWAY

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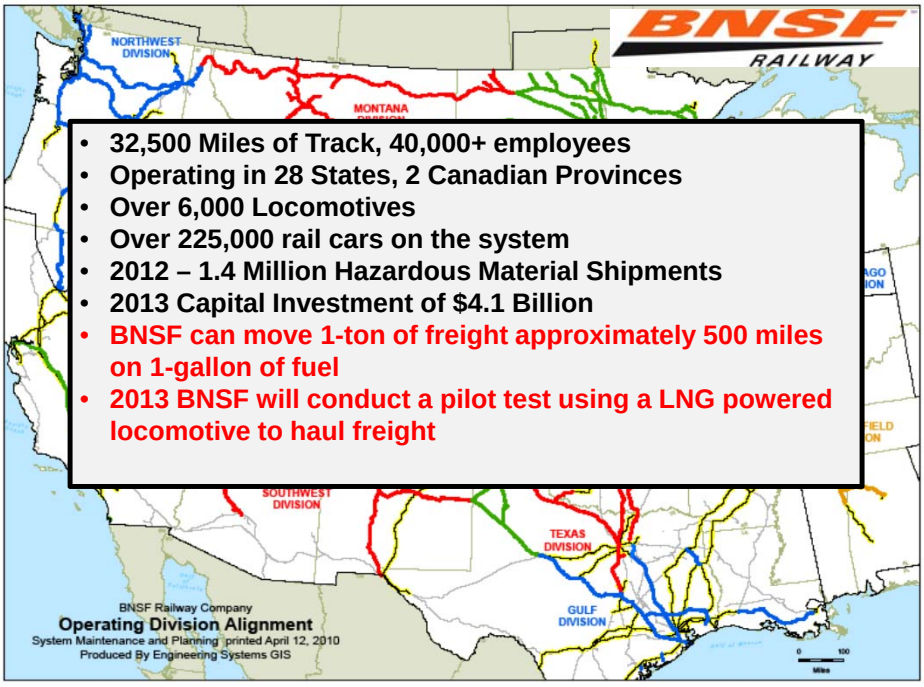
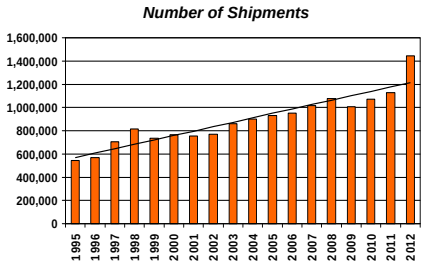
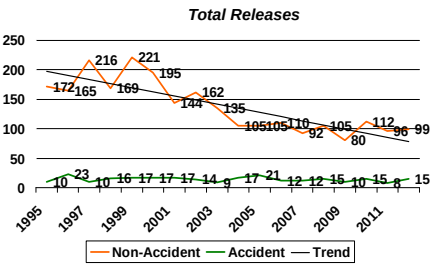


- 32,500 Miles of Track, 40,000+ employees
- Operating in 28 States, 2 Canadian Provinces
- Over 6,000 Locomotives
- Over 225,000 rail cars on the system
- 2012 – 1.4 Million Hazardous Material Shipments
- 2013 Capital Investment of $4.1 Billion
- BNSF can move 1-ton of freight approximately 500 miles on 1-gallon of fuel
- 2013 BNSF will conduct a pilot test using a LNG powered locomotive to haul freight

BNSF Hazardous Materials Transportation





Examples of Types of Releases

-Any identifiable release is reportable under DOT regulations

Non-Accident Release

Accident Release

4

Crude Oil – DOT Class 3 Hazardous Material

- **Currently for BNSF, US "Crude by Rail" consists of mainly transportation from various Shale oil sources (i.e Bakken, Eagle Ford, Permian Basin etc).**
- **A small amount of Canadian Dilbit or Bitumen oil is transported by BNSF into the US via Rail (<1000 shipments in 2012 or approx. 0.65% of total crude oil transported by BNSF)**
- **In 2012 - 3,632 shipments of light sweet crude oil came to WA State, 1,557 shipments to OR State.**

	BNSF Crude Oil Transport		
Year	LDD SHPMTS	RESIDUE SHPMTS	TOTAL SHPMTS
2011	38,312	39,514	77,826
2012	152,926	162,678	315,604
% Change	299.16%	311.70%	305.53%

5

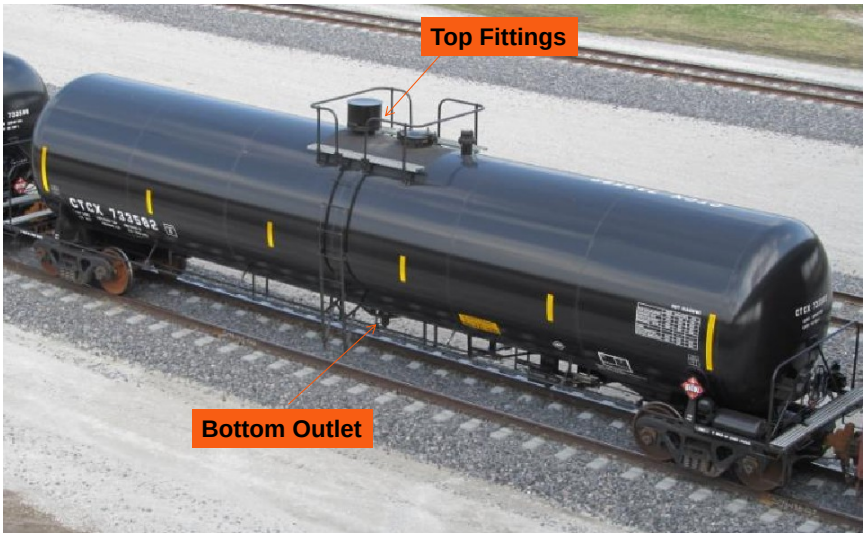
2012 Crude Oil Release Stats (BNSF Railway)

FY 2012 – 315,604 Total Shipments

- **>1,200 Unit Crude Oil Trains**
- **0 Accident Releases**
- **16 Crude Oil Non-Accident Releases (NAR's – Shipper Securement/QC issues), average release was <3 gallons**
- **2012 BNSF FRA Rail Accident Rate of 1.88 (per million train-miles), Lowest in BNSF History – Currently at 1.78 for 2013 YTD**

6

Low Pressure Tank Car – DOT 111A100W1



7

Planning/Preparedness

8

Community Training

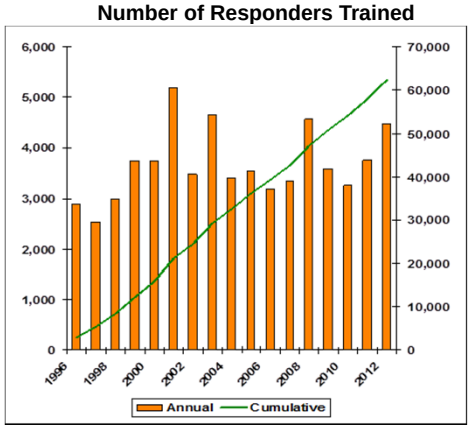
Community focus is on training responders and providing interpretative information. Training is available via instructor lead or computer based training.

Training topics include:

- Train list / shipping papers
- Placards
- Equipment
- Incident Assessment
- *Hands-on equipment in field – Instructor lead*

Recipient of *TRANSCAER*® National Award – Last 10 consecutive years

Number of Responders Trained



9

Local Responder Training

10

Emergency Planning

Community Hazardous Materials Flow Study Support:

-Security Sensitive Information – Distributed on a "need to know basis"

STCC NUMBER	STCC DESCRIPTION	CLASS CODE	RESIDUE CAR COUNT	LOADED CAR COUNT	RESIDUE INTER-MODAL	LOADED INTER-MODAL	TOTAL LOADED COUNT
4909152	ALCOHOLS, N.O.S.	3	4501	5754	0	0	5754
4910165	PETROLEUM CRUDE OIL	3	2378	3500	0	0	3500
4905752	LIQUEFIED PETROLEUM GAS	2.1	3870	2438	0	0	2438
4961605	ELEVATED TEMPERATURE LIQUID, N.O.S.	9	2022	2169	0	0	2169
4905421	LIQUEFIED PETROLEUM GAS	2.1	1362	1274	0	0	1274
4907439	HYDROCARBONS, LIQUID, N.O.S.	3	938	1236	0	0	1236
4907265	STYRENE MONOMER, STABILIZED	3	590	927	0	0	927
4905424	BUTANE	2.1	238	719	0	0	719
4914110	GAS OIL	CL	101	666	0	0	666
4920523	CHLORINE	2.3	1026	646	0	0	646
4935240	SODIUM HYDROXIDE SOLUTION	8	385	451	0	0	451
4930228	HYDROCHLORIC ACID	8	465	398	0	0	398
4904509	CARBON DIOXIDE, REFRIGERATED LIQUID	2.2	414	360	0	0	360
4945770	SULFUR, MOLTEN	9	316	359	0	0	359
4914168	FUEL OIL	CL	302	354	0	0	354

Emergency Preparedness and Planning

SERP Identifies how the BNSF responds to Incidents

Contents:

1. Notifications, Public Affairs, Hazard ID, Incident Classification, Incident Management, Resource Utilization, Safety & Health, Reported Chemical Exposures, Terminating an Incident, Roles and Responsibilities, Security of HAZMAT shipments

Appendices:

- LERP's (Local Emergency Response Plans)
  1. Developed for our Large Fixed Terminals
  2. Contains Site/Location Specific Information/Resources
  3. Conduct Drills at over 45 locations per year (full scale or TTX)
- LRP's (Local Reaction Plans)
  1. Specific Location Threats – Pueblo Weapons Depot etc.
  2. Environmental Sensitivities – Geographical Response Plans/Strategies

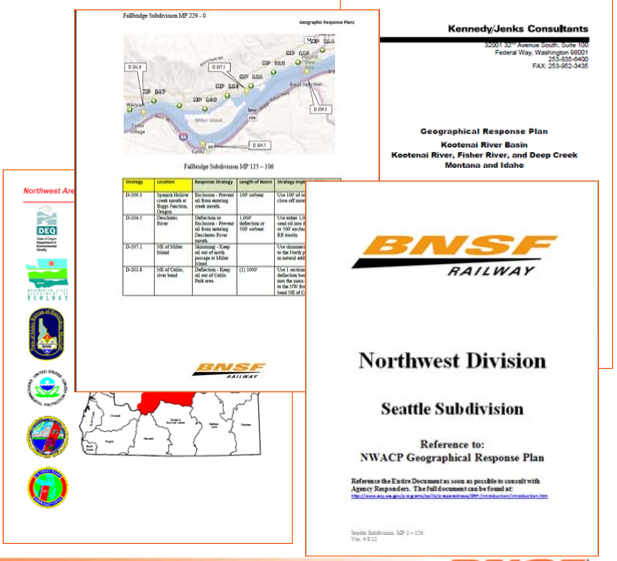
Geographical Response Plan Support/Development – Water Response

Public Plans

- Northwest *(w/ additional quick access reference documents)*
- Coastal
- Mississippi River
- Working w/ EPA + others on Plans in ND, MT, WY

Rail Specific

- Kootenai River (MT)
- Columbia River CCP's
- Colorado River (CO)
- Wind River (WY)
- Middlefork Flathead/Glacier Park – In development (MT)



Accident Prevention

Railroad Engineering/Accident Prevention

On-Board Devices examples:

1.23 Channel Event Recorders, cameras

2.GPS – Locomotives, some Railcars

3.Positive Train Control *2015 Mandate*

Wayside Detector examples:

1.Warm Wheel/Bearing Detector

2.Wheel Impact Load Detector (WILD)

3.Trackside Acoustical Detector

4.Truck Performance Detector

5.Dragging Equipment Detector

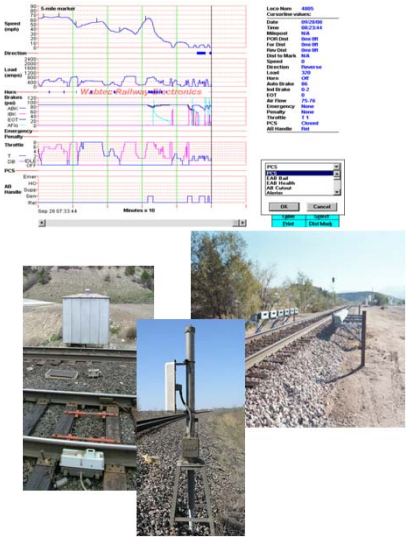
Engineering examples:

1.Track Geometry Measurements

2.Rail Flaw Detector

3.Slide Detectors, Earthquake Monitoring

Operating Practices/Accident Investigation +others



BNSF RAILWAY

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Emergency Response

BNSF RAILWAY

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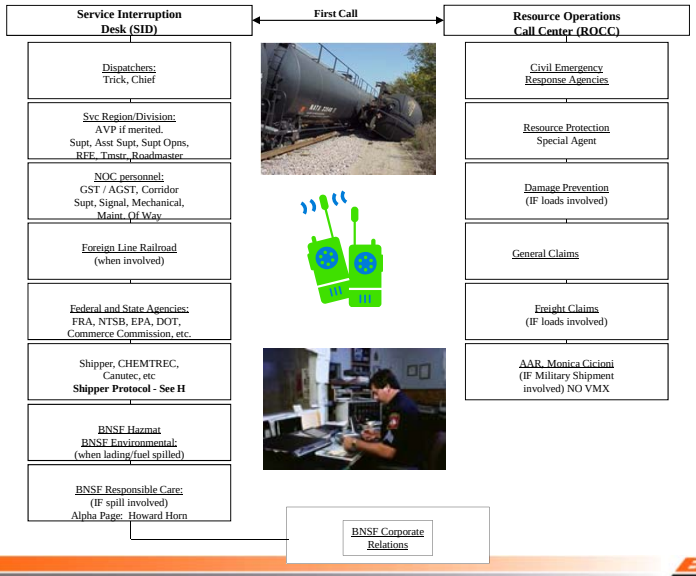
Incident Notification



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NIMS Incident Command System

- **BNSF Railway will initiate, manage and maintain a rapid, aggressive, well coordinated, and effective response**
- **BNSF hazardous material responders, contractors, operations supervisors and train crews will work within the Unified Incident Command Structure**

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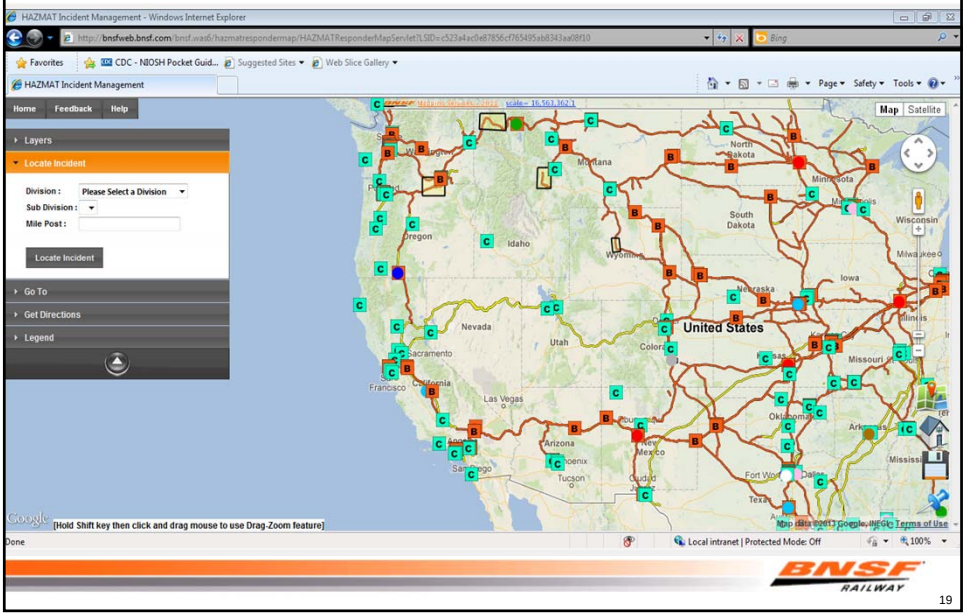
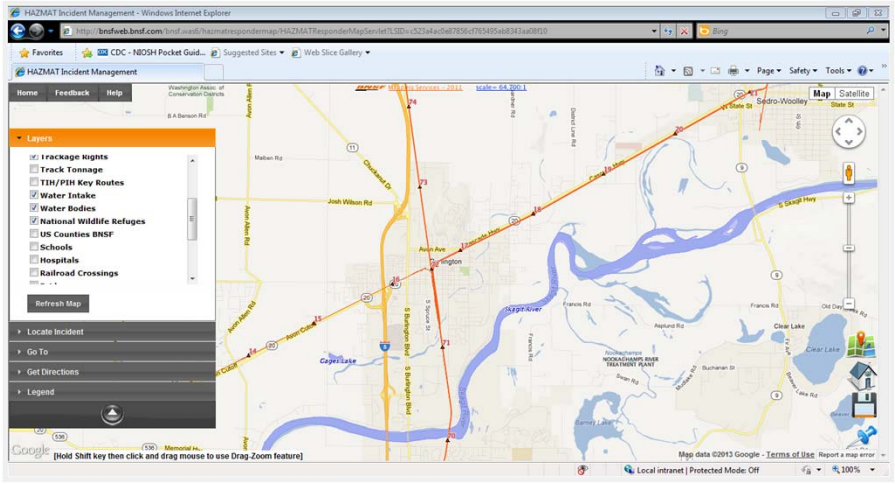
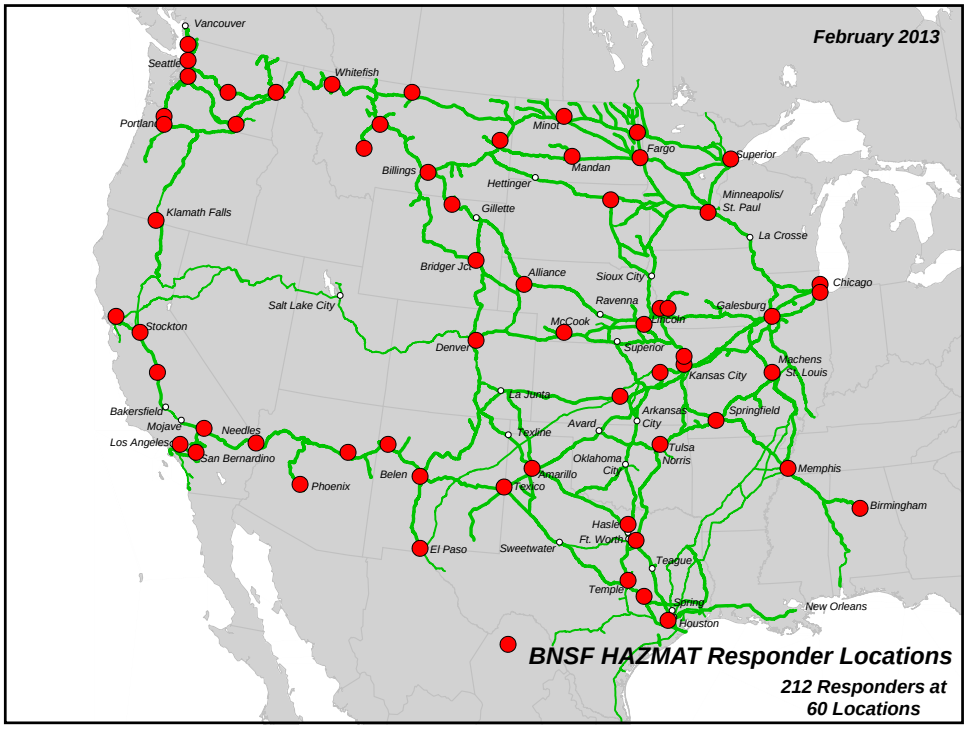
Response: Hazmat GIS



Hazmat GIS – Misc. Sensitive Feature Layers





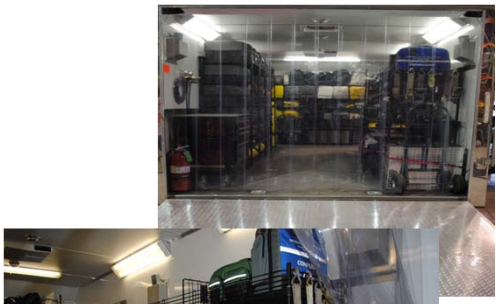
AR-AFFF Fire Trailer Program

1. **Designed to address the surge in Ethanol and Crude Oil shipments.**
2. **Provide equipment, supplies and contract Firefighters in response to polar solvent and fire incidents**

- Currently 16 trailers throughout system location based on HM routes – NW = Pasco, WA

Emergency Breathing Air Trailers

1. Currently 5 Trailers on the system (NW = Pasco, WA)
2. Provides an extended supply of Breathing air for HM Incidents.
3. Supplied Air setups available for Heavy Equipment Operators



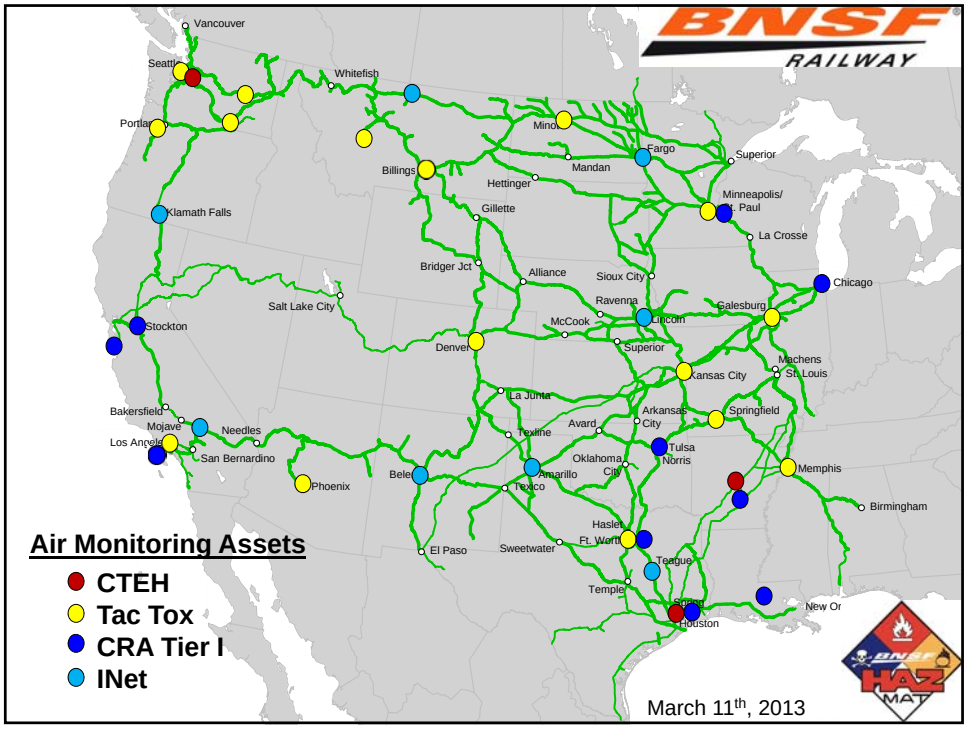
BNSF RAILWAY

23

BNSF Tactical Toxicology (Tac Tox) Program

1. **Utilized to provide rapid data acquisition and real time air monitoring results for incidents throughout our system.**
2. **CTEH**
   - 24 hour access to PhD Toxicologists and Dispersion Modelers
   - Utilize Safer® Star Air Dispersion Model offering topographical model input
3. **Kit Contents (19 Kits total – NW=Spokane, Pasco, Seattle, Vancouver, Portland)**
   - PID, 4 gas monitor, Kestrel weather meter, Solar Irradiance meter, Detector Tubes/pump, GPS, Calibration gasses and equipment.

BNSF RAILWAY


BNSF RAILWAY
Air Monitoring Assets
CTEH
Tac Tox
CRA Tier I
INet
March 11th, 2013
Vancouver
Seattle
Whitefish
Portland
Billings
Minot
Fargo
Superior
Mandan
Hettinger
Minneapolis/ St. Paul
Gillette
Klamath Falls
La Crosse
Bridger Jct
Alliance
Sioux City
Chicago
Salt Lake City
Ravenna
Galesburg
Stockton
McCook
Lincoln
Denver
Superior
Kansas City
Machens
St. Louis
La Junta
Bakersfield
Arkansas City
Springfield
Mojave
Needles
Texline
Avard
Los Angeles
Tulsa
San Bernardino
Oklahoma City
Norris
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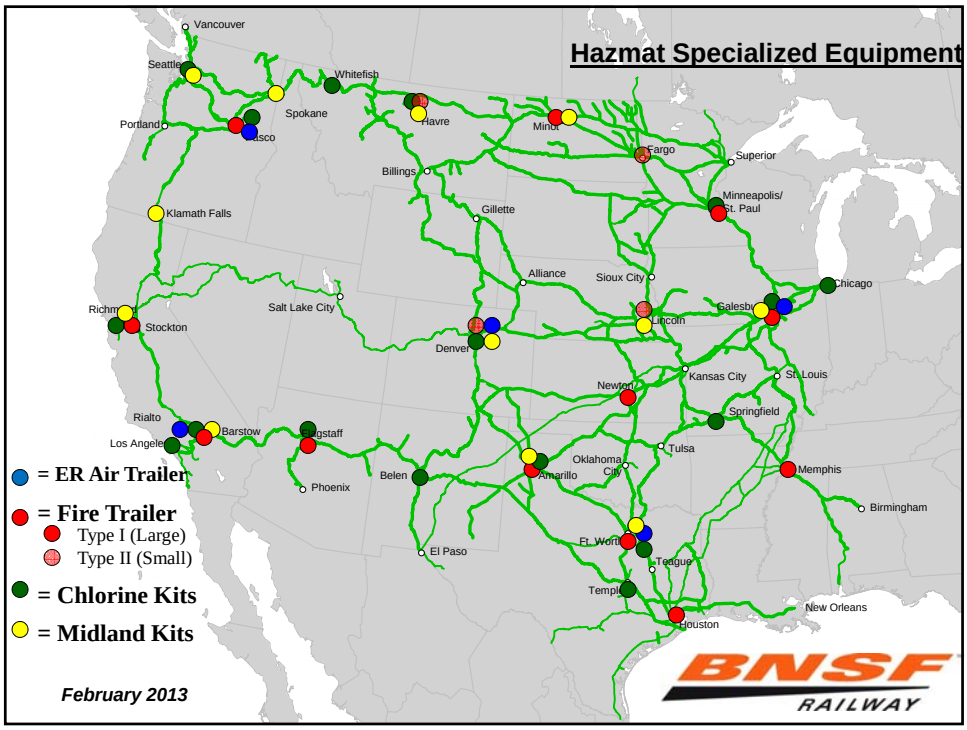
Ft. Worth
El Paso
Sweetwater
Teague
Temple
New Or
Houston


Hazmat Specialized Equipment
= ER Air Trailer
= Fire Trailer
Type I (Large)
Type II (Small)
= Chlorine Kits
= Midland Kits
February 2013
BNSF RAILWAY
Vancouver
Seattle
Whitefish
Spokane
Portland
Havre
Minot
Fargo
Superior
Billings
Minneapolis/ St. Paul
Klamath Falls
Gillette
Alliance
Sioux City
Chicago
Salt Lake City
Stockton
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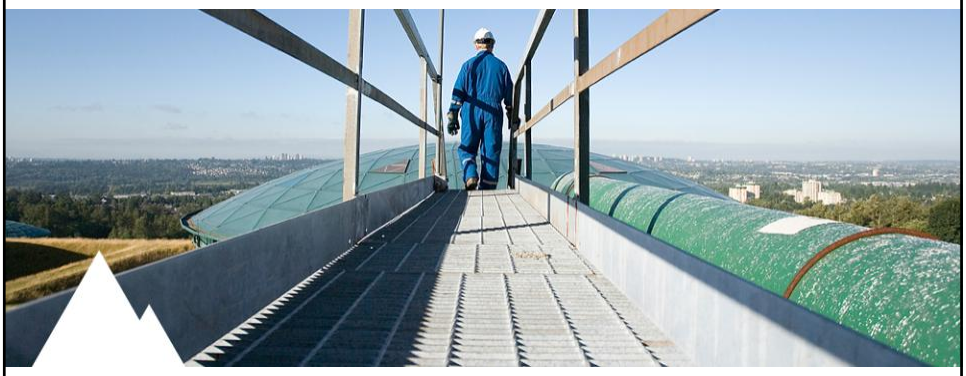
Kansas City
St. Louis
Newton
Rialto
Barstow
Springfield
Los Angeles
Tulsa
Oklahoma City
Phoenix
Belen
Amarillo
Memphis
Birmingham
El Paso
Ft. Worth
Teague
Temple
New Orleans
Houston


BNSF
RAILWAY



TRANS MOUNTAIN PIPELINE SYSTEM

OIL SANDS PRODUCT FORUM
APRIL 16, 2013

1

Trans Mountain Pipeline

Current Operations

- Operating since 1953
- Capacity: 300,000 bpd
- 715 miles between Edmonton and Burnaby
- Ferndale and Anacortes
- Transports refined products, heavy and light crude oils including dilbit
- Last expanded in 2008

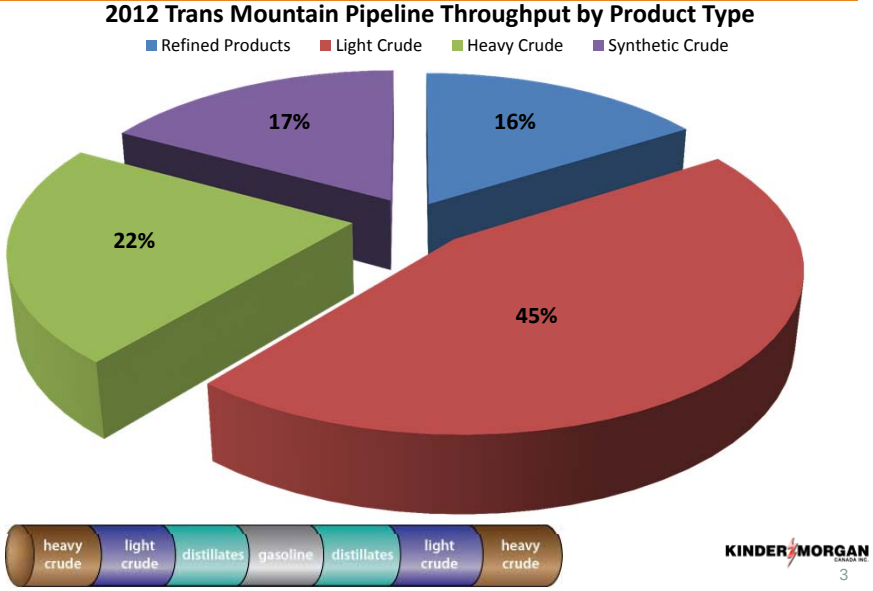
Proposed Expansion

- Expand capacity to 890,000 bpd
- Customer contracts for ~ 700,000 bpd on 15 and 20 year terms
- Increased demand from U.S. west coast and Asia – drives need for additional capacity to Washington refineries and Westridge Marine Terminal

- Twin remaining 620 miles of pipeline
- Increase pumping capability
- Increase storage capacity
- Increase Puget Sound pipeline capacity
- Add 2 tanker berths
- Increase in tanker traffic - not tanker size

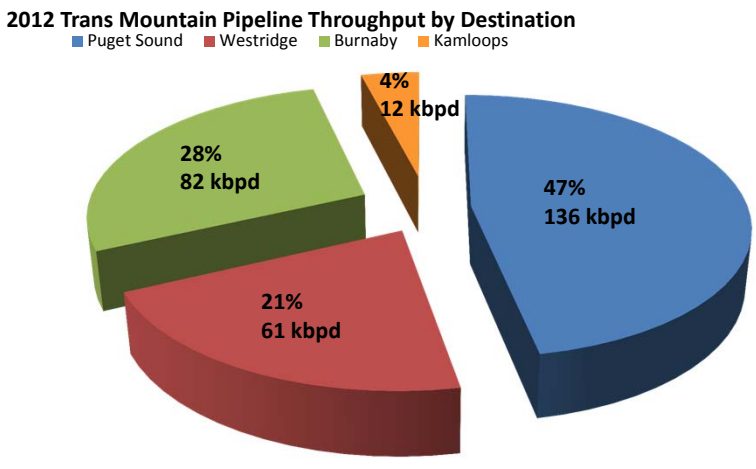
2

TMPL Throughput 2012



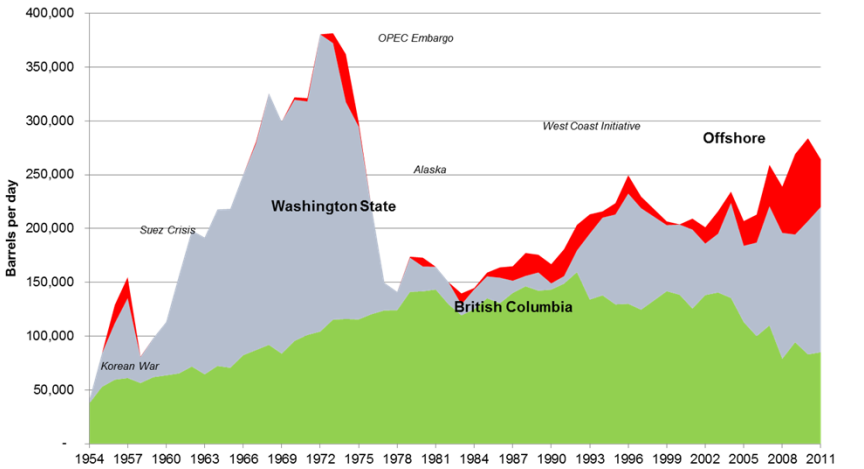
3

TMPL Throughput 2012



4

Product Destination – History to 2011



5

Puget Sound System

Existing System

- Serves Cherry Point and Anacortes
  - Length: 105 km (65 miles)
  - Diameter: 20” and 16”
  - Current capacity: 170,000 bpd
  - Pump stations: one at Laurel
  - Transit time ~24 hours

Proposed Upgrades

- Increase capacity to 225,000 bpd
  - New Burlington Pump Station
  - New 20” diameter pipeline (~1 mile long), deactivation of adjacent 16-inch diameter pipeline
  - Removal of existing Burlington scraper trap
  - One additional pump at Laurel Pump Station
  - One additional meter at each Ferndale and Anacortes Facilities
  - $40 million

6

Emergency Response

Emergency Response Plans

- Compliant with Washington Administrative Code (WAC)
- Approved by Washington Department of Ecology (WSDOE) and Department of Transportation - Pipeline and Hazardous Materials Safety (PHMSA)
- Emergency Response Field Guides
- Control Points Manual
- Incident Command System (ICS)

Equipment

- Two recovery trailers (Laurel and Anacortes)
- Two boom boats for lake and river deployments
- ICS Trailer equipped with all of the materials to set up a command post

- Annual Training
- Annual Exercises

7

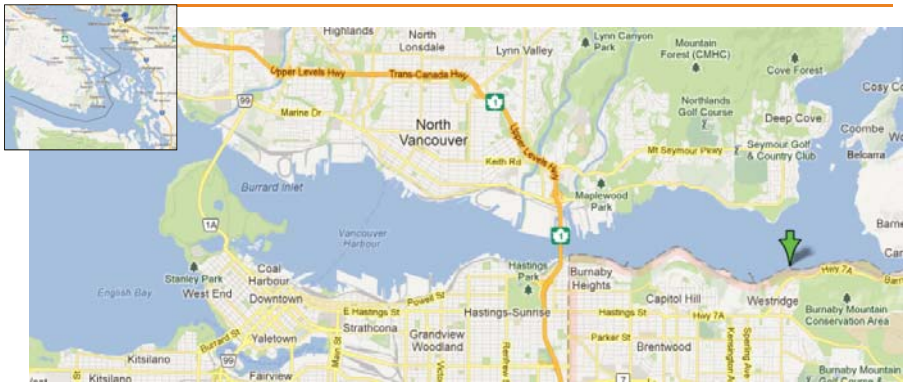
Outside Resources Available

Kinder Morgan has signed agreements with outside resources:

- Marine Spill Response Corporation (MSRC)
  - MSRC is a service provider for Kinder Morgan in the event of a water-based spill. They have the staff and equipment to respond to a large spill. MSRC can also respond to a land-based spill.
- Witt | O'Brien's
  - Witt | O'Brien's is a service provider to Kinder Morgan in the event of any emergency. They will provide support and staff to the Incident Management Team (IMT) when necessary.
- National Response Corporation (NRC)
  - Kinder Morgan is presently working on signing an agreement with NRC by the end of year.

8

Westridge Marine Terminal

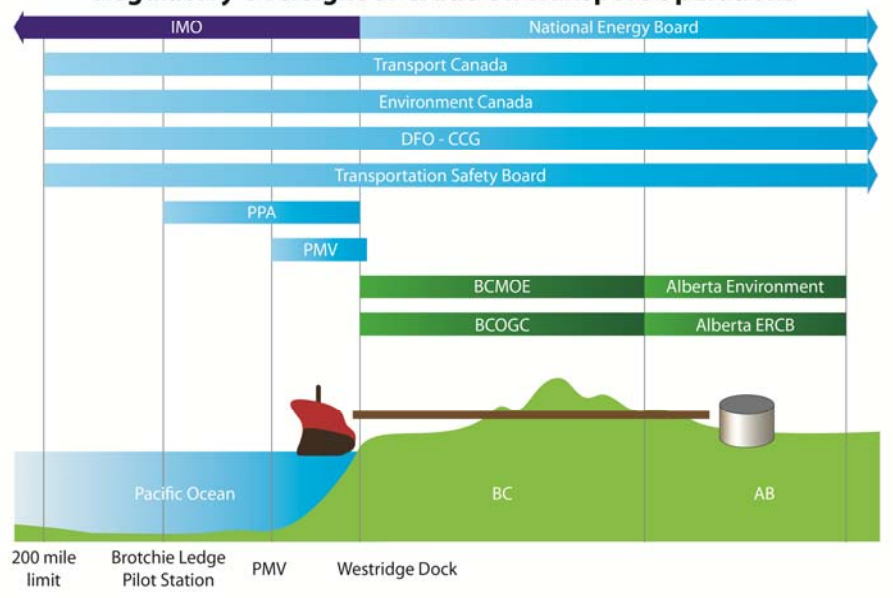


- One tanker berth face
- Partially (85%) laden Aframax
  - Typically 5 tankers/month
  - 2 crude oil barges/month
  - 1 jet fuel barge (receiving)/month
- ~3% of PMV traffic

- Three tanker berth faces
- Partially (85%) laden Aframax
  - Up to 34 tankers/month
  - 2 crude oil barges/month
  - 1 jet fuel barge (receiving)/month
- ~14% of current PMV traffic

9

Regulatory Oversight of Crude Oil Transport Operations



10

Product Quality

We transport a wide range of products and the terms and conditions for this service are defined in our Tariff 88

These conditions include product quality limits typical of major pipelines:

(a) Reid vapour pressure:103 kPa
(b) Sand, dust, gums, sediment, water or other impurities (total in aggregate): 0.5%
(c) Receipt Point a temperature: 38ºC
(d) **Density: 940 kg/m³**
(e) Kinematic Viscosity: 350cSt
(f) Having any organic chlorides or other compounds with physical or chemical characteristics that may render such Petroleum not readily transportable by the Carrier…

Trans Mountain has been transporting diluted bitumen since late 1980s without incident or operational problems due to dilbit properties

Fate and Behavior

KMC has engaged O'Brien's Response Management and Polaris Applied Sciences to conduct a Study of Fate and Effects of Heavy Crude Oils on Marine Waters

• Step 1	Literature Search	Completed
• Step 2	Gap Analysis and Research Plan	Completed
• Step 3	Applied Research (location TBD)	Scheduled for Spring
• Step 4	Final Report	Scheduled for Summer

Applied Research is intended to include test of typical oil sands products under ambient conditions similar to those of the Salish Sea

Other tests on diluted bitumen are underway

- API
- National Academy of Science

info@transmountain.com
1.866.514.6700
www.transmountain.com

13

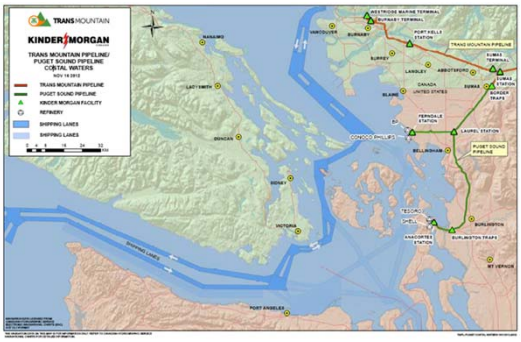
Westridge Marine Terminal

- Vessel is selected by a pipeline shipper and proposed to KMC
- Proposed vessel must meet all international and local rules and regulations
- Vessel is vetted by KMC to ensure:
  - Age, design and construction
  - Certification and insurance requirement
  - Manning
  - No adverse operating history
  - Terminal compatibility
- Terminal reserves the right to decline a vessel
- All vessels destined to a Canadian port are required under law to have a contractual arrangement in place with the certified oil spill response organization – WCMRC

14

Marine Traffic

- Transit follows established traffic separation scheme (CCG and USCG)
- Traffic is monitored by vessel traffic services (CCG and USGC)
- Aids to navigation maintained by CCG and USCG
- PMV and Transport Canada rules and regulations in place

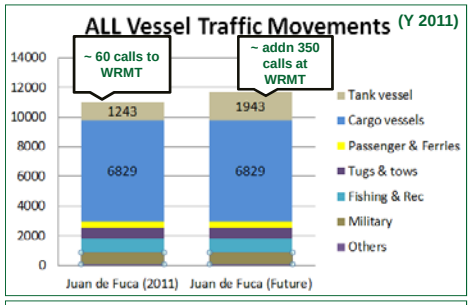


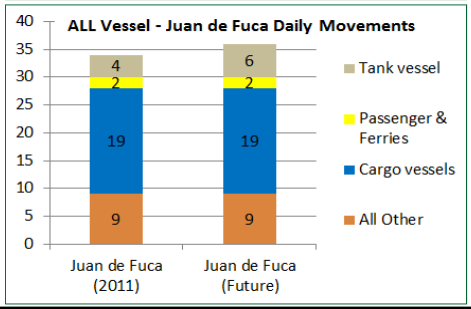
- BC Coast Pilots (certified by Pacific Pilotage Authority) onboard between Victoria and Terminal
  - 2 Pilots during loaded transit
- Tug escort arrangements using tethered tugs during harbor transit (loaded and ballast)
  - Up to 4 tugs during departure
- Tethered purpose built escort tug through Haro Straits and Boundary Pass (loaded)

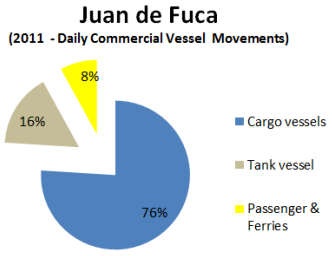
KINDER MORGAN

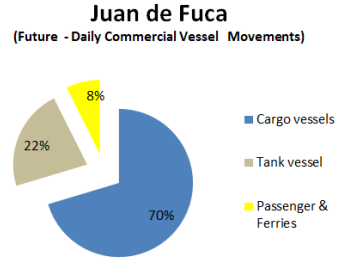
15

Vessel Traffic Analysis









KINDER MORGAN

16

Based on 2011 AIS information from Marine Exchange

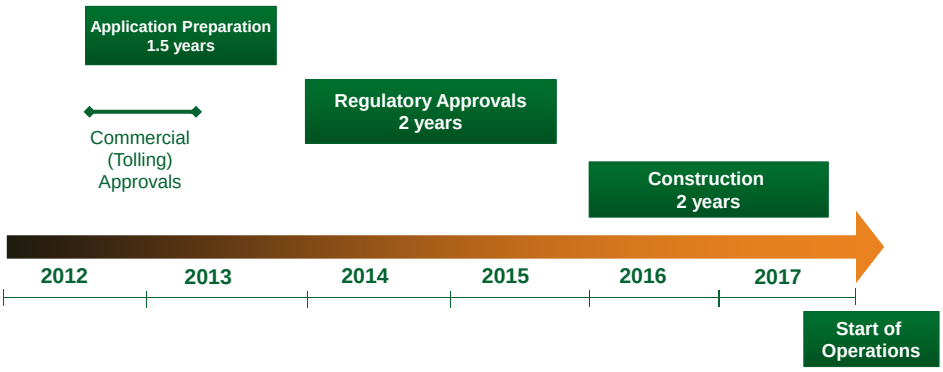
Project Application Requirements

- Application to National Energy Board
- Application must describe “effect of the project on the environment”
- Effects include those from normal operations and from “accidents and malfunctions”
- Application will describe effect of increased tanker traffic

- Marine studies to support the application will include those required for TERMPOL review by Transport Canada
- TERMPOL review involves quantitative risk assessment
  - Moffat Nichol
  - Det Norske Veritas (DNV)
  - Witt | O’Brien’s
  - Tetra Tech

17

Trans Mountain Expansion Schedule



18

Oil Sands Products Forum

April 16, 2013

Three Types of Barges Capable of Transporting Crude Oil in PNW
Upper Columbia River – Inland Barge Operations
Lower Columbia River , Oceans and Puget Sound

Upper Columbia River
Capacity: 40KB-50KB
Inland Class
Limit to 14 Draft

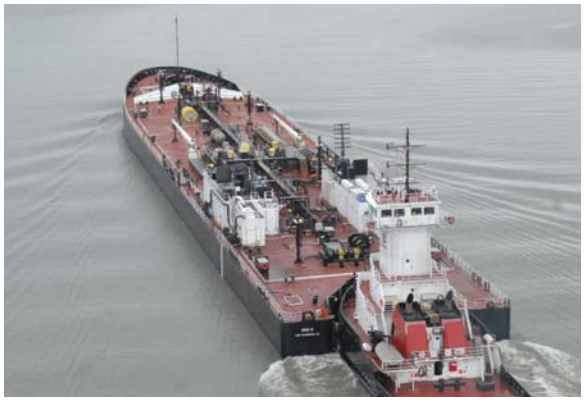
Tidewater Barge Lines

Push Mode/Double Hull/Vapor Recovery Systems
Currently not moving crude oil.
Primary trade is moving CPP Up River from Portland, OR/Vancouver WA to Tri Cities tank farms.

Lower Columbia River, Oceans, and Puget Sound
Capacity: 40KB -120KB
Oceans Class
Towline Barges

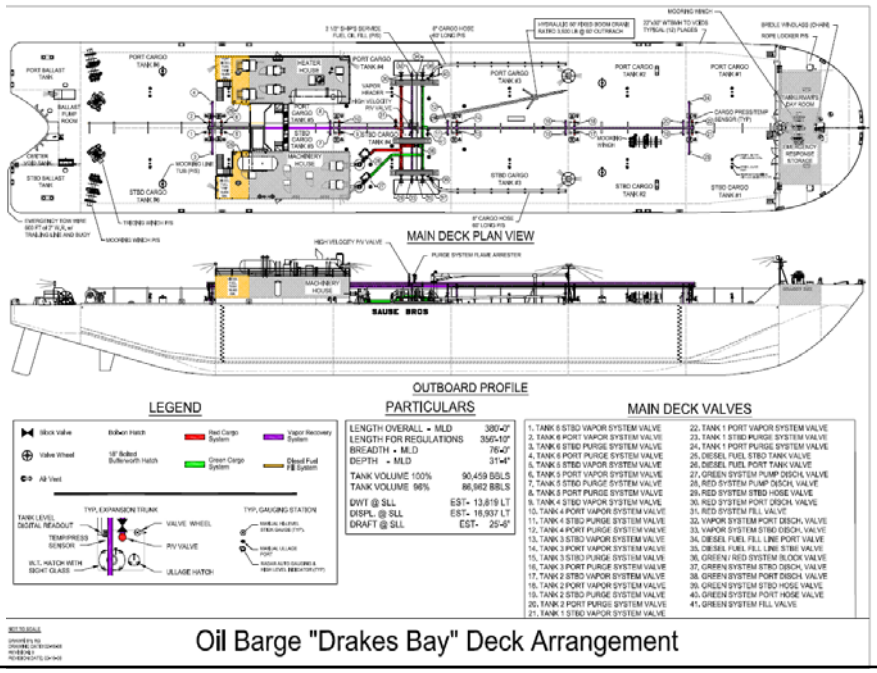
Sause Bros. Inc
Push or Tow Mode/Double Hull/Vapor Recovery Systems/ Vapor Absorption Systems/ Inert Vapor Systems
Currently Transporting Crude Oil/Lightering Ops
California and Puget Sound ex Vancouver, BC

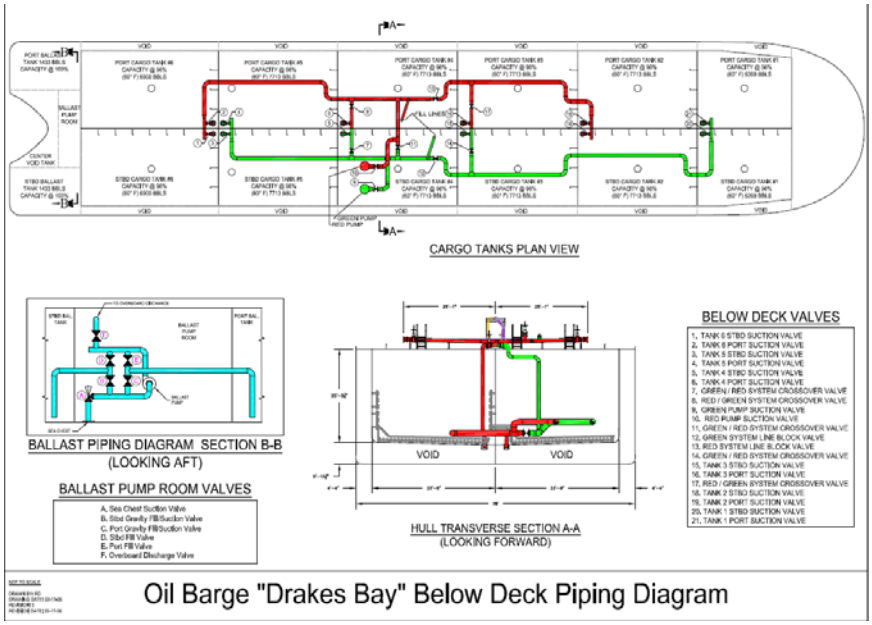
Lower Columbia River, Oceans, and Puget Sound
Capacity: 80KB -180KB
Oceans Class
ATB (Articulated Tug Barge)



Crowley Maritime
Push Mode/Double Hull/Vapor Recovery Systems/Inert Vapor Systems
Currently Transporting Crude Oil/Lightering Ops
California, Lower Columbia River and Puget Sound

Sause Bros. TB Drakes Bay





Questions, Observations, or Comments ??

Environment Canada Environnement Canada

Canada

Fate, Behavior & Modeling of Spilled Oil Sands Products
(Freshwater & Marine Environments)

Bruce Hollebone
ESTS, Environment Canada

Oil Sands Products Training
Seattle, WA
16 April 2013

Oil Fate, Behaviour and Models

Model:

Quantitative or semi-quantitative prediction of oil movement in environment (trajectory), and transformation by environmental factors (weathering)

Oil Behaviour:

A physical/chemical transformation of the oil, a “weathering” process

Oil Fate:

The eventual end-point state an oil may reach

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Canada

Weathering

- In the environment crude oil and refined products are modified by natural physical, chemical, and biological processes that change their composition and fate.
- These processes are collectively referred to as weathering
- Primary processes include: evaporation, formation of emulsions, dissolution, photochemical and biological oxidation.
- The oil properties and how they change in the environment are one of the major drivers of oil behaviour (what it does), fate (where it goes), persistance (how long it lasts) and effects (who gets hurt).

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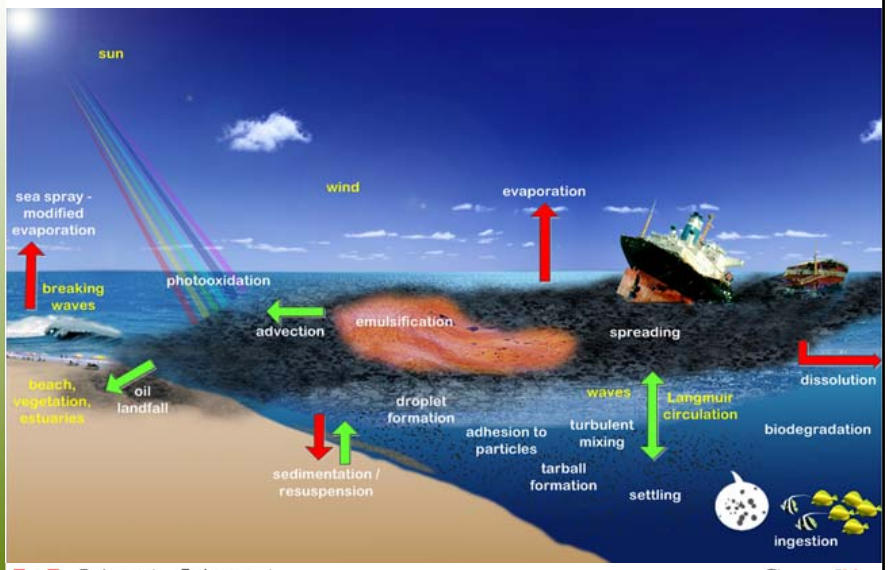
Behaviour and Fate



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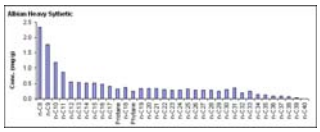
Selected Physical Properties

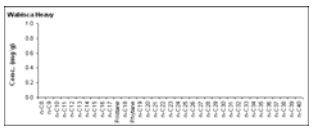
Commercial Type		Heavy Sour Synbit	Sweet Synthetic Crude	Condensate	Heavy Sour Dilsynbit	Heavy Sour Dilbit	Light Sweet Crude
Oil		MacKay River Bitumen Diluted with Light Synthetic Crude Oil	Syncrude Synthetic Light Crude Oil	CRW Condensate	Albian Heavy Synthetic	Wabasca Heavy	West Texas Intermediate
Density (g/mL)	0 ºC				0.9463	1.0109	0.8594
	15 ºC	0.943	0.873	0.734	0.9372	0.9572	0.8474
Viscosity (mPa·s)	0 ºC				465	1007933	19.2
	15 ºC	241.9	6	0.6	156	128100	8.6
Flash Point	(ºC)	10	<-5	<-5	-23	151	-10
Pour Point	(ºC)	<-24	<-24	<-25	<-30	-6	-22
Sulfur	(%)				2.3	4.7	0.90%

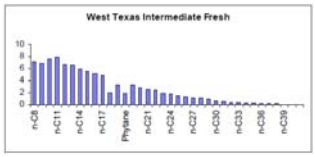
Environment Canada Environnement Canada Canada

Chemistries

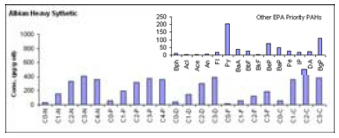
Saturate n-Alkanes

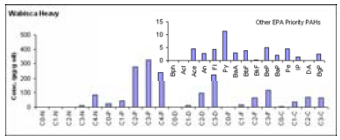


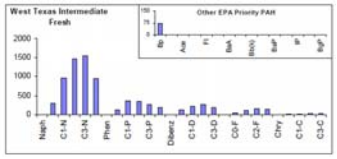




Polycyclic Aromatic Hydrocarbons (PAH)







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Effects of Weathering on Models

- Weathering affects oil characteristics, density, viscosity, surface/interfacial tensions
- Physical and chemical changes cause differences in trajectory behaviours and oil fate

Oil Type	Wind Drift or Leeway (%)
Gasoline	3--4
Diesel	3--4
Fresh IFO	3
Fresh Crude	3--4
Weathered IFO	2--3
Emulsified Oil	1--2
Scattered Tarballs	0.5--2

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Factors: Evaporation

- Best understood weathering process.
- Evaporation is influential behaviour component
- A light crude can lose as much as 75% in two days and a medium crude as much as 40%
- A physical/thermodynamic process, molecules are removed from the oil, but not changed chemically.
- One of the best studied types of weathering, many major types of models for oil -> air evaporation.

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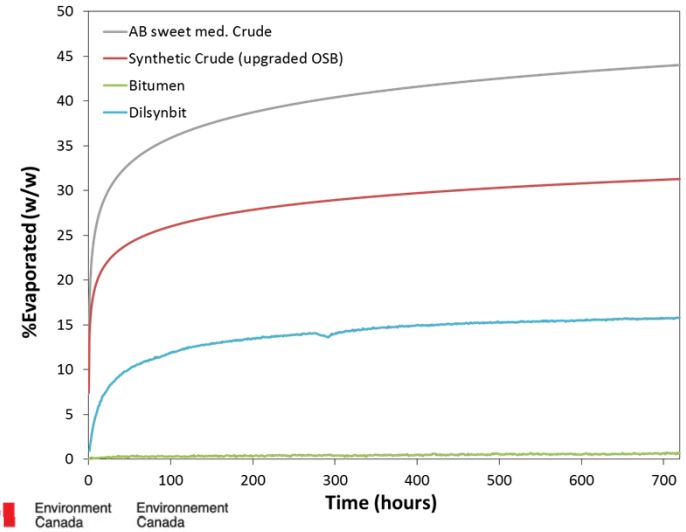
Evaporation of Oil Sands Products



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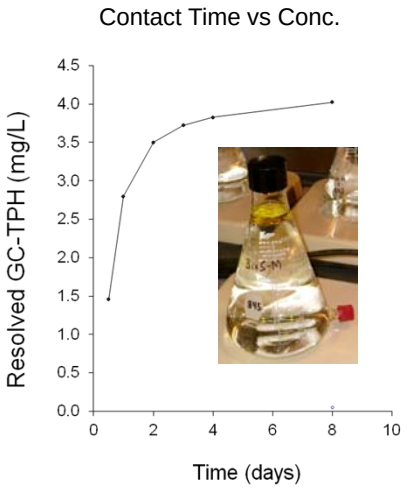
Dissolution and Solubility

- Not a major effect on oil behaviour, but can have large effects on organisms and habitats
- Affected by oil concentration, mixing energy, temperature and time
- Can be limited by diffusion rates through oil
- Physical models well developed



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Factors: Photo-oxidation

- Observed to cause increase in density in real-world spills
- "Skin" formation
- Appears to increase oxidized components of oil
  - Enhances water uptake and emulsion formation
- No models for behaviour

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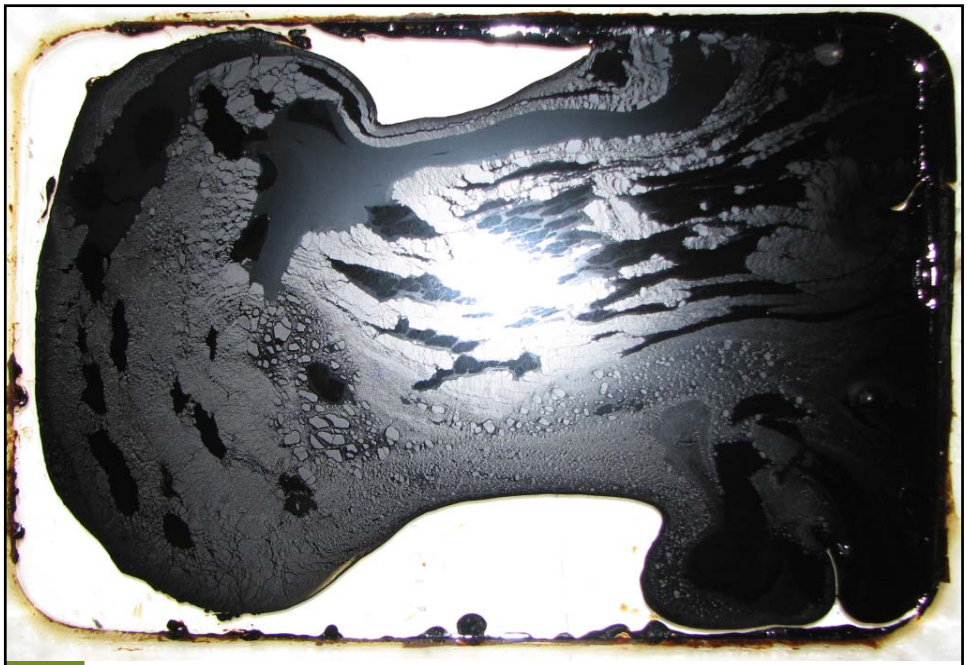

Environment Canada Environnement Canada Canada

Factors: Water Uptake

- Formation of finely dispersed water droplets in an oil phase
- Emulsion densities increase, viscosities greatly increase
- Changes state of oil, but not chemistry.
- Changes transport: oil is lower in water, has higher stickiness and much higher viscosity
- “Entrained water”– simple viscosity-bound water in oil – may persist for significant amounts of time
- Models for water uptake and retention are not well developed --- all data is empirical/experimental

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Environment Canada Environnement Canada

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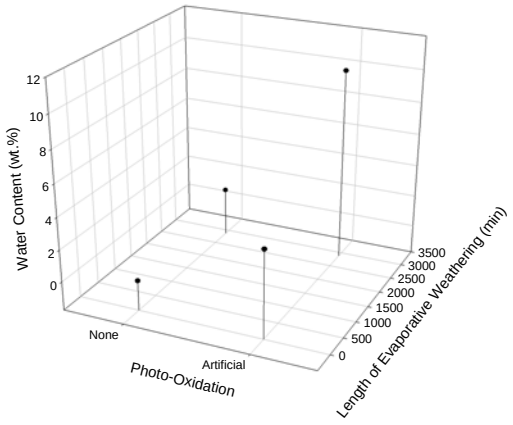
Evaporation and Photo-oxidation Effects on Water Content of Oil



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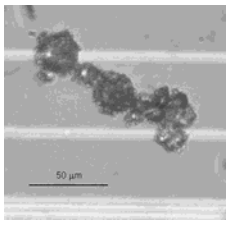
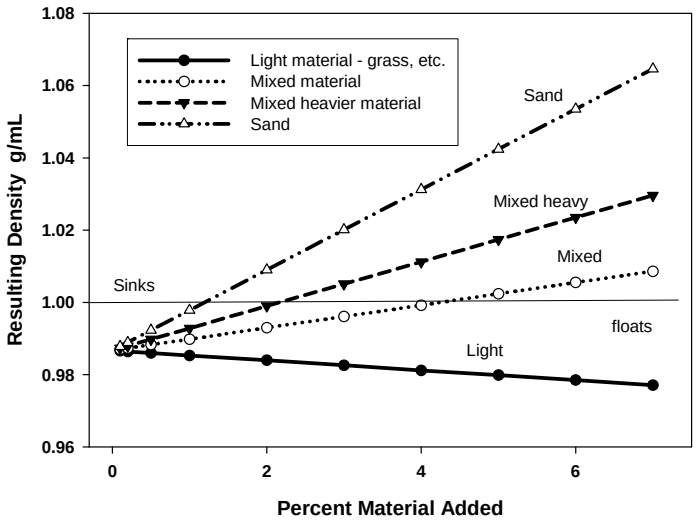
Factors: Sediment Interaction

- Observed sedimentation of sunken oil at several spills
  - Quantitative data from spills of opportunity is sparse.
- Quantitative models just now starting to be developed
- Several modes of uptake
  - Suspended particulates (OMA/OFI/OSA/SPM, etc...)
  - Surf-zone interactions



Environment Canada Environnement Canada

Canada



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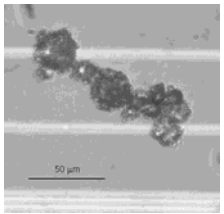
Canada

Dispersion and Sediment Interaction

- Dispersion of oil into small droplets occurs in high-energy environments: breaking waves, storms, floods, surf zones.
- Dispersion can promote rapid weathering because of proportionately large surface areas to volume of oil
  - Dissolution
  - Emulsification
  - Sediment uptake
  - Water uptake
- Sinking and “tarball formation”
- Models are under active development



Khelifa et al, 2008

Environment Canada Environnement Canada

Canada

Water Surface

Environment Canada Environnement Canada

Canada

Immediately After Agitation

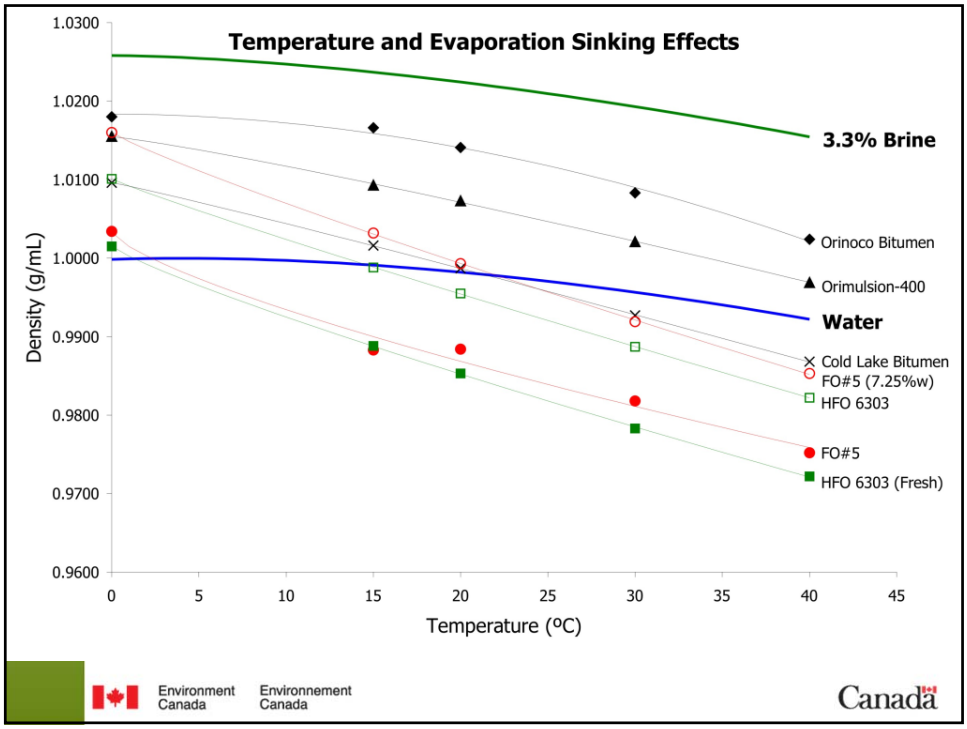
Environment Canada Environnement Canada

Canada

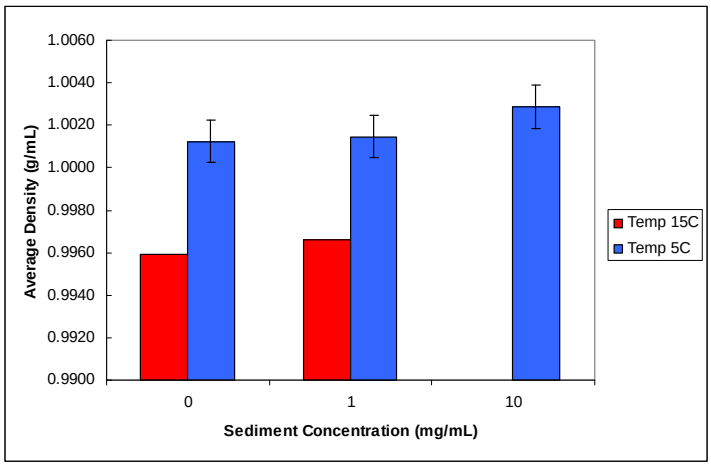
A Few Minutes Later

Factors: Temperature

- Oil density increases with decreasing temperature
- Cyclic - daily and seasonal variations, with additional weather factors
- Temperature affects many oil properties (viscosity, interfacial tensions)
  - Potential for non-linear interactions
- Empirically well understood, practical models exist



Sediment Uptake vs Temperature



Chemical Weathering

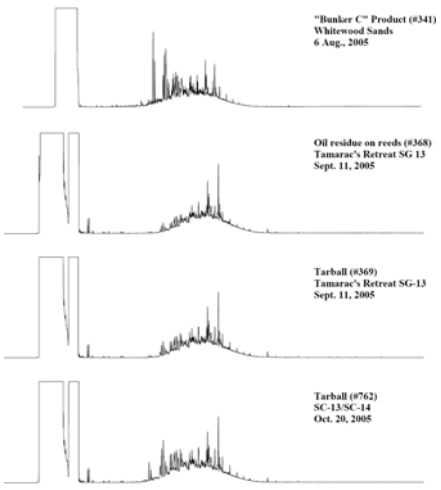
- Chemical distribution of oil changes in the environment.

Removal:
- Evaporation
- Dissolution and dispersal

Transformational:
- Chemical degradation/oxidation (eg photo-enhanced)
- Biological degradation

Weathering changes to oil

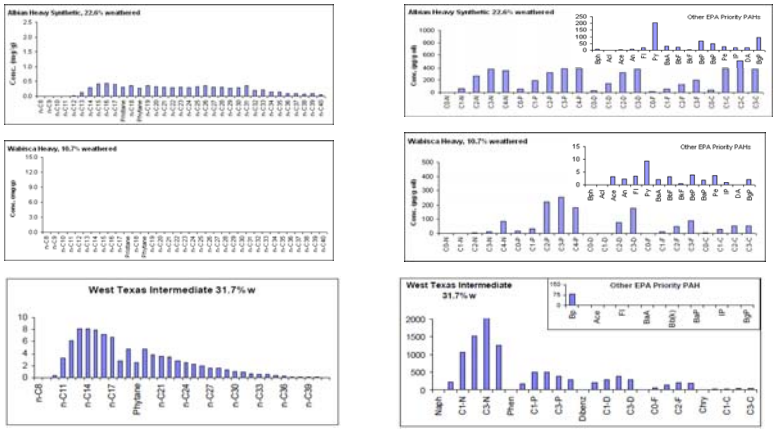
- Largest changes occur rapidly after spill, with slow degradation later
- Rapid removal of light ends <C25 (F1 + F2)
- The fate of the oil strongly affects degredation
- Densities uniformly increased with exposure
- Oil does not weather evenly; highly degraded skins can contain less weathered oil.
- Models are mostly empirical



Effects of Evaporation

Saturate n-Alkanes

Polycyclic Aromatic Hydrocarbons (PAH)



Environment Canada Environnement Canada

Canada

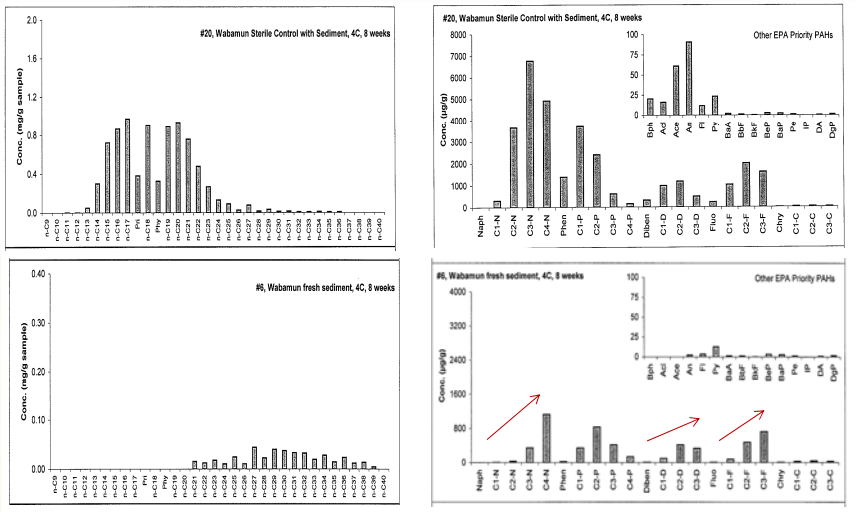
Biodegredation

- Long-term action of microbes on oil
- Almost reverse of photo-oxidation: smaller molecules affected first, straight-chain alkanes preferred, followed by unalkylated aromatics.
- Can last for months to years.
- Aerobic can be much faster than anaerobic.
- Availability of fertilizers and electron acceptors

Environment Canada Environnement Canada

Canada

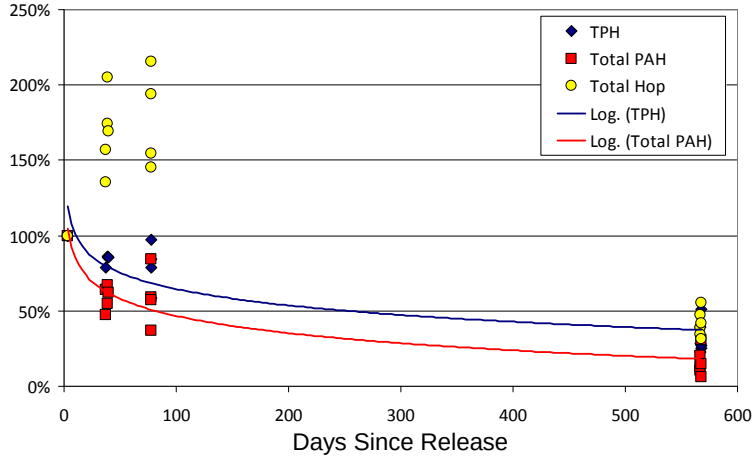
Biodegradation of Heavy Oil



Environment Canada Environnement Canada

Canada

Bio-oxidation in natural samples



Hollebone et al, 2011

Environment Canada Environnement Canada

Canada

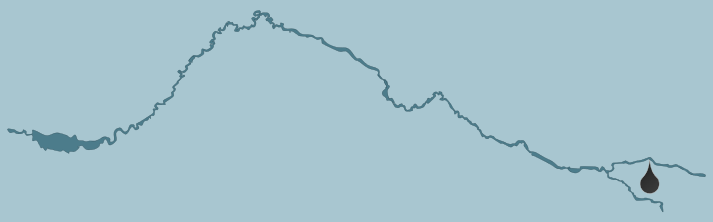
Open Questions

- Changes to dilbit chemistry by evaporation of diluent components (rate of change)
- Dispersion of oil in water (droplet size, rise time, coalescence)
- Resuspension and remobilization potential
- Dissolution in water & bioavailability
- Toxicity, chemical and physical
- Persistence
- Interactions of factors to affect behaviours

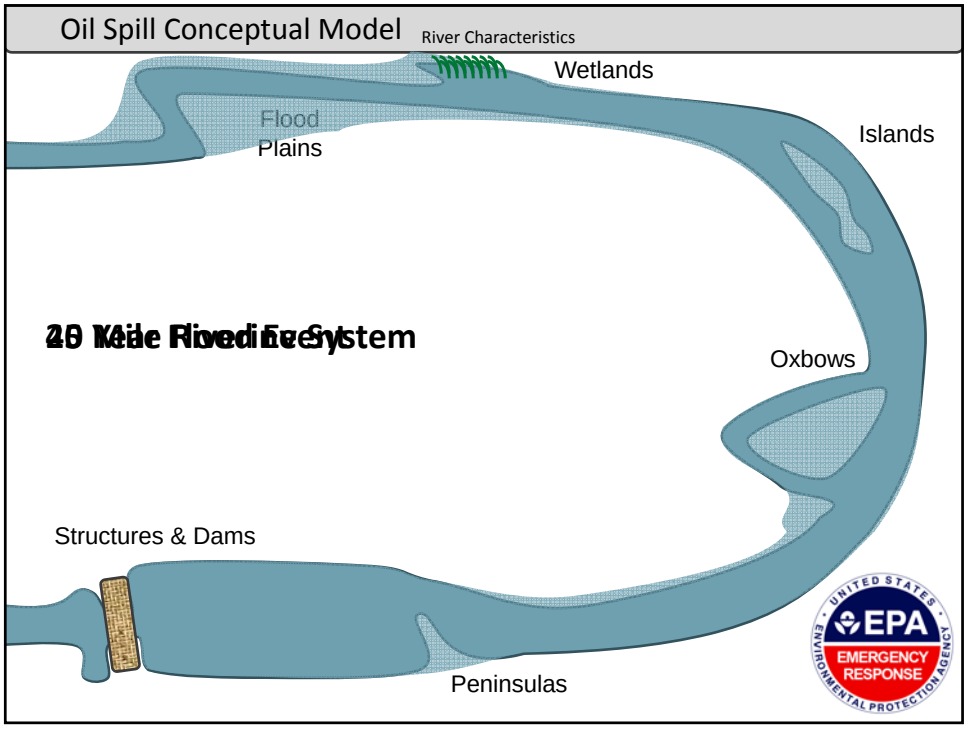
Questions? Comments?

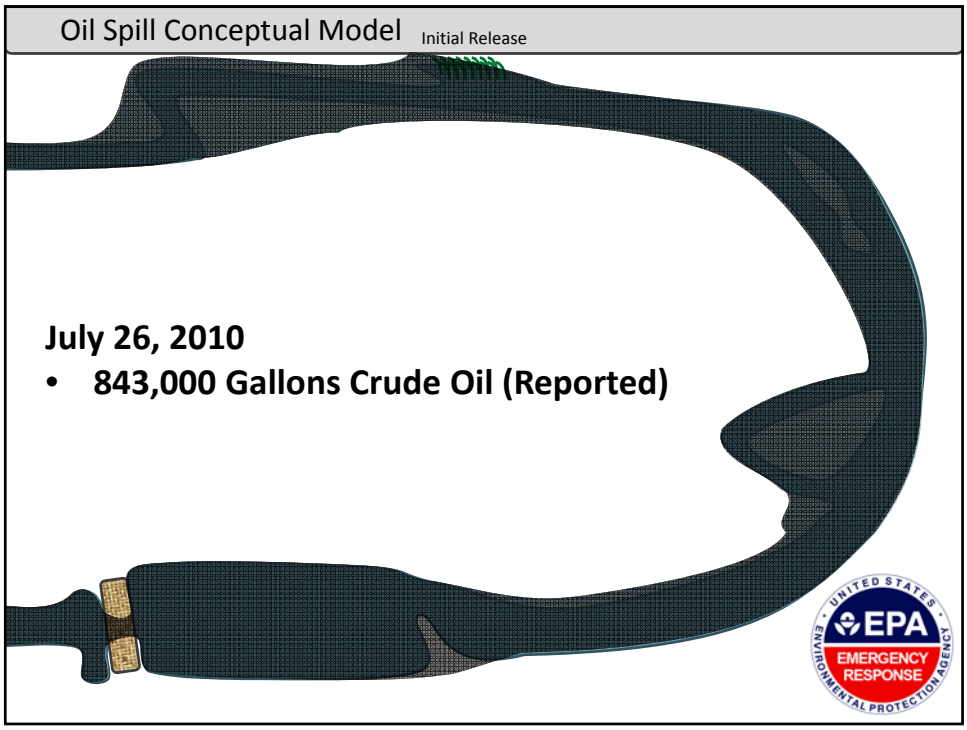
END

CSE Oil Sands Product Forum
April 16, 2013



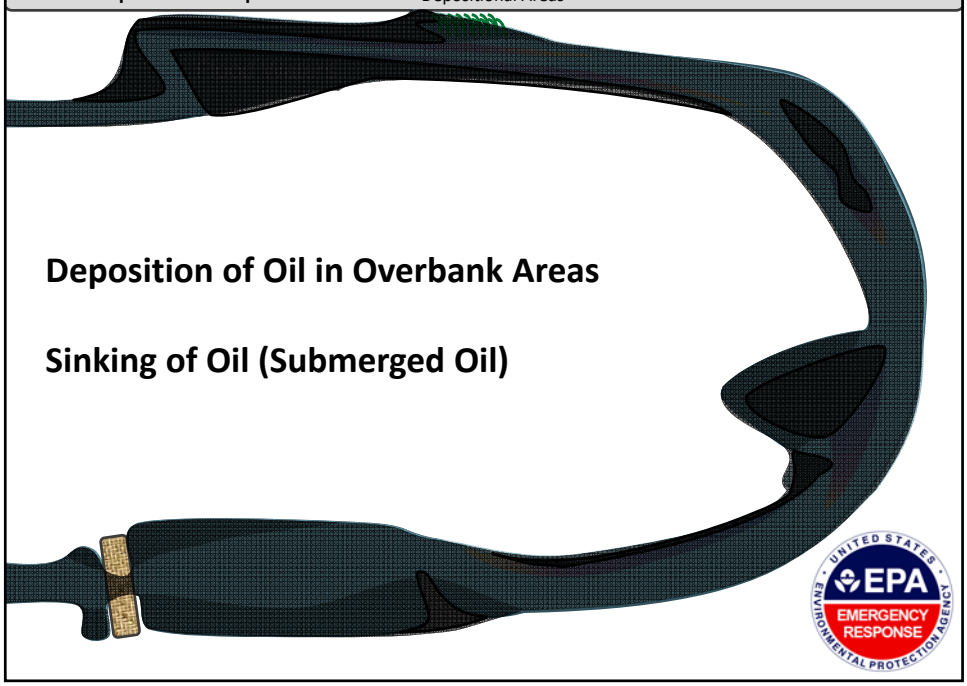
What Happened?
Day 1: July 25, 2010


Oil Spill Conceptual Model
River Characteristics
Wetlands
Flood
Plains
Islands
Oxbows
Structures & Dams
Peninsulas
EPA
EMERGENCY
RESPONSE


Oil Spill Conceptual Model
Initial Release
July 26, 2010
• 843,000 Gallons Crude Oil (Reported)
EPA
EMERGENCY
RESPONSE

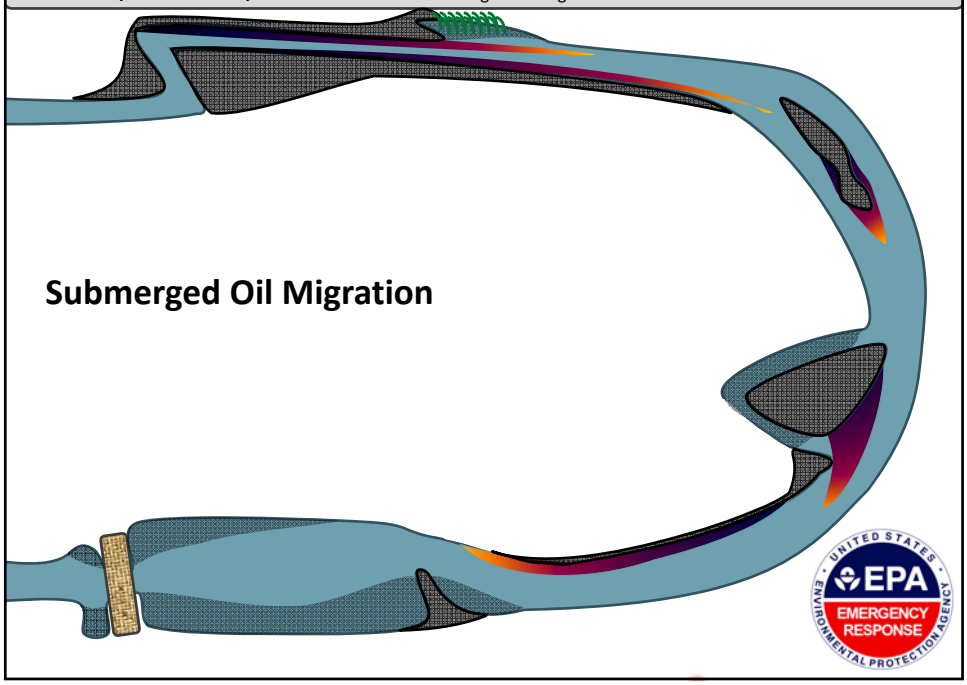
Oil Spill Conceptual Model

Depositional Areas



Oil Spill Conceptual Model

Submerged Oil Migration



Then What?
Day 40 through Day 607

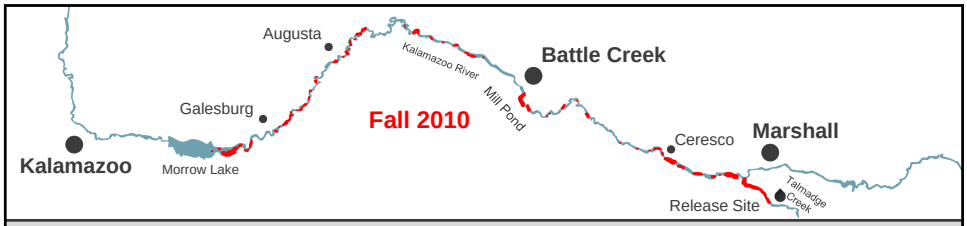
Overbank Work

Submerged Oil Work

Removal and disposal of 186,000 yd³ of impacted soil and debris


Talmadge Creek

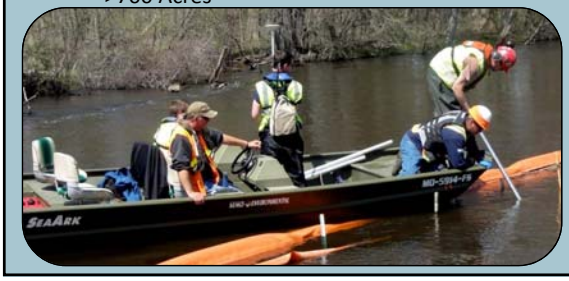

MP 5.92 Excavation

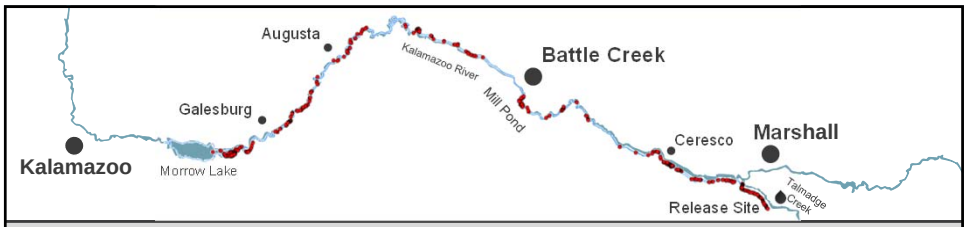


Submerged Oil Work

Identification of Oil

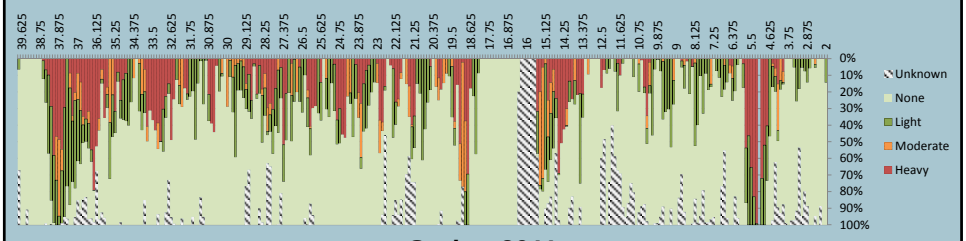
- Poling (18,000+ points)
- Coring (1,000+ cores)
- 200+ Submerged Oil Sites
- >700 Acres



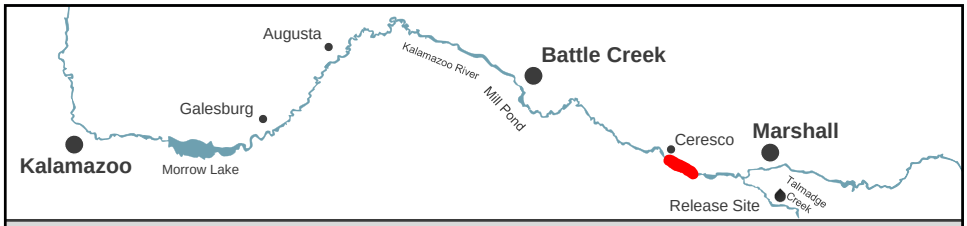


Summary of Work 2011

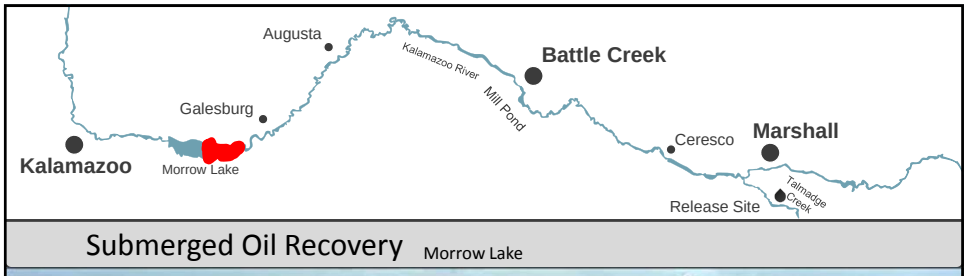
Submerged Oil – Distribution by Area



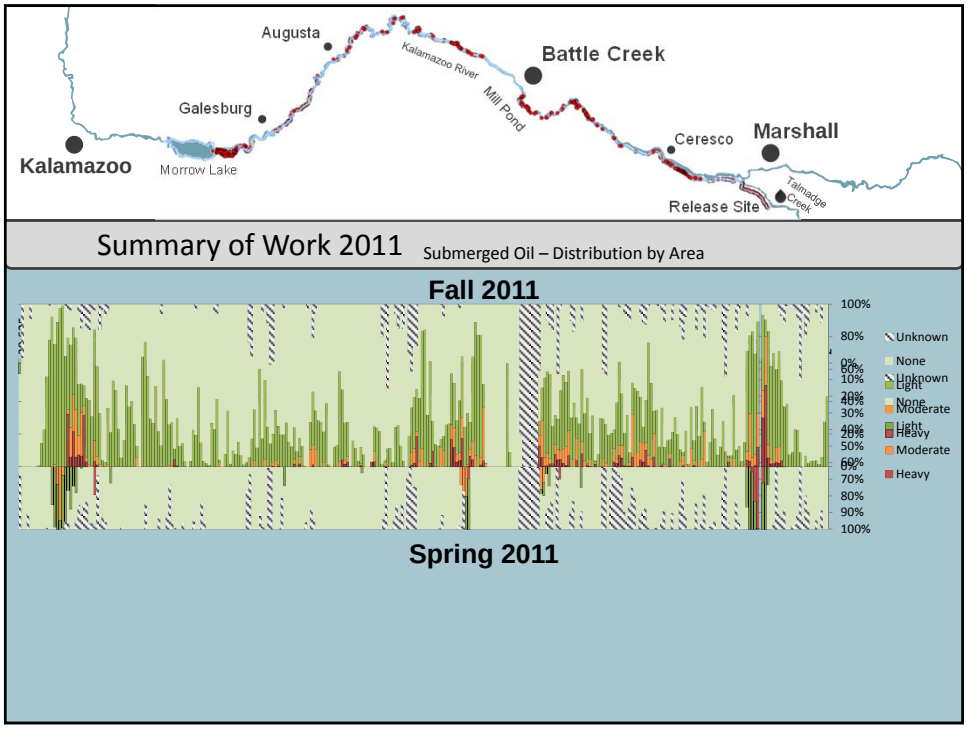
Spring 2011

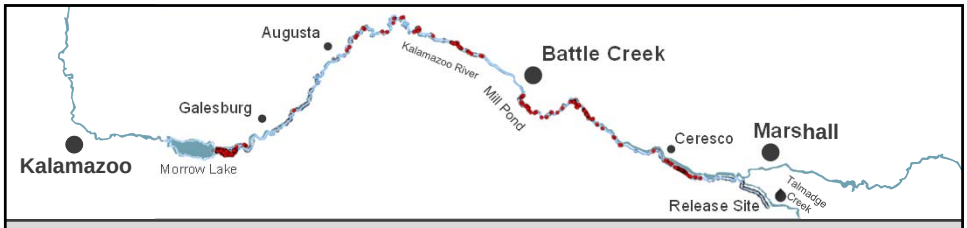


Submerged Oil Recovery Ceresco



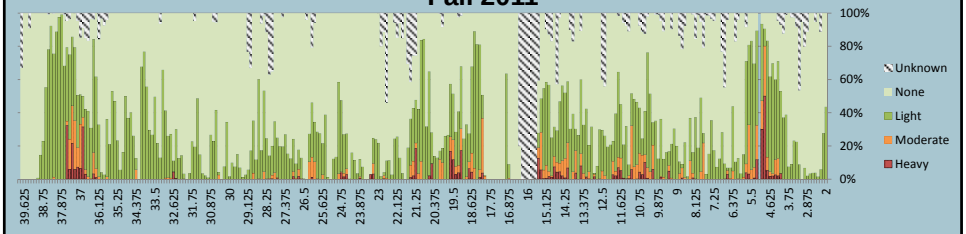
Submerged Oil Recovery Morrow Lake


Augusta
Kalamazoo River
Battle Creek
Mill Pond
Galesburg
Ceresco
Marshall
Kalamazoo
Morrow Lake
Talmadge Creek
Release Site
Summary of Work 2011
Submerged Oil – Distribution by Area
Fall 2011
Spring 2011
Unknown
None
Light
Moderate
Heavy



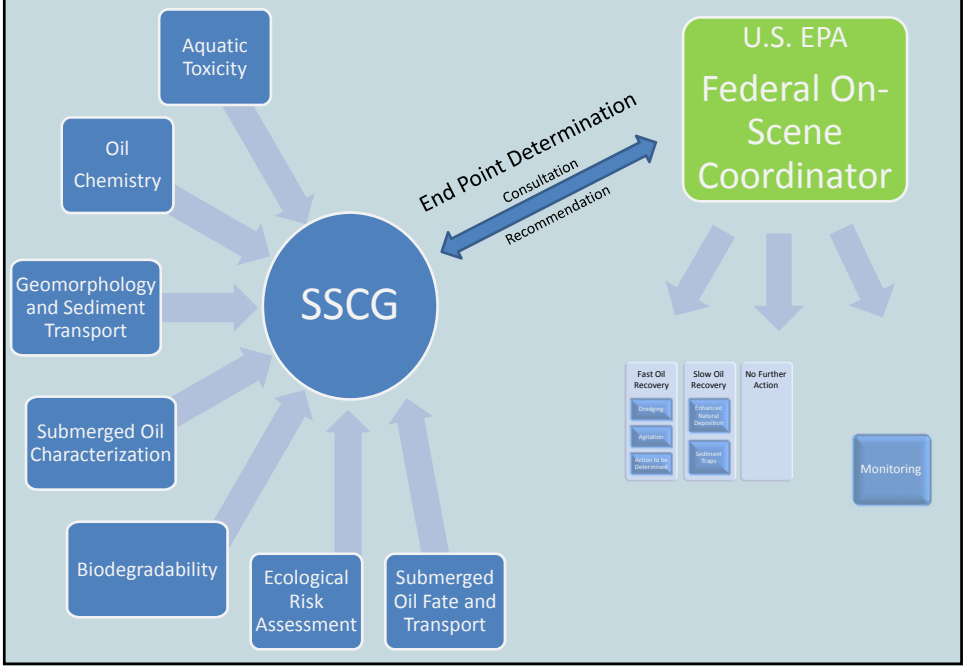
Strategy Development

Fall 2011



As the submerged oil footprint is reduced, cleanup strategy needs to be revisited to **balance** the level of recovery to achieve positive net environmental benefit.

Scientific Support Coordination Group



Scientific Support Coordination Group – Composition

Federal Agency Participation

State Agency Participation

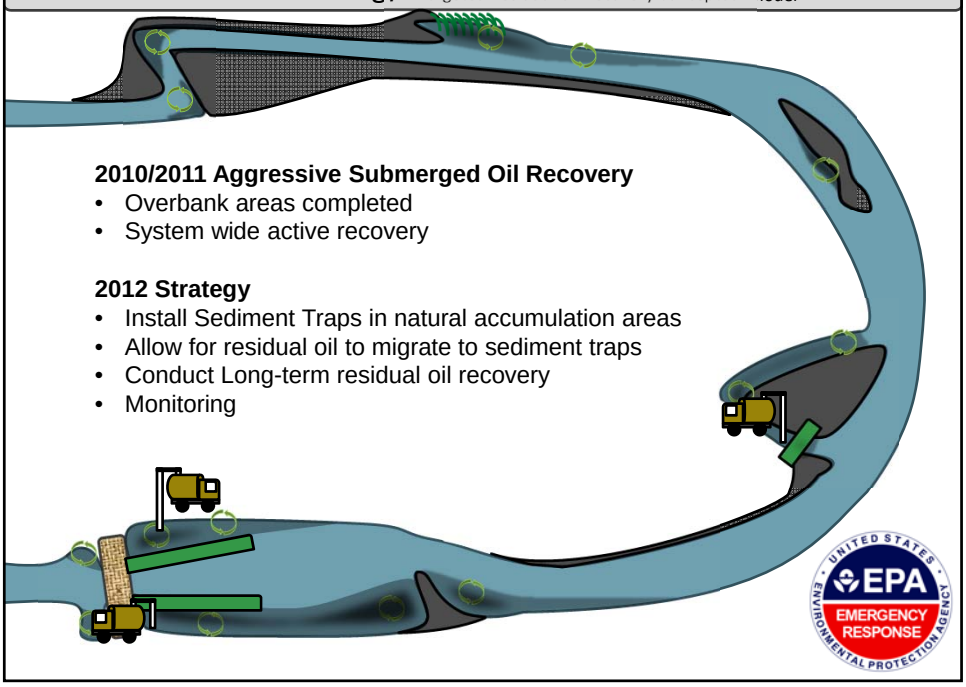
Academia

Private Consultants

Canadian Participation

2012 Strategy

Targeted Residual Oil Recovery Conceptual Model

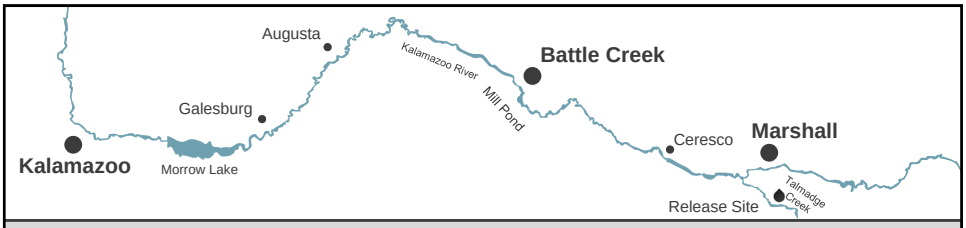


2010/2011 Aggressive Submerged Oil Recovery

- Overbank areas completed
- System wide active recovery

2012 Strategy

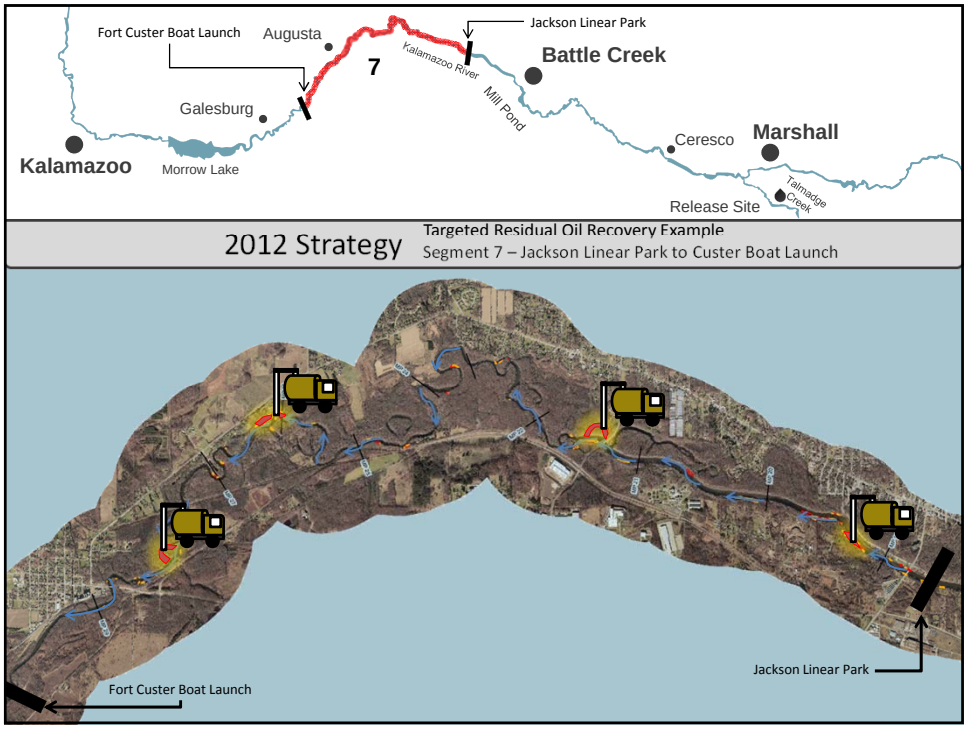
- Install Sediment Traps in natural accumulation areas
- Allow for residual oil to migrate to sediment traps
- Conduct Long-term residual oil recovery
- Monitoring



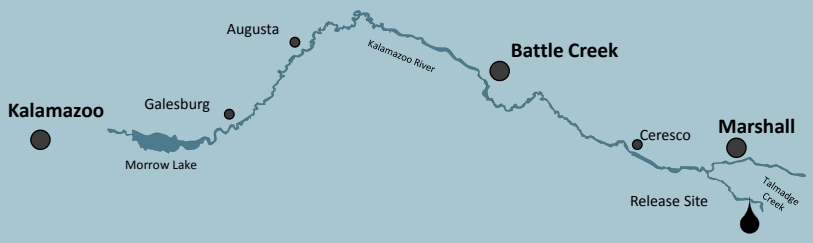
New Strategy for 2012

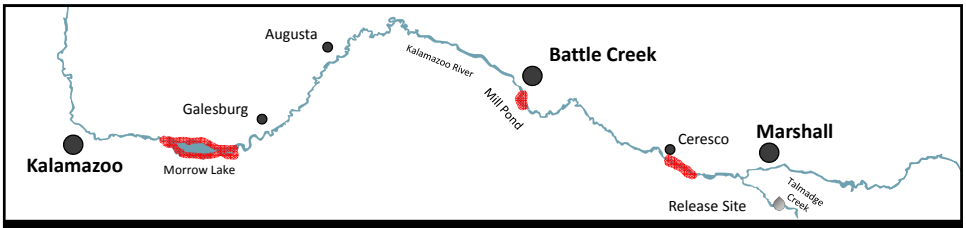
Elements

- Reassess all submerged oil locations
- Minimize ecological impact of recovery
- Utilize natural transport and depositional areas of the river (sediment traps)
    - Allows use of less intrusive recovery techniques
    - Allow for natural habitat recovery


Fort Custer Boat Launch
Augusta
7
Jackson Linear Park
Kalamazoo River
Mill Pond
Battle Creek
Galesburg
Kalamazoo
Morrow Lake
Ceresco
Marshall
Talmadge Creek
Release Site
2012 Strategy
Targeted Residual Oil Recovery Example
Segment 7 – Jackson Linear Park to Custer Boat Launch
Jackson Linear Park
Fort Custer Boat Launch

Now





Areas Addressed by U.S. EPA Proposed Order

Approximately 6 of 40 River Miles are Addressed by the U.S. EPA Proposed Order:

- **Ceresco** (MP 4.75 to 5.85)
- **Mill Ponds** (MP 13.9 to 15.7)
- **Morrow Lake and Delta** (MP 36.25 to 39.85)

U.S. EPA REGULATORY BACKGROUND
Federal Water Pollution Control Act

(4) The President shall by regulation determine for the purposes of this section those quantities of oil and any hazardous substances the discharge of which may be harmful to the public health or welfare or the environment of the United States, including but not limited to fish, shellfish, wildlife, and public and private property, shorelines, and beaches.

U.S. EPA REGULATORY BACKGROUND
40 CFR Ch. 1 Part 110 Discharge of Oil

reational or other purposes;
(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce;
(3) That are used or could be used for industrial purposes by industries in interstate commerce;
(d) All impoundments of waters otherwise defined as navigable waters under this section;
(e) Tributaries of waters identified in paragraphs (a) through (d) of this section, including adjacent wetlands; and
(f) Wetlands adjacent to waters identified in paragraphs (a) through (e) of this section: Provided, That waste treatment systems (other than cooling ponds meeting the criteria of this paragraph) are not waters of the United States;

Navigable waters do not include prior converted cropland. Notwithstanding the determination of an area's status as prior converted cropland by any other federal agency, for the purposes of the Clean Water Act, the final authority regarding Clean Water Act jurisdiction remains with EPA.

NPDES means National Pollutant Discharge Elimination System;

Sheen means an iridescent appearance on the surface of water;

Sludge means an aggregate of oil or oil and other matter of any kind in any form other than dredged spoil having a combined specific gravity equivalent to or greater than water;

§ 110.2 Applicability.

The regulations of this part apply to the discharge of oil prohibited by section 311(b)(3) of the Act.

[61 FR 7421, Feb. 28, 1996]

§ 110.3 Discharge of oil in such quantities as "may be harmful" pursuant to section 311(b)(4) of the Act.

For purposes of section 311(b)(4) of the Act, discharges of oil in such quantities that the Administrator has determined may be harmful to the public health or welfare or the environment of the United States include discharges of oil that:

(a) Violate applicable water quality standards; or

(b) Cause a film or sheen upon or discoloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

[61 FR 7421, Feb. 28, 1996]

§ 110.4 Dispersants.

Addition of dispersants or emulsifiers to oil to be discharged that would circumvent the provisions of this part is prohibited.

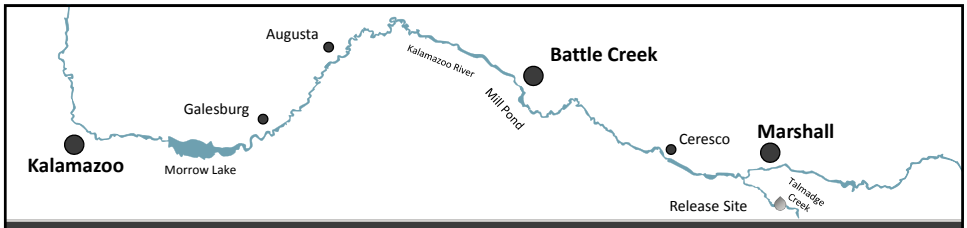
[52 FR 10719, Apr. 2, 1987. Redesignated at 61 FR 7421, Feb. 28, 1996]

§ 110.5 Discharges of oil not determined "as may be harmful" pursu-

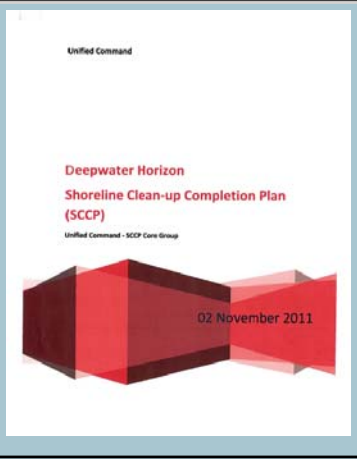
Oil flowing over Ceresco Dam 2010

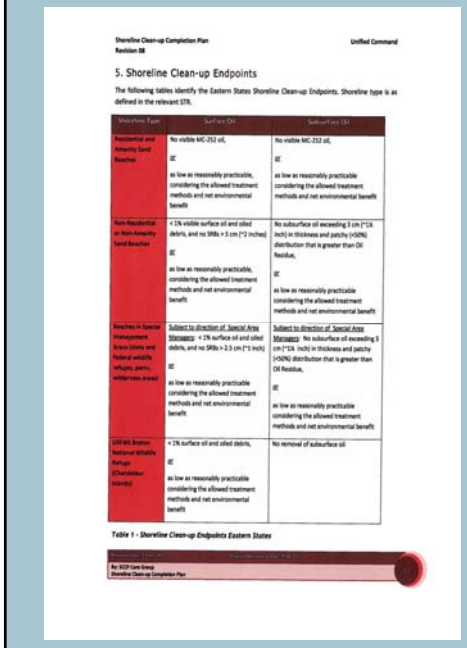
Oil pooled downstream of Ceresco Dam 2010

2010 Ceresco Dam during early response activities



Endpoint Framework





Shoreline Clean-up Completion Plan — Unified Command
Revision 08

5. Shoreline Clean-up Endpoints

The following tables identify the Eastern States Shoreline Clean-up Endpoints. Shoreline type is as defined in the relevant STR.

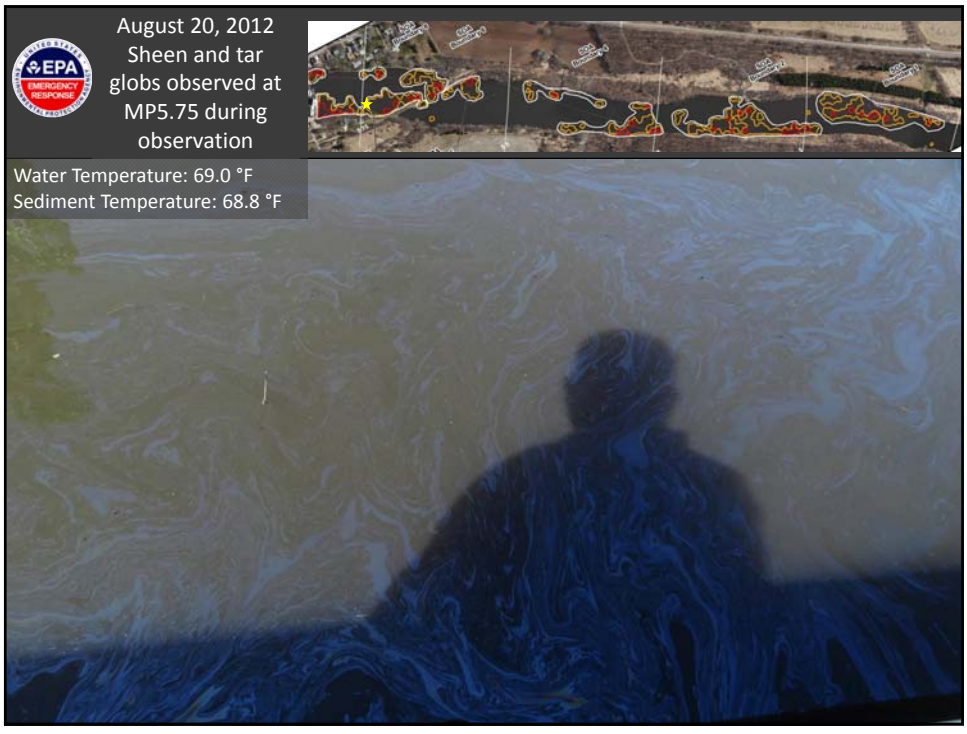
Shoreline Type	Surface Oil	Subsurface Oil
Residential and Amenity Sand Beaches	No visible MC-252 oil, or as low as reasonably practicable, considering the allowed treatment methods and net environmental benefit	No visible MC-252 oil, or as low as reasonably practicable considering the allowed treatment methods and net environmental benefit
Non-Residential or Non-Amenity Sand Beaches	< 1% visible surface oil and oiled debris, and no SRBs > 5 cm (~2 inches) or as low as reasonably practicable, considering the allowed treatment methods and net environmental benefit	No subsurface oil exceeding 3 cm (~1¼ inch) in thickness and patchy (<50%) distribution that is greater than Oil Residue, or as low as reasonably practicable considering the allowed treatment methods and net environmental benefit
Beaches in Special Management Areas (state and federal wildlife refuges, parks, wilderness areas)	Subject to direction of Special Area Managers: < 1% surface oil and oiled debris, and no SRBs > 2.5 cm (~1 inch) or as low as reasonably practicable considering the allowed treatment methods and net environmental benefit	Subject to direction of Special Area Managers: No subsurface oil exceeding 3 cm (~1¼ inch) in thickness and patchy (<50%) distribution that is greater than Oil Residue, or as low as reasonably practicable considering the allowed treatment methods and net environmental benefit
USFWS Breton National Wildlife Refuge (Chandeleur Islands)	< 1% surface oil and oiled debris, or as low as reasonably practicable considering the allowed treatment methods and net environmental benefit	No removal of subsurface oil

Table 1 - Shoreline Clean-up Endpoints Eastern States

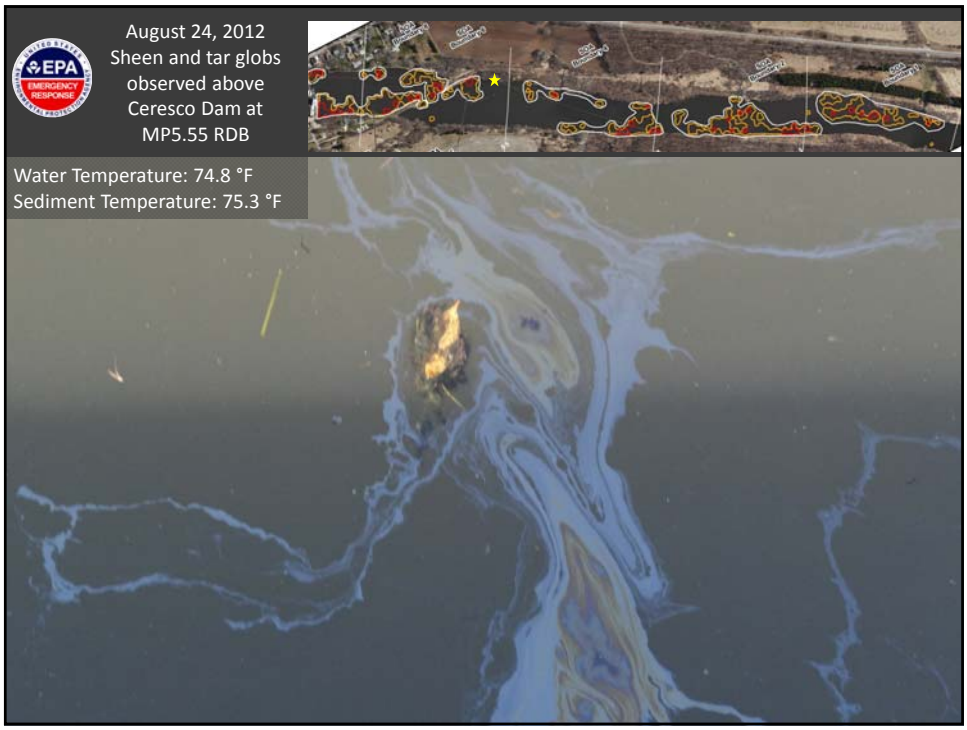
X. Clean-up Endpoints

The following table identifies Line 6B Oil Spill Clean-up Endpoints under U.S. EPA's Order(s).

River Corridor	Overbank Oil Endpoints	Submerged Oil Endpoints
General	1. No Line 6B oil on surfaces that rubs off on contact; **and** 2. No oil and/or sheen from Line 6B that affects navigable waterways and/or poses the threat of release of a visible oil and/or sheen to navigable waterways.	1. No Line 6B oil and/or oil-contaminated sediments at levels represented by heavy or moderate poling response using U.S. EPA-approved poling methods; **and** 2. No Line 6B oil and/or oil-contaminated sediments that has the potential to migrate downstream of Morrow Dam.
	or As little oil and/or sheen from Line 6B as practicable considering the treatment methods allowed and net environmental benefit.	**or** As little oil and/or oil-contaminated sediment from Line 6B as practicable considering the treatment methods allowed and net environmental benefit.
Sediment Traps	Not applicable.	Allow Line 6B oil and/or oil-contaminated sediments to accumulate at specific sediment traps along the river. Recover oil periodically, in accordance with U.S. EPA-approved Operations & Maintenance Plan.
Sensitive Habitat Areas MP 8.5 LDB OB 11.79 LDB OB 26.23 RDB	As little oil and/or sheen from Line 6B as practicable considering the treatment methods allowed and net environmental benefit.	No removal of submerged oil.
High Recreational Use *(under consideration for implementation at public access points)* Saylors Landing Ceresco Dam Fisherman Landing Historical Bridge Park Paddlers Cove C-5 Boat Launch Jackson Linear Park Custer Road Fort Custer Galesburg Park River Oaks Park Canoe Launch River Oaks Park	1. No Line 6B oil on surfaces that rubs off on contact; **and** 2. No oil and/or sheen from Line 6B that affects navigable waterways and/or poses the threat of release of a visible oil and/or sheen to navigable waterways.	No Line 6B oil and/or oil-contaminated sediments at levels represented by heavy or moderate poling response using U.S. EPA-approved poling methods, and located within XXX feet of a public access point.

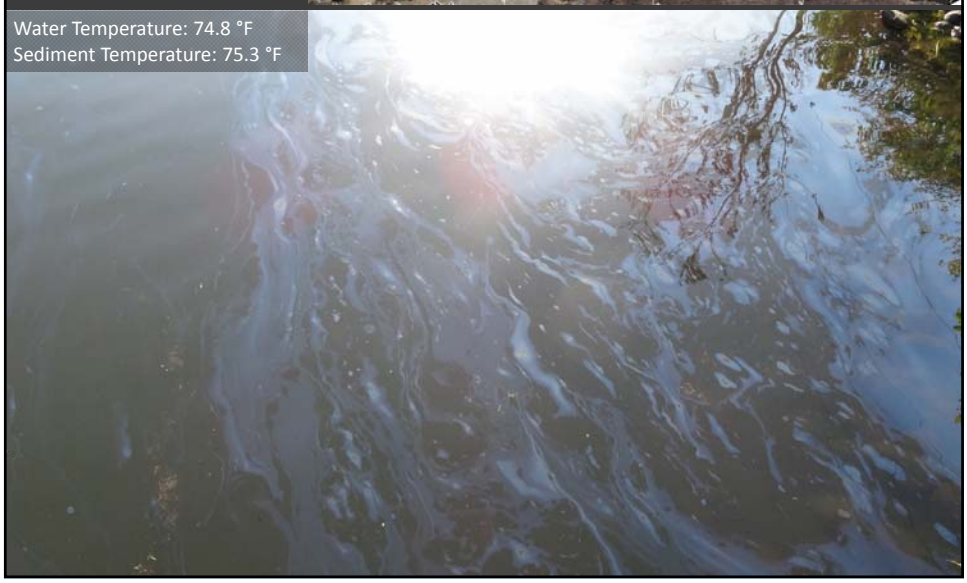



August 24, 2012
Sheen and tar globs observed above Ceresco Dam at MP5.63 LDB
Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F


August 24, 2012
Sheen and tar globs observed above Ceresco Dam at MP5.55 RDB
Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F

August 24, 2012
Sheen and tar globs observed above Ceresco Dam at MP5.63 LDB

Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F



August 24, 2012
Sheen and tar globs observed above Ceresco Dam at MP5.63 LDB

Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F

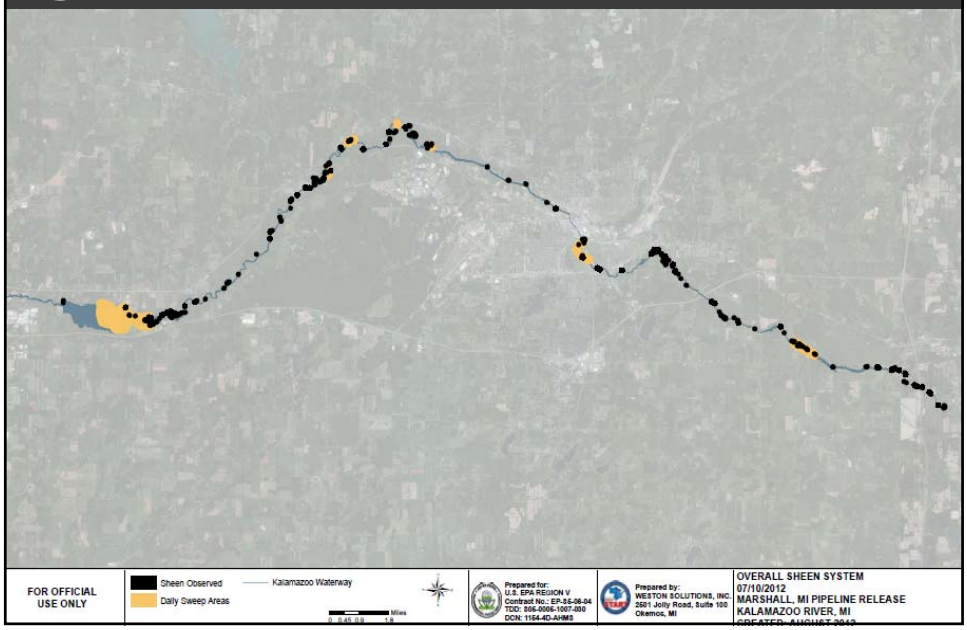
August 24, 2012
Sheen observed above Ceresco Dam at MP5.75 LDB

Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F

August 27, 2012
Sheen observed above Ceresco Dam at MP5.75 LDB

Water Temperature: 74.8 °F
Sediment Temperature: 75.3 °F

2012 Sheen Management at Submerged Oil Locations



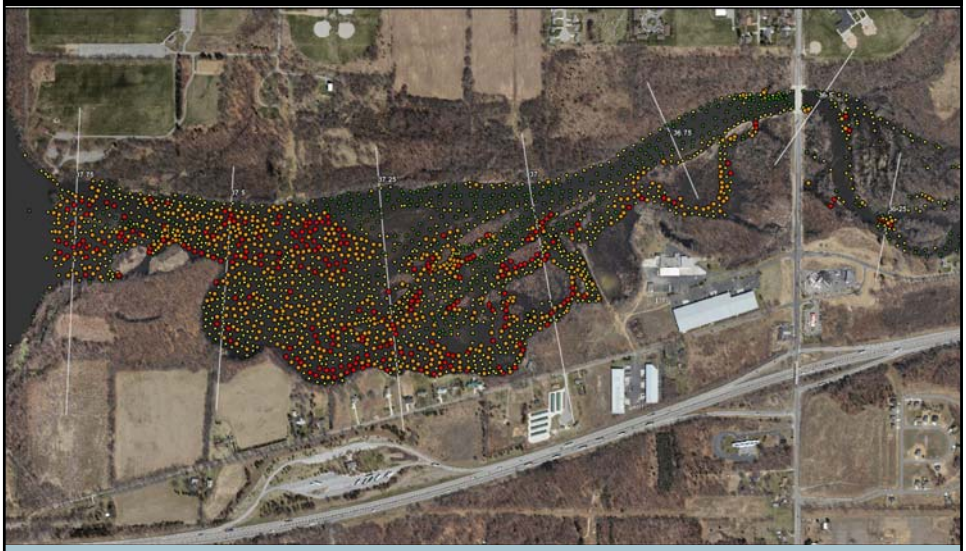
Late Summer Reassessment 2012 Poling Data
Ceresco Dam

Moderate and Heavy Submerged Oil Delineations
Late Summer Reassessment 2012
Ceresco Dam

Late Summer Reassessment 2012 Poling Data
Mill Ponds

Moderate and Heavy Submerged Oil Delineations
Late Summer Reassessment 2012
Mill Ponds

Spring Reassessment 2012 Poling Data
Morrow Lake Delta



Moderate and Heavy Submerged Oil Delineations
Spring Reassessment 2012
Morrow Lake Delta

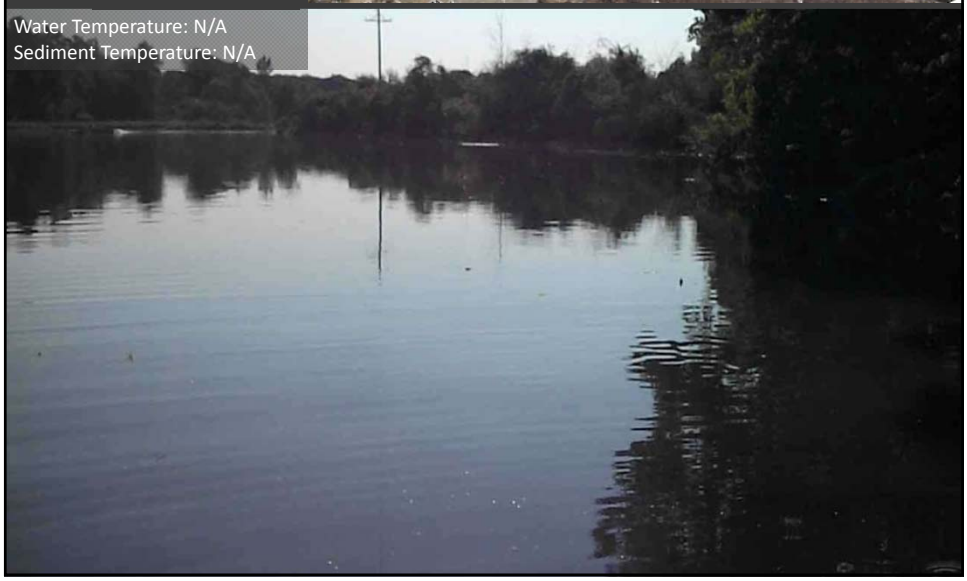
Late Summer Reassessment 2011 Poling Data
Morrow Lake

Spring Reassessment 2012 Poling Data
Morrow Lake

Fall 2012 Poling Data
Morrow Lake

August 30, 2012
Sheen observed above Ceresco during poling activities

Water Temperature: N/A
Sediment Temperature: N/A



Continuing Submerged Oil Science

Water Temperature:
Sediment Temperature:

- Submerged oil mobility
- Transport Modeling
- Temperature effects
- Biodegradeability
- NEBA
- Oil Mineral Aggregate formation
- Forensic chemistry
- Ebullition

Experience with Diluted Bitumen Spill

WCMRC
Western Canada Marine Response Corporation
READY TODAY. PREPARED FOR TOMORROW. PROTECTING OUR WATERS.

Bill Jahelka
Vancouver Island Manager
Western Canada Marine Response Corporation

Western Canada Marine Response Corporation (WCMRC)

WCMRC
Western Canada Marine Response Corporation
READY TODAY. PREPARED FOR TOMORROW. PROTECTING OUR WATERS.

WCMRC Video

- WCMRC is the Response Organization certified to respond to marine oil spills along British Columbia's 27,000 km of coastline.
- Established in 1976 as an industry co-op, it became Canada's first certified response organization in 1995.

- WCMRC has its main office in Burnaby, and regional offices located in Duncan and Prince Rupert.
- WCMRC's full and part-time staff are available 24/7 for spill responses and can access equipment caches located strategically along the west coast.

WCMRC's Member base is approximately 2200

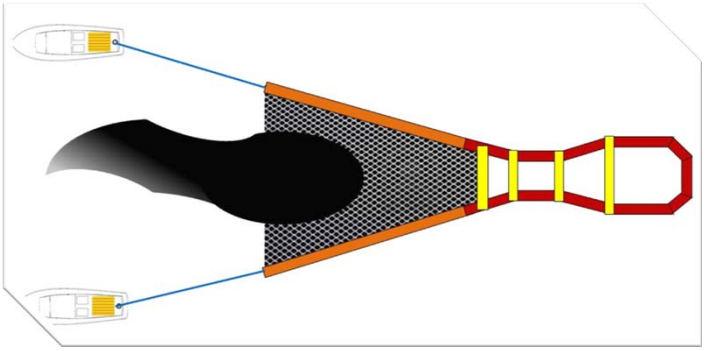
- Oil Companies
- Tankers
- Barges
- Freighters
- Ferries
- Cruise Ships
- Oil Handling Facilities

Containment Boom

- River (River Boom)
- Shoreline (Shore Seal Boom)
- Sheltered Water (General Purpose Boom)
- Unsheltered Water (Kepner & Zoom Boom)
- Open Water (Ro-boom)

Sweep Systems

- NOFI Sweep
- NOFI Current Buster



Portable Oil Spill Response Skimmers

- Fuzzy Disk Skimmer
- RBS Multi Head Skimmer
- GT-185 Skimmer with Brush Conversion

Skimming vessels

Storage

- Barges
- Towable Bladders
- Floating Collar Tanks

2007 Westridge Response

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What is Dilbit?

Dilbit (diluted bitumen) means "Blends made from heavy crudes and/or bitumens and a diluent" usually condensate.

Synbit (synthetic bitumen) a 50/50 blend of bitumen and synthetic crude oil. This was the spilled product.

The Incident

- 13:15 hrs. July 25th, 2007, call from the Burnaby Fire Department that they were responding to a crude oil pipeline rupture.
- 13:35 hrs. Calls to confirm that the oil has entered the sewer lines but nothing has been seen in water yet.
- 13:55 hrs. first sighting of oil in Burrard Inlet, volume unknown
- 14:15 hrs. first boom deployed. Support from member tug company and local oil company's response vessel.
- 15:00 hrs. WCMRC on-scene vessels report initial containment boom in place at release point #1 – Aerial survey of area shows sheen outside primary boom
- 16:00 hrs. additional 1,000 ft. of boom brought in for secondary boom at release points

Approximately 232,000 liters; 1400 barrels of crude oil spill had been released

Approximately 100,000 liters; 100 tonnes enters storm drains and makes its way into Burrard Inlet.


1st Priority – Scene assessment/Safety
2nd Priority – Containment – Boom
3rd Priority – Gross oil recovery
4th Priority – Shoreline protection & shoreline cleanup


Two knot currents


July 27, 2007

Oil Recovery

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Burrard Cleaner No. 2
12.8 Meters
8 knots
16.2 Tonne per hour
12 Tonne storage capacity

RBS Triton 10 – Portable Skimmer
2.7 Tonne per hour

6 Vacuum Trucks used

Marco Skimming belt

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MARCO Belt Skimmer video


• 1200 Meters of shoreline
• Shoreline treatment using Corexit 9580A


Corexit Application

Crab Traps filled with sorbent snare were lowered into the containment area to assess for “sinking” oil.

Response Duration

- The bulk oil on-water clean up was completed within five days
- Shoreline clean up completed within two months
- On-going monitoring completed within 18 months

Key Learnings:

- Diluted Bitumen did not sink in this situation (minimal wave action and wind, warm temperatures, clear salt water)
- Response equipment worked well during both containment and recovery
- Shoreline equipment (low pressure deluge, passive recovery) worked well
- Excellent Response Network support

Questions?

Bill Jahelka
Western Canada Marine Response Corporation
billj@wcmrc.com

Assessing Natural Resource Impacts from the Enbridge Pipeline Spill into the Kalamazoo River

Stephanie Millsap, Lisa Williams, and Joseph Haas - *U.S. Fish & Wildlife Service*

Sharon Hanshue and Jay Wesley - *Michigan Department of Natural Resources*

William Taft and Michael Walterhouse - *Michigan Department of Environmental Quality*

Jessica Winter - *National Oceanic and Atmospheric Administration*

R Todd Williamson - *Match-E-Be-Nash-She-Wish Tribe of Pottawatomi*

Douglas Beltman, Allison Ebbets, and Kaylene Ritter - *Stratus Consulting*

Donald E. Tillitt, Diana Papoulias, and Diane Nicks - *U.S. Geological Survey*

Peter Badra - *Michigan State University*

Presentation Outline

- Natural Resource Damage Assessment overview
- Enbridge oil spill incident description
- Trustees' data collection efforts

Oil Pollution Act Authorizes Natural Resource Damage Assessment

OPA (33 U.S.C. § § 2701, *et seq.*) and NRD Regulations: 15 C.F.R. Part 990

"The goal of OPA is to make the environment and the public whole for injuries to natural resources and services resulting from an oil spill into navigable waters and adjoining shorelines."

-15 C.F.R. 990.10

Trustees assess natural resource injuries on behalf of the public

There are eight trustees for the Kalamazoo River Oil Spill

How NRDA Restores and Protects Trust Resources

Trustees work with Response Agencies and Responsible Parties to:

- Ensure protection of trust resources during response;
- Identify and quantify lost resources/services;
- Implement projects to restore injured resources and their associated services to their baseline condition (primary restoration); and
- Implement additional projects to compensate the public for interim losses (compensatory restoration).

NRDA seeks to determine:

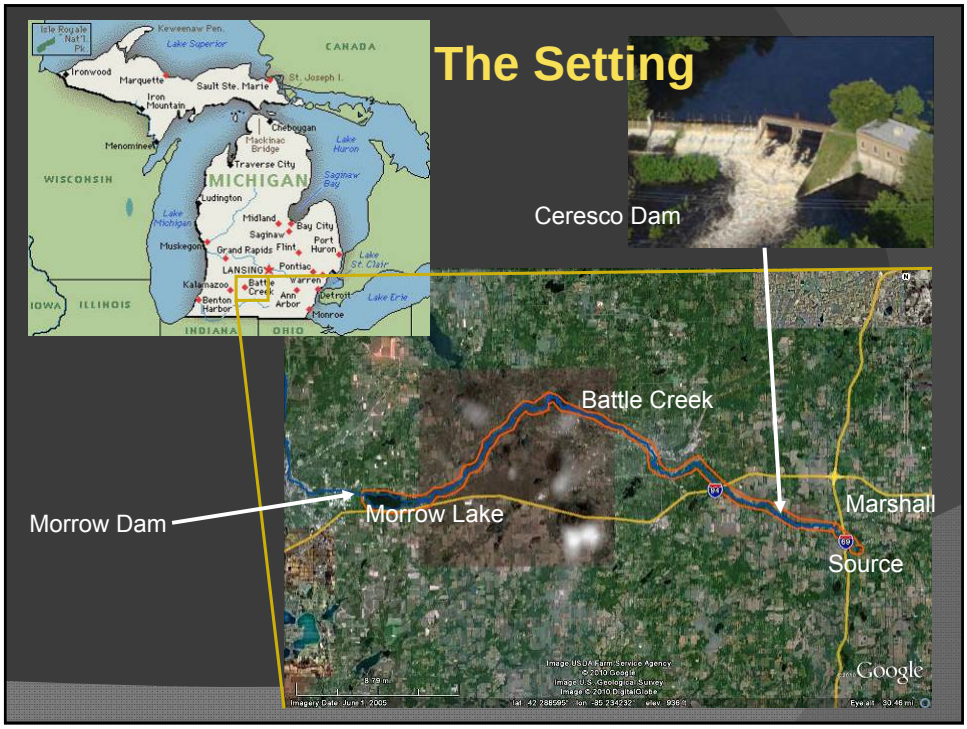
- What natural resources are/have been injured?
- What was the extent of the injury?
  - Spatial extent
  - Duration
  - Severity
- How long will the injury take to recover?
- What types of restoration projects can address the injuries?
- How much restoration is needed to compensate for the injuries over time?

The Incident

- 30” underground pipeline ruptured on July 25, 2010
- Approximately 1 million gallons of tar sands crude oil released
- Oil seeped through wetland soils into a creek tributary to the Kalamazoo River

The Material

- 2 products in pipeline at the time of the rupture:
  - Starting a batch of Cold Lake Blend (77%)
    - 70% bitumen
    - 30% diluent (natural gas condensate)
  - End of a batch of Western Canadian Select (23%)


The Setting
Ceresco Dam
Battle Creek
Morrow Dam
Morrow Lake
Marshall
Source
CANADA
MICHIGAN
WISCONSIN
INDIANA
OHIO
ILLINOIS
IOWA
Google

Assessment Tasks

- Identify probable injuries
- What data are response agencies collecting that can be used for injury characterization?
  - Coordinate with response agencies to share the data
  - Identify data gaps, develop sampling plans
- What baseline data are available and how informative are they?
  - Is it possible to conduct similar surveys post-spill?

Overview of NRDA Data Collected

- Extent of oiling in floodplain habitats
- Vegetation
- Erosion
- Fish
- Aquatic macroinvertebrates
- Mussels
- Chemistry (source oil, water, sediment, and biota)
- Wildlife
- Impacts to human uses

Floodplain Oiling Survey

- Objectives
  - Identify and characterize extent and degree of oiling in the floodplains
  - Characterize the general floodplain habitat types in the areas of the spilled oil
- Methods and Results
  - Transects at 50m intervals
  - 744 transects surveyed representing 23 river miles and associated floodplains
  - 66% of transects were oiled to some extent
  - Field observations provided to Response and data later used by Response

Rapid Vegetation Survey

- Identify types of vegetation present
- Identify rates of invasive plant species in order to compare over time

Erosion

- Proactively raised concerns to Response Agencies based on field observations.
- Reviewing erosion control plans and evaluating monitoring results.

Fish Kill Surveys

- Conducted by state fishery biologists
- Followed previously published standard protocols
- No major fish kills observed in spill area

Fish Status And Trends

- Conducted by state fishery biologists
- Followed standard protocols
  - 6 locations (2 upstream reference sites)
  - Baseline data at two sites - including a long-term monitoring site

Fish Status and Trends

- Fish data included:
  - Catch per effort and length
  - Species identification
- Habitat data included:
  - Conductivity, temperature, substrate, channel width and depth, velocity, bank and riparian condition, and large woody debris density
- Results
  - Talmadge Creek fish community was reduced and habitat greatly diminished in 2010. Some recovery in 2011 and 2012.
  - Kalamazoo River: Some declines in fish community diversity and abundance at some sites.
  - Ongoing cleanup activities require continued monitoring.

Fish Exposure and Health

- Data collected in cooperation with USGS
  - 110 fish from 4 sampling locations
    (includes 1 upstream reference)

- Analyses include:
  - Health assessment index
  - Histopathology of gill, spleen, head kidney tissues
  - Collected and archived bile samples for possible future analysis
  - Differential analysis of blood smears (potential)

Aquatic Macroinvertebrate Survey

- State biologists used pre-existing survey protocols to assess abundance and diversity
  - 7 locations on Kalamazoo River and Talmadge Creek
  - Included locations with past data
- Results
  - In 2010, diversity and abundance were reduced.
  - In 2011, scores improved, but abundance was still impacted.
  - In 2012, Kalamazoo River sites had healthy results while Talmadge Creek still appeared to be recovering.
  - On Talmadge Creek, decreased vegetative cover exposed more of the stream channel to sunlight, altering community composition
  - Ongoing cleanup work and lack of complete recovery require further monitoring.

Comparison of habitats surveyed for macroinvertebrates

- Upstream reference site on Talmadge Creek

- Impacted site on Talmadge Creek (excavated to remove oil)

Mussel Shell Survey

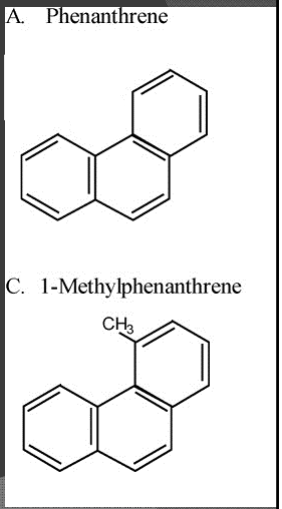
- Assessed physical condition of post-mortem mussel shells:
  - Broken vs. crushed
  - Degree of weathering, ranging from “fresh dead” to “heavily worn”
- 18 species documented
- Crushed and freshly dead shells found within spill area but not in reference area

Chemistry Analysis

- Water Column
  - 90 samples at 8 locations
- Mussel tissue
  - 12 composite samples at 4 locations
- Sediment
  - 12 composite samples at 4 locations
    - Co-located with mussel tissue samples

PAH Analytes

- Response generally analyzed for 16 priority PAHs
- Alkylated PAHs are more abundant, persist for a longer time, and are sometimes more toxic than the parent PAHs
- NRDA PAH analyses included alkyl homologues
- Some analyses also included heavy metals that are known to be elevated in the source oil (e.g. vanadium)



Wildlife Recovery

- Wildlife recovery and rehabilitation center recorded
  - level of effort and geographic coverage of wildlife operations
  - capture, treatment, and release of oiled animals
- Over 3,000 turtles, 170 birds, and 38 mammals were brought to the rehabilitation center, with survival rates to release of 97%, 84%, and 68%, respectively

Human Uses

- River closed to public access for nearly 2 years.

Trustees are evaluating recreational use of the river to determine when it recovers to baseline conditions and estimate damages.

Key Features of Oil Sands Pipeline Spill for NRDA

- Heavy oil fate and transport
- New cleanup techniques
- Diluted bitumen toxicity

Contact Information

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jessica.winter@noaa.gov

WELCOME

Oil Sands Products Working Group

April 17, 2013

Center for Spills in the Environment

Oil Sands Products Working Group

Today for Practitioners

Center for Spills in the Environment

Goals of Today's Working Group Meeting

- Answer clarifying questions from yesterday's forum
- Focus on response to various OSP spill scenarios
  - Today's response
  - Define unique OSP challenges/issues
  - What (and when) needed to improve response?
  - Changes needed to Contingency Plans

Center for Spills in the Environment

3

Answers to Clarifying Questions from Yesterday

Center for Spills in the Environment

Workshop Agenda: Wednesday

9:15 AM	Potential Areas of Impact and Resources at Risk from Oil Sands Products in the Pacific States Linda Pilkey-Jarvis and Danielle Butsick, *Washington Dept of Ecology*
10:00 AM	Goals and Format for Day 2 (Practitioners only) (Breakout Groups by Spill Scenario)
	Break
10:15 AM	Breakout Groups: Session 1
12:00 PM	Working Lunch in Groups
1:00 PM	Breakout Group Session II
2:30 PM	Breakout Group Reports
3:30 PM	Conclusions and Next Steps
4:00 PM	Closing Remarks

Center for Spills in the Environment 5

OSP Scenarios

- Train derailment along Columbia River
  - Bitumen spill
- Inland pipeline spill with potential marsh and lake impacts
  - OSP
- Catastrophic pump failure at March Point dock when filling tank barge
  - OSP
- Barge accident on reef in Puget Sound
  - OSP

Center for Spills in the Environment 6

Breakout Group Questions

- For scenarios: What would response be now?
- What issues/challenges would response face that are unique to OSP spill scenario?
  - Environmental unit, logistics, human dimensions, health & safety, etc.
- What information needed and what questions need answers to improve response to scenario?
  - Prioritize needs: 12 months, 2-3 years, 4+ years
- How does Contingency Planning need to change for OSP spill?

Center for Spills in the Environment

7

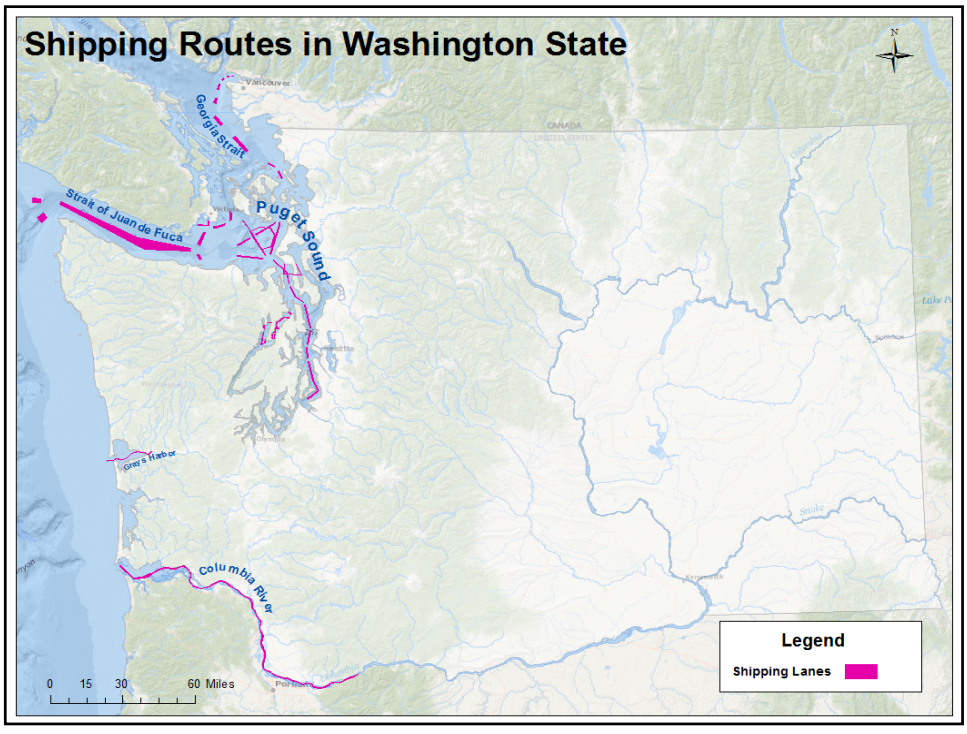
Breakout Group Assignments

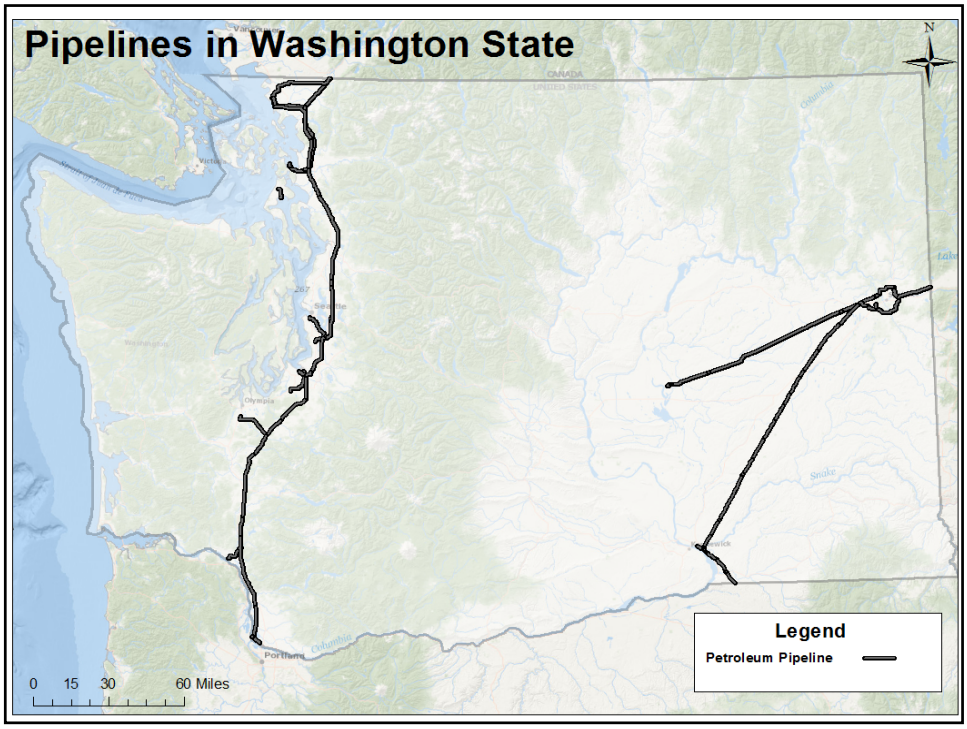
GROUP	SCENARIO	ROOM
A	VESSEL- MARINE	CONFERENCE ROOM B
B	TRAIN - INLAND RIVER	CONFERENCE ROOM A
C	PIPELINE – INLAND	AUDITORIUM STAGE
D	FACILITY – MARINE	LOBBY

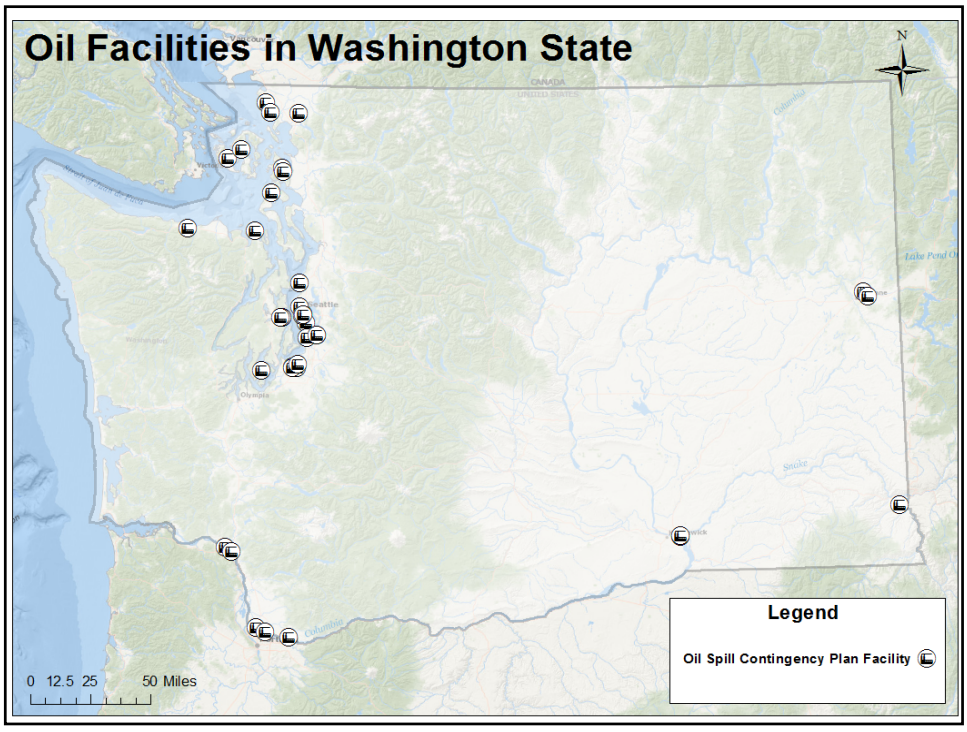
8

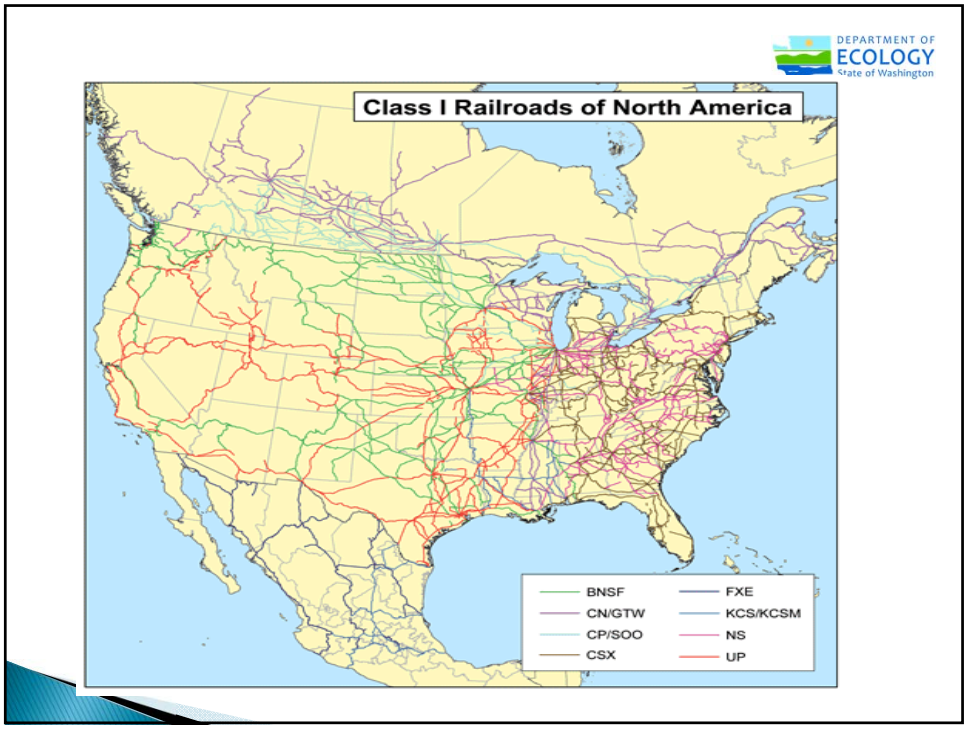
Oil Transportation Routes & Resources at Risk

Linda Pilkey-Jarvis, Danielle Butsick
WA Ecology Spills Preparedness
Oil Sands Products Working Group
April 17, 2013




Pipelines in Washington State
N
CANADA
UNITED STATES
Columbia
Lake
Snake
Olympia
Portland
Legend
Petroleum Pipeline
0 15 30 60 Miles


Oil Facilities in Washington State
N
CANADA
UNITED STATES
Columbia
Lake Pend O
Seattle
Olympia
Snake
Legend
Oil Spill Contingency Plan Facility
0 12.5 25 50 Miles


DEPARTMENT OF
ECOLOGY
State of Washington
Class I Railroads of North America
BNSF
CN/GTW
CP/SOO
CSX
FXE
KCS/KCSM
NS
UP


Rail in Washington State
N
CANADA
UNITED STATES
Legend
Rail Line
0 12.5 25 50 Miles

Resources at Risk: Sources of Information

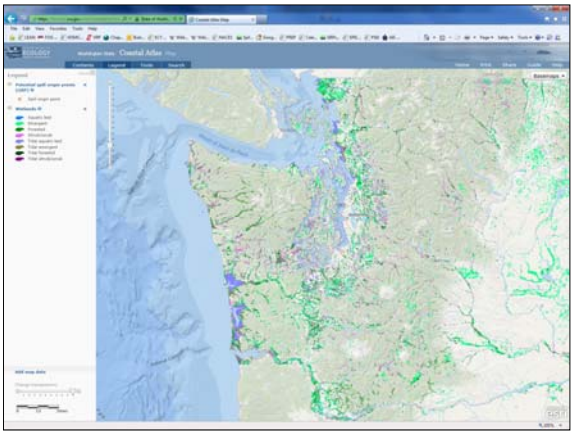
- Environmental Sensitivity Index (ESI) Maps
  - Publicly accessible data about habitat sensitivity.
  - Maps can be downloaded in PDF form or GIS data.

http://response.restoration.noaa.gov/esi

- Environmental Response Management Application (ERMA) Puget Sound
  - Online tool used by responders that shows ESI maps, ship locations, and weather. Includes static and real time data.

http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma/

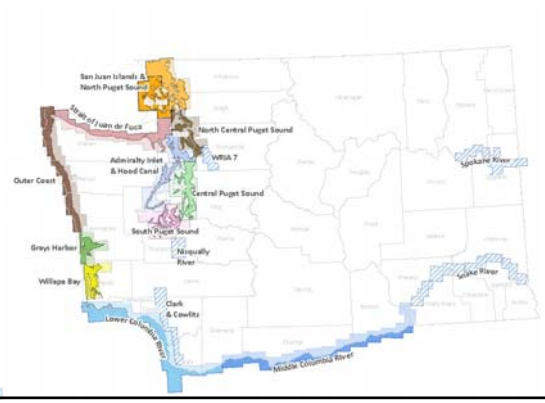
- Washington State Coastal Atlas
  - Online GIS tool managed by Ecology and open to the public.
  - Includes public access, natural resources, sensitive habitat, and other information.



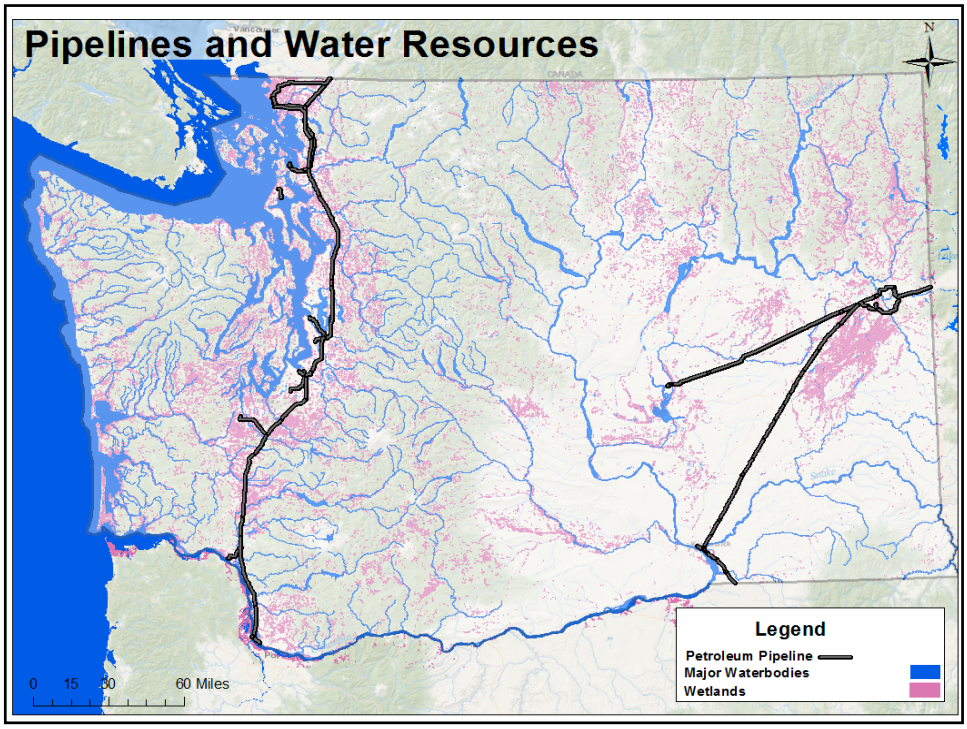
https://fortress.wa.gov/ecy/coastalatlas/

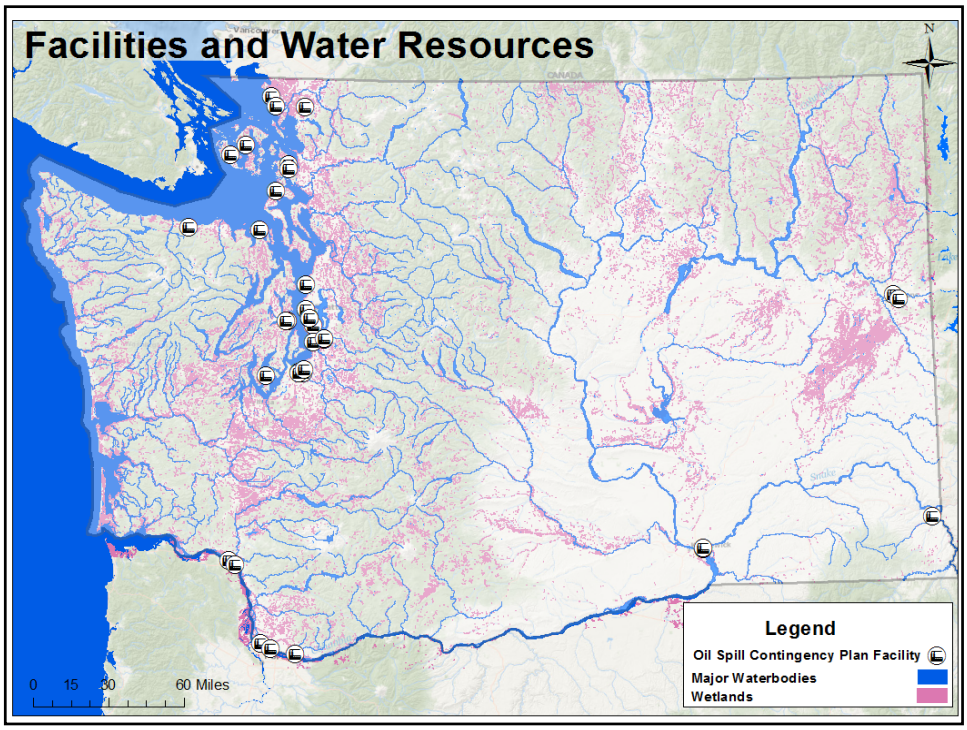
Geographic Response Plans:

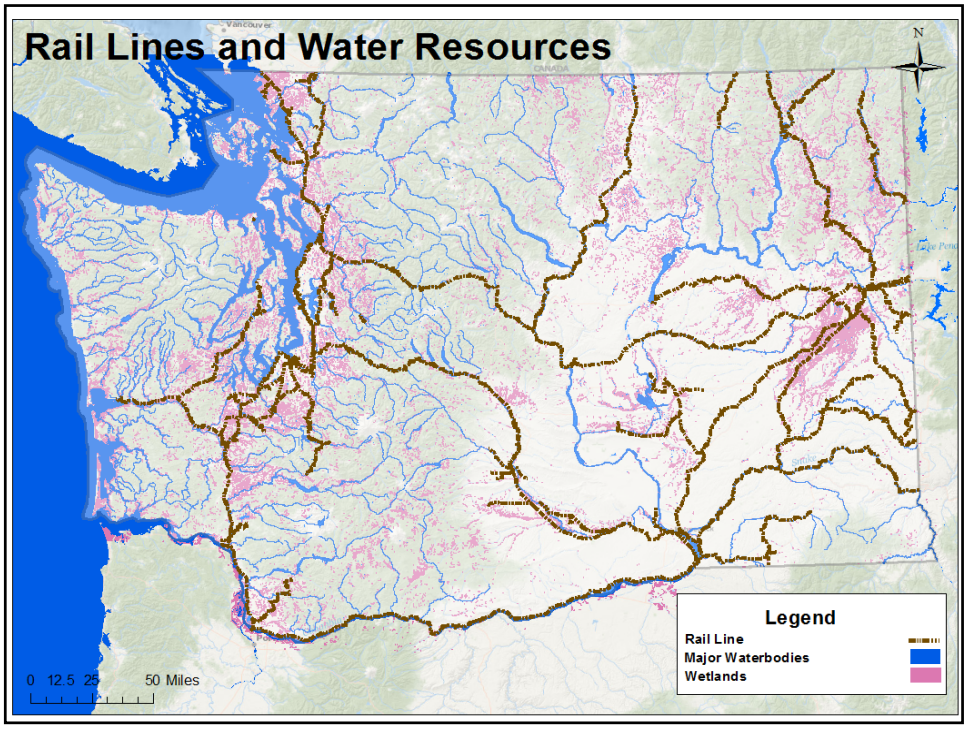
- First step in identifying resources to be protected – but not *all* of the resources potentially at risk.

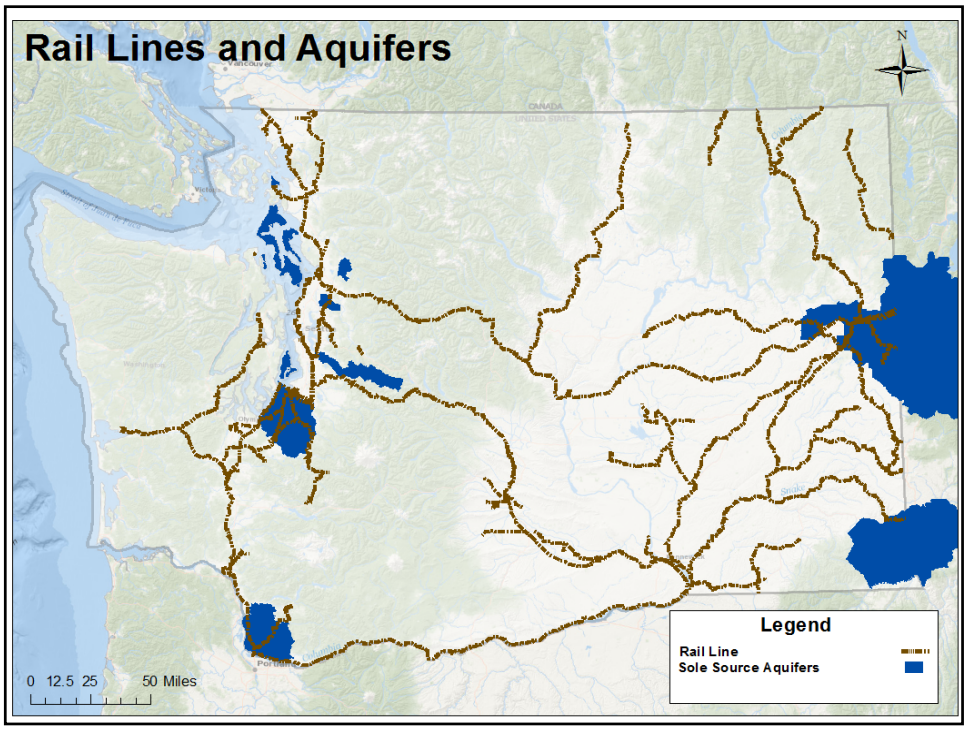


Resources at Risk: Rivers Streams and Sole Source Aquifers


Pipelines and Water Resources
N
Legend
Petroleum Pipeline
Major Waterbodies
Wetlands
0 15 30 60 Miles


Facilities and Water Resources
N
Legend
Oil Spill Contingency Plan Facility
Major Waterbodies
Wetlands
0 15 30 60 Miles


Rail Lines and Water Resources
N
Legend
Rail Line
Major Waterbodies
Wetlands
0 12.5 25 50 Miles


Rail Lines and Aquifers
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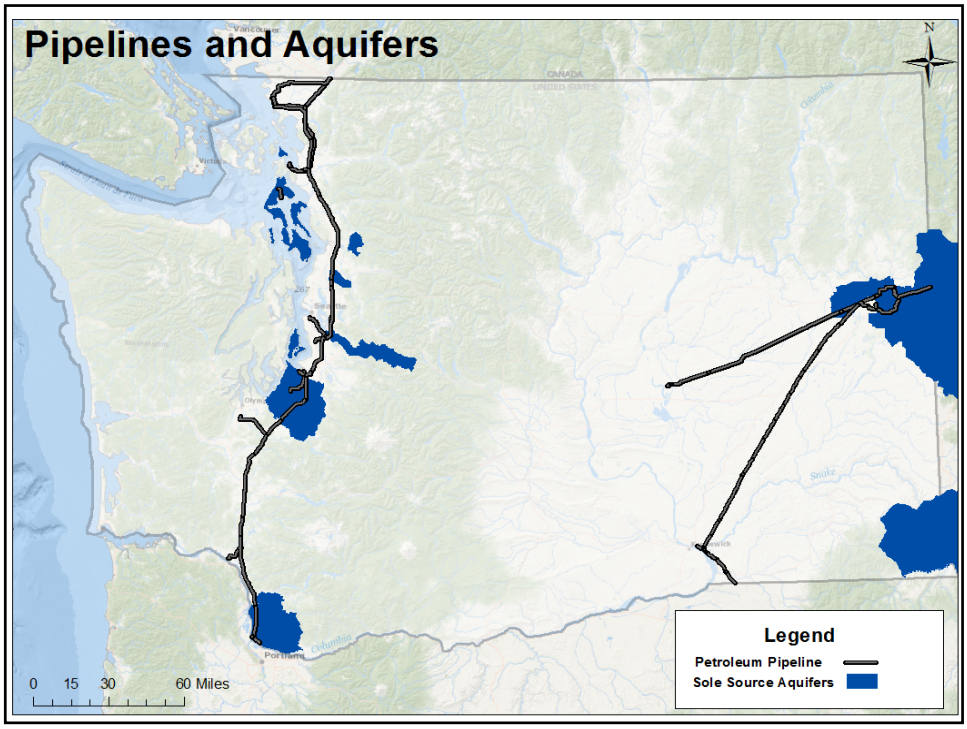
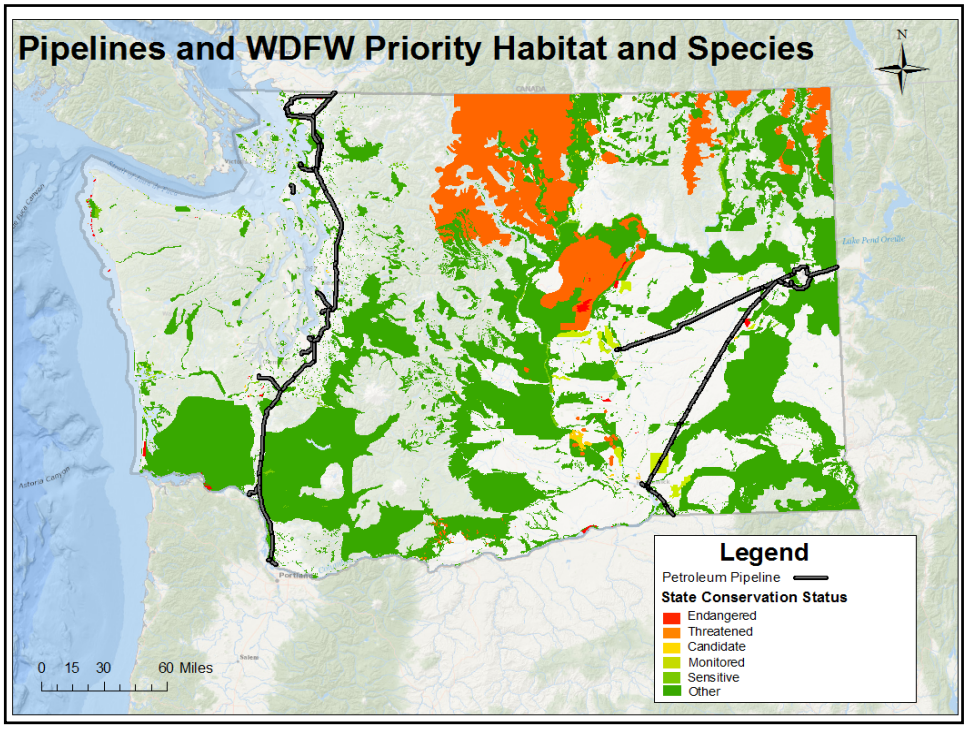
Legend
Rail Line
Sole Source Aquifers
0 12.5 25 50 Miles

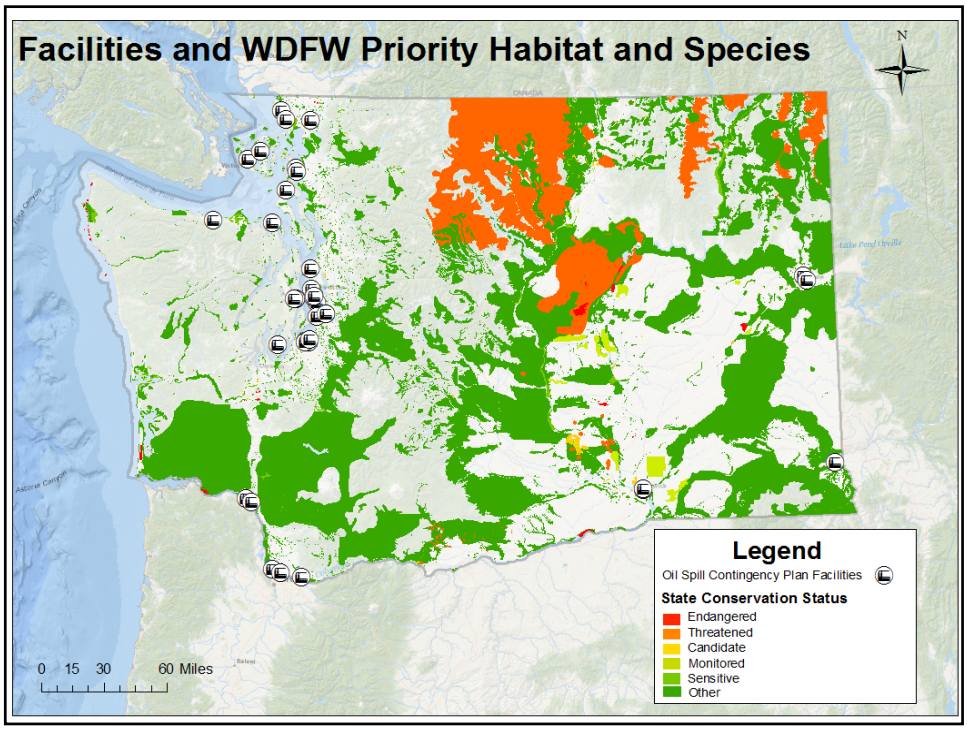


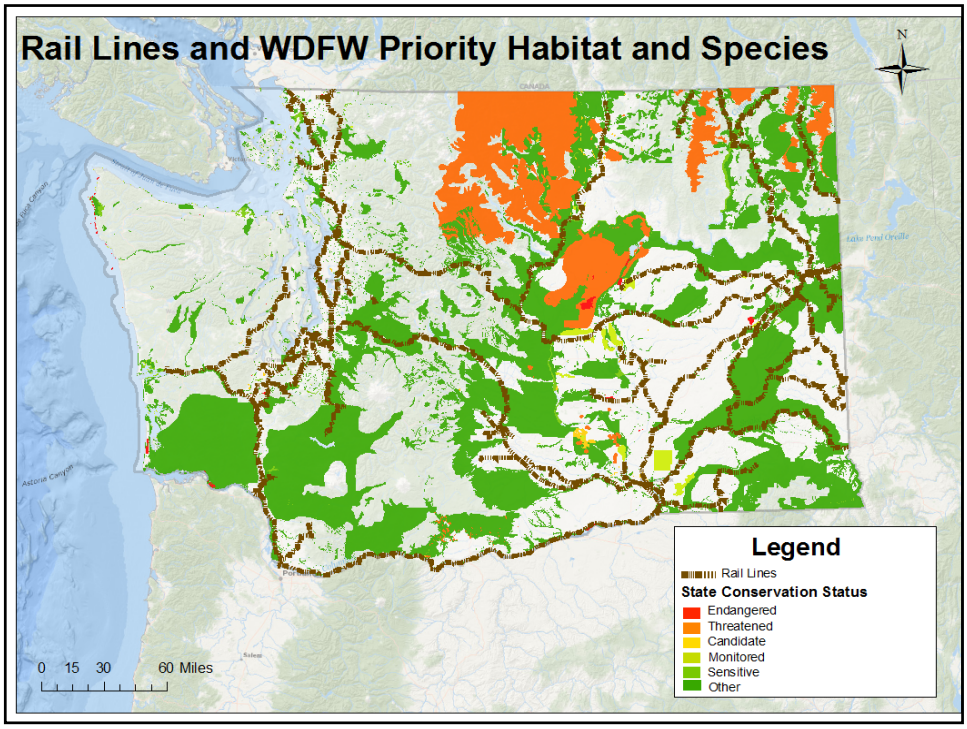
DEPARTMENT OF ECOLOGY
State of Washington

Resources at Risk:
Priority Habitat and Species
Threatened and Endangered Species

http://wdfw.wa.gov/conservation/phs/


Pipelines and WDFW Priority Habitat and Species
N
Legend
Petroleum Pipeline
State Conservation Status
Endangered
Threatened
Candidate
Monitored
Sensitive
Other
0 15 30 60 Miles


Facilities and WDFW Priority Habitat and Species
N
Legend
Oil Spill Contingency Plan Facilities
State Conservation Status
Endangered
Threatened
Candidate
Monitored
Sensitive
Other
0 15 30 60 Miles



Federally Listed Species in Washington State Waters

Threatened

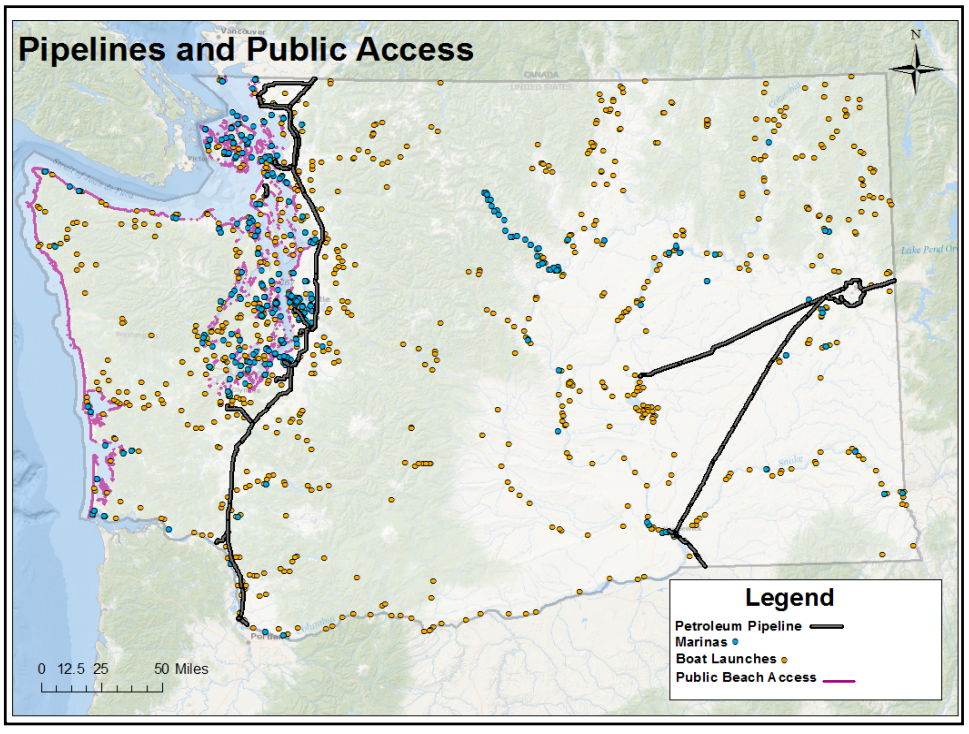
- Marbled Murrelet
- Western Snowy Plover
- Lower Columbia River Chinook Salmon
- Puget Sound Chinook Salmon
- Snake River Chinook Salmon
- Columbia River Chum Salmon
- Sockeye Salmon
- Steller Sea Lion
- Green Sea Turtle
- Lower Columbia Steelhead
- Puget Sound Steelhead
- Snake River Steelhead
- Upper Columbia River Steelhead
- Bull Trout

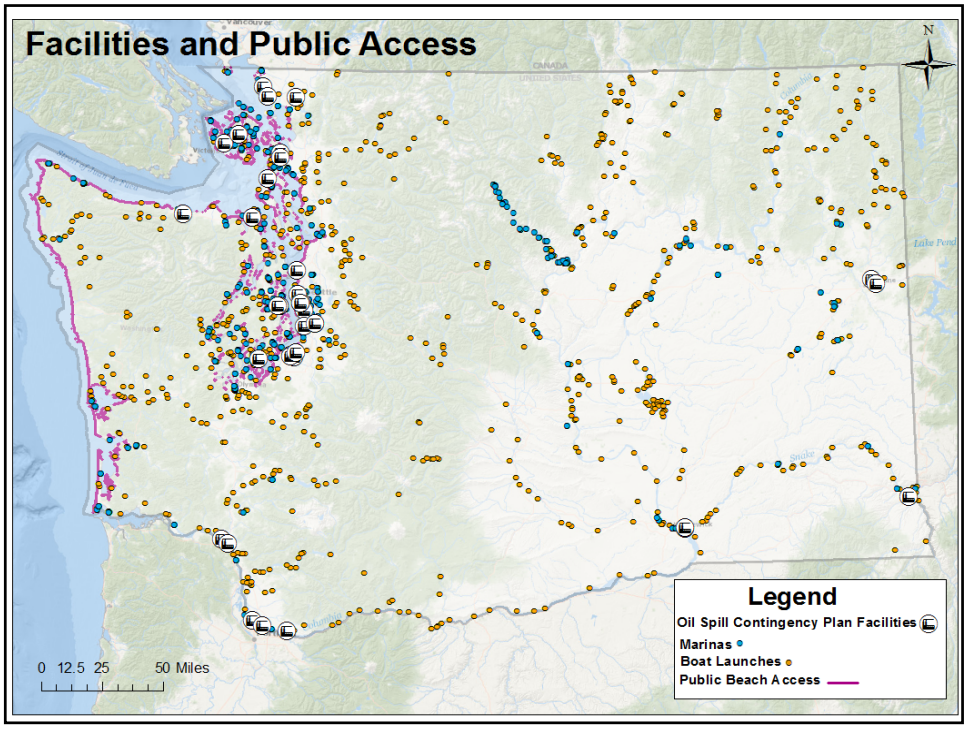
Endangered

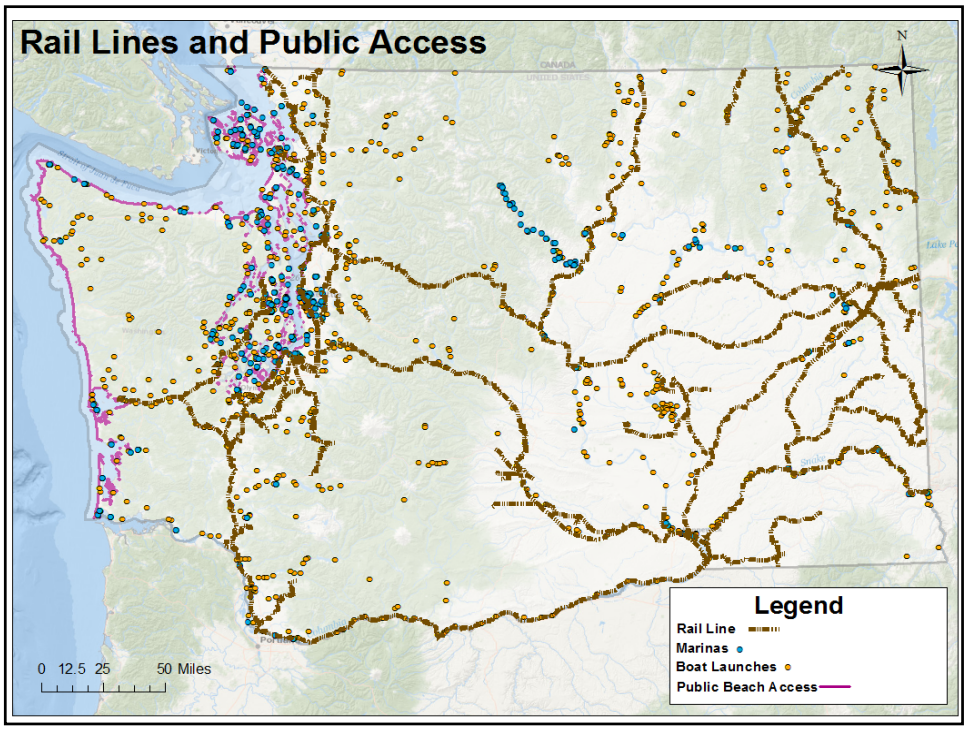
- Humpback Whale
- Southern Resident Killer- Whale
- Leatherback Sea Turtle
- Upper Columbia Chinook Salmon
- Short Tailed Albatross

http://www.nmfs.noaa.gov/pr/species/esa/

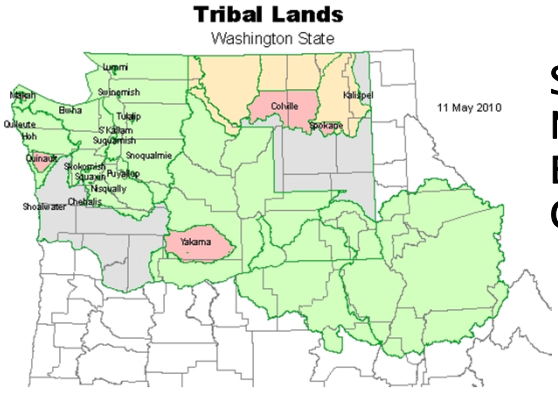
Resources at Risk: Public Access and Recreation




Facilities and Public Access
N
Legend
Oil Spill Contingency Plan Facilities
Marinas
Boat Launches
Public Beach Access
0 12.5 25 50 Miles


Rail Lines and Public Access
N
Legend
Rail Line
Marinas
Boat Launches
Public Beach Access
0 12.5 25 50 Miles

Tribal Resources at Risk:



Subsidence
Natural
Economic
Cultural

Thank you

- Linda Pilkey-Jarvis,
- Danielle Butsick

OIL SANDS PRODUCTS FORUM
NOAA Sand Point Facility
Seattle, WA
April 16-17, 2013
Meeting Notes

April 16, 2013
Plenary Session

I. Welcome/Background and Workshop Goals- (Nancy Kinner, Dale Jensen, Sarah Brace, Bob McFarland)

Notes:
Add questions/answers to the website!

II. Oil Sands Overview and Natural Resource Development (Randy Mikula)

Notes:
Geology
Resources/reserve
Environmental;-- water use, discharges
Geology update bitumen deeper forced to surface bacterial worked on the lighter crude leaving heavier
Canada #3 on world stage of reserve

- 1,7 trillion barrels resources
- Reserve what they can get 179 billion bbl.

Yrs of production 448yrs 104yr mineable 760 *in situ*.
Production rate of removal usually on the low side.
What is oil sands 85% MINERALS 10% BITUMIN WATER 5%
Upgrading Bitumen to syncrude removes carbon and sulfur. (see slide)
Diluents complex: C5/c6 paraffin's, naphtha, light crude, gas oils,

Pricing of crude underpriced because of market need to get pipelines build

Mining SAGD steam assisted gravity drainage limited surface damage
Surface mines: lot of land disturbance
Energy use more with SAGD
Cold lake deposit uses injected steam and recover up same pipe
Energy to get fuel processed to transport to market

Environmental:
Disturbance 400,000 sq. KM
Land disturbance to include all of the exploratory areas (Native Americans) much greater
Water use:

- Big issue
- Tailing ponds MFT mature fine tails (collects in tailings pond)
- 2 Barrels of water to 1 bbl. bitumen
- Dry stackable tailings
- Centrifugal technology 8 in operations at Syncrude
- Slide shows comparison of water reduction

Water quality

- Late next to Syncrude tailing pond
- Water from tailings used calcium to reduce tox reduced tox in half.

Questions:
How much sand up with process of SAGD that is part of process that requires energy. Not much with SAGD as oil doesn't come up.
With heavy oil extraction more energy to remove sand less for extraction.

Native American comment need to work together to balance stakeholder perspective.

- Need to balance risk --- What is the long term issue more than the economics also balance human issues, way of life and environmental.

There's is a cleaning facility between extraction and shipping (screens)

III. Characteristics of Oil Sands Products (Heather Dettman)

Notes:
Simplified chain shown tin slide to get to transportation (Slide) - syncrude
SAGD light and heavy fractions all together
With bitumen and diluent these are blended product
Goes to a cleanup before into pipe
First pipe gathering pipe has a lot of erosion, corrosion
When you get water and sand off, then less problem to get to final cleanup. Final cleanup
Initial BP 204/399.3F
50% above 524/975 F
Biodegradation has resulted in organic acid in oil
70% of acid above 524/975F
5wt% TAN salad dressing TAN 47
Nat gas condensate liquid which comes up with gas (CRW)
Syncrude upgraded product
Diluent dilbit 3o% to meet specs
Syncrude 50% to meet specs
Crude monitor.CA for info
Bakken has only 10% of material in tar range

Initial point of boiling starts at 0
Dilbit boiling ranges much as 50% high BP

Light crude not necessarily go for you (slide). Important for benzene release for responders.
Transport of oil specs—in pipes (slide specs)
There is now some hot bitumen of transported by rail. Heat up and put in tank cars
Most corrosion from pipe in water. Corrosion comes from outside or in areas of sludge buildup.
Acids removed from oil sands in washing process.
Organic acids called (naphthenic acids) are problem in refinery where the acids become concentrated.
In OSP although TAN higher the washing of material in process keeps smaller more corrosive acids down
When sulfur is in form of H2S than can be problem. In the heavy bitumen the sulfur is tided up to carbon thus not problem in pipeline. Could be in in refinery in cracking more corrosive.

Sand low in dilbit because removed in preprocessing.

Questions:
When dilbit is spilled it does not come apart? Yes light ends may evaporate but not split
When spilled does benzene separate quicker. Boiling point same in all oils for benzene— so evaporates similarly In oils with more gases Bakken might carry benzene off quicker.
Crudemonitor.ca website
How is oil from OSP defined for taxes? Calif. Has rules to define oil which will be provided to NEK.

IV. Panel: Transportation of Oil Sands Products (rail, pipeline, vessel)

Notes:

Justin Piper BNSF crude oil transport.
Rail slides with amount of transport. Small amount but big % increase of crude
Accident releases most at shipper facility
Accident rate 1.88 /1miilion train miles
If bitumen is hot tank car is jacketed when added hot
Community training for commodity on routes
System Response plans and also separate plans for large facility. Drills each year to test.
Accident prevention/engineering (slide)
Incident notification to Fort Worth> Work with others under incident response structure
Use GIS to help with response (slide)

Michael Davis Kinder Morgan
Trans Mountain Pipeline Edmonton to Burnaby. In process of twinning pipeline to increase capacity
20% of capacity in yr. bitumen
2012 refinery capacity (slide)

Tankers currently 8 0f 10 goes to Calif. I to Asia I other locations.
-- 5 tankers/mo.
Potential to increase 5 to 34 tankers/mo.
Puget Sound system increasing capacity to service areas (slide)
Emergency response plans for system and utilize training
Energy re. Bd. Regulates operation of pipeline.
In Canada the port and shipping is reg. by the Canadian Coast Guard.
Tariff Product quality (slide).
Doing study on fate and Behavior (slide)

Dick Lauer: Oil transport on water
3 types upper Columbia Barge ops
40-50KB limited to 14ft.
Double hulled with vapor recovery
Refined material

Lower Columbia and Sound
Ocean going
Double hulled
Vapor Absorb. System
Refinery feedstock

Articulated barge-tug
Double hulled/vapor recovery
Crude transport

Barge for transport from Kinder Morgan
90kb
6/month

Initial responders on barge are on barge
Ability to use double hull to balance load and use hydrostatic balance to reduce flow rate and keep barge afloat

Question for rail. Who is responsible for spill. Rail company takes responsibility once they take on cargo. Later if issues with car safety liability may be distributed legally.
Where is equipment for response kept? Specialized equipment in Pasco other locations have equipment for oil.

Marine response: responses are built on tanker size so the equipment and personnel are prepared for much larger spills.
Cost to deliver:
Pipeline, barge, rail truck in lowest to highest cost. Many factors. Pipeline highest capital cost.

V. Fate, Behavior and Modeling of Oil Sands Products (Bruce Hollebone)

Notes:

Polycyclic Aromatics Hydrocarbons (PAHs) most important for tox.
Bitumen chemistry compared to other oils – no alkanes (lost to biodegradation)
Weather factors: Slides

- Evaporation- lost parts but chemistry not changed
- Dissolution and solubility
    - Dissolution important for toxicology to organisms
    - Energy, temp conc. Impact

Photo oxidation- changes density

Water uptake—fine water into water. Changes density, not chemistry. Emulsion can last from days to years

Combination of photo oxidation, water uptake changes behavior (slide)

Sediment uptake-- increases sinking

Sediment dispersion interaction combination—dispersion into droplets in zone of high activity. Creates larger surface area and more rapid interaction other weather factors (slide)

New info Kalamazoo—increase in temp decrease viscosity oil may be released from the sediment

Transformational changes

Chemical weathering

Biodegradation—aerobic vs. anaerobic

Open questions

Changes due to evaporation
Dispersion of droplets
Resuspension and remobilization
Dissolution in water and toxicology
Persistence
Interaction of factors

VI. Enbridge/Kalamazoo Case Study Including Response Technologies for OSP (Ralph Dollhopf)

Notes:

Containment of oil was at dam at Morrow lake at dam
Public health

Monitors for workers safety and public health

Readings air monitoring over 40 miles of the river

Scat over 40 miles and mapped into GIS for overbank oil

Used pompoms in crab pots across flow of the river

Islands severely contaminated
Ultimately removed part of the island
Used bags and pompoms to lift out material

Day 1 July 2010
River in 25 year flood stage
843000 gals
Submerged oil to natural deposition areas
Initial 740000 in first few weeks
Day 40 to 607
Submerged oil and overbank material
Spring 2011 overbank under control
Excavate Tallmadge creek twice 2nd time reroute of the creek
Submerged oil used poling initially to determine location
Used water jets to agitate and others recovering
Employed a cost benefit approach to help with the remaining tactical areas where submerged oil existed (used experts to help with this)
2011 approach sediment traps to trap residual amounts where remaining oil was left.
Sheen still manifests due to temp or agitation from boating and water movement. Sheen most consistent where sub oil known to exist
Oil from the delta continues to move into lake—a concern.
Going forward dredge the delta area 5 miles of the river. The remaining 35 miles would use the sediment traps. This would be a be a maintenance operation
Continuing sub oil science

- Submerged oil mobility
- Transport modeling
- Temp. effects
- Biodegradability
- NEBA
- Oil Mineral aggregate formation
- Forensic chemistry
- Ebullition

VII. Burnaby Spill Case Study (Bill Jahelka)

Notes:
Burnaby July 25th 2007
Dilbit spill
Portable skimmers and skimmer vessel
Skimmers worked as they would for any crude oil spill
Able to get to site quickly and were successful recovering
Corexit 9580q flushing product to oil off intertidal
Add corexit then wash shore wash it back where it can be skimmed
Shoreline cleanup took month

VIII. Assessing Natural Resource Impacts From the Enbridge Pipeline Spill into the Kalamazoo River (Jessica Winter)

Notes:

NRDA overview
Trustee efforts
8 trustees including 2 tribes
Studies
Veg study
Erosion study
State fish kill study. No major fish kills also monitored O2 in areas where dredge remediation was occurring
Fish status and trends – used long term monitoring sites from ongoing study
2010 Tallmadge creek initial decline now recovery
Other areas minor impacts
Fish exposure and health 110 fish from 4 locations. Some gill lesions
Aquatic Macro 2010diversity and abundance impacts
(See slides)
Mussel shells survey Impacts of cleanup and vessels on mussels
18 species
Crushed shells in spill sites but not in reference sites
Classify death time by degree of weathering
Chemistry analysis
Water column
Mussel tissue
Wildlife recovery - Turtles tagged on release (3000)—no plan for that yet
Public recreational uses underway to see how long it takes to return to baseline.
Features of NRDA
Heavy oil transport and fate
New cleanup techniques
Diluted bitumen tox unknown

IX. Wrap-Up (Nancy Kinner)

Notes:

Report marine Capt. Ferguson
Notes and presentation

PRODUCTS FORUM
NOAA Sand Point Facility
Seattle, WA
April 16-17, 2013
Meeting Notes

April 17, 2013
Plenary Session

X. Recap and Questions from Day 1 (Nancy Kinner, All)

Notes:
Question for train STIC code assigned to rail cargo. Defines overall characteristics of product, does not tell various types of diluent.
Shipping questions- What types of material will go to straits of Juan DeFuca. There will be increase in shipping through straits based on kinder Morgan estimates. 5-34 barge load

Questions: How much energy is required to get OSP to market. All crudes will be equivalent after reach shipping point. Energy for SAGD for steam is high. In hot water scenario have reduced temp from 80C to 40C
Economics indicate they can do energy and still make money.
Pipe specs determine what is actually used so everything beyond loading is a blend.
If bitumen is spilled into marine environment will it float. Initially it will float then it may sink later depending on weathering.
Will this act like other crude? Dilbit may sink quicker than other crudes because it is closer to density for sinking.
It is like many other crudes brought in to be blended like other crudes.
shippers also view it like other crudes
How it weathers is different than other crude. Need to be prepared for responding to the different weathering
It is a hydrocarbons, petroleum so it reacts like petroleum. 2 examples: Burnaby and Kalamazoo show it react differently depending on other environmental conditions.
there is not much known about the toxicity for OSP. Research is beginning. Only tox. Data is focused on PAH
More information needed on droplet size and exposure to better understand the tox.
What the bitumen is diluted with will determine more about who the OSP will react in the water.
The diluent that is more solvent like will make it more different from other crudes The long term fate of oil is different with OSP. Examples where over time the bitumen will sink then as bacteria eats up ends of bitumen it may rise again (example in tailing ponds in Alberta)
Odor issues/air issues in emergency response. Based on what seen in Fort McMurry there are odor is probably based on what on is used as diluent. With more solvent type diluent there may be more odor and need to monitor.

Diluent/bitumen together they do not separate
Showed the curves again that indicate that the light ends C5-C6 (15 hrs.) of dilbit do evaporate rapidly that then the rest weathers slowly and the buoyancy will approach 1.0 – and sink more of a reality.
Need 80C to get pure bitumen to get it out of tank cars. May be less with diluent.
Are diluents propriety? No they are not in transportation system. Some diluents in the use at site for recovery are proprietary.
How much of the Kalamazoo sank—need to ask Ralph still in study
Is Dilbit and Synbit dispersible with dispersants? Burnaby dil/synbit tested with limit effectiveness. No work yet on dilbit. Expect that most will react like crude.

XI. Potential Areas of Impact and Resources at Risk From OSP in Pacific States and British Columbia (Linda Pilkey-Jarvis, Daniel Butsick)

Notes:
Regional plan has been blended into overall regional plans. Task force working on a broad plan.
Shipping traffic significant.
Wash and BC traffic to Asia
Existing plans do not have action for persistent oil
Grays harbor is looking permit a shipping facility for crude, Transport to California and potentially Asia
Pipelines Major lines transiting states
Oil facilities on major waterways. 5 refineries in Wash.
BNSF is the major carrier. Working with state on larger scale planning
ESI maps available in GIS data—can be accessed.
Presentation Maps (slides)
Tribe is sensitive issue. Tribes are represented on unified command.

Scenarios:
Train derailment
Inland pipeline spill
Catastrophic pump failure
Barge Accident on reef in Puget Sound

XII. Goals and Format Day 2 and Group Questions (Nancy Kinner)

Group Questions:

1. For these scenarios, what would the response be now?
2. What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these OSP spill scenarios?
3. What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).
4. How does Contingency Planning need to change to accommodate an oil sands product spill?

XIII. Breakout Group Reports

Group B: Train – Inland River (Holly Robinson)
Notes only:
Undiluted bitumen
Track close to river
Bitumen into River
Surface sheen and sinking in water downstream
Attack as a normal spill
Identify intakes on the river that might be impacted
Identify important species that might be impacted
Understand where equipment was located relative to spill for submerged oil
For Information needed: Red, Yellow Green relative timing (notes)
Contingency planning need info sheets for public
Collect available reports
Task force to develop planning

Group A: Vessel – Marine (Capt Ferguson)
See Group Notes and Presentation

Group D: Facility - Marine (Graham Knox)
Notes Scenario Storm at Facility remove the pre-booming and a pump failure released into Padilla Bay.
Notes:
Response similar to other spills but because of syn or dilbit may change sinking or other air issues
Need to define products better
Models need to be improved to predict transport
Develop/understand case studies and lessons learned
Recommendations added to ADIOS
MSDS sheets for products
Find manufacturer details
Evacuation that might be needed

Group C: Pipeline- Inland (Brad Martin)
Notes & need the paper copies
Native American consultation
Drainage to Bellingham Bay
Benzene monitoring important component

- Monitoring
- Sampling

Cleanup techniques shoreline
Discussed Volunteer component (college town)
Security control
Strategies for recovery of sunken oil in western rocky stream
Lake small and surrounding wetland – could you use boat or would it disturb more

Info needs:

- What is the oil
- Training who has the training
- Chronic toxicity studies
- NEBS analysis
- Weathering data for the oil and what are the useful tools for the responders
- Who are the right people to communicate with to get the right information on oil?
- What instrumentation is available sonar?
- Groundwater impacts – what are they and how to address them.
- Question on effective shutdown—did some calculations. And determined the amount was correct—Used worst case scenario of amount in the pipe over a certain length.

Follow up with links on the detection of submerged oil

XIV. Wrap-up Next Steps (Nancy Kinner, All)

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Break Out Group Number: Group A
Breakout Group Scenario: Vessel - Marine

General Questions to Addressed:

For these scenarios, what would the response be now? Come up with generic response, and then assume worst case scenario.

Launches air crafts, cutters, salvage teams, set up command coast at second and then find second command post closer to the incident? Dispersants? Burning it or use a polymer. Mechanical response to. EU to discuss air monitoring and safety is important for responders and community. Early aspects of response. Marine protected areas and other sensitive zones. Information management aspect must be robust and needs improvement…100 folks focused!

Be specific to the scenario described!

Can dispersants be effective? We don't know! Know your oil in the area and its characteristics. Who is responsible to do that science and testing to determine the affective use of dispersants? Know what the risk is. The products that are approved are often not available.

*You must know what actually spilled! Will we know what is in the barge that spilled and who would tell us. MSDS will give information on crudes and chemistry. Can we ask the people who blended the crude in first place? We need conversation with industry to get back to source and provide information. Bring in specialist of source oil and can go to a lab to analytical response. Tank samples can imprint the oil.

*What is the public thinking in a spill incident of this scenario? Tar sands oil spill! This is politics and messaging. We need to be able to capture a message in the case of a tar sands oil spill! States, feds, and

locals on same page and what the spill actually means.

Are we going to have to address people's concerns? This has to do with communication.

RP will be operator of vessel? Who owns the product? They are the incident commander. River or Puget sound plan. Who owns the oil is the RP, but the incident commander is: "tom"

Laws define whether the carrier or owner pays the "bills". 1 RP in a marine setting. Someone needs to step up and make it right.

Who has official MSDS? Cold Lake Crude oil is a standard oil.

Not much information available on how long it takes oil sands to weather and sink. When will the oil be beached? We do not know about the mixing. What is the sediment going to be like? Can NOAA's model be used for oil sands when it is used for standard crude.

*What is the limitation of putting booms, and skimmers? Conditions limit the response. Safety assessment is done to know when we can work with respect to the slick, which MSDS can we use.

Distillation curve will be get online. How long does it take information about the characteristics of oil? The details. Air monitoring on the beach. Spring will have freshwater interface and have lots of particulates and cause sediment interaction. Is it coming ashore?

Time of day is important.

*How much of the information do we need to know ahead of time and what can we get at the time of incident? "Bill" site has compensation data and does analysis of oils and once a month. It often takes days or weeks to get good info about the product.

*Lack of common nomenclature about what the product is! We should require everyone to start using same names.

The spill is finite. First we will stop the spill, and then waiting a week - a lot will be on the beach. Am I going to have a sinking problem with a 5 day period? Will it sink or get to beach first?

7 foot swells, turbidity…this will likely cause sinking.

Once oil goes below the surface is there a practical recovery? Fluorometers and sorbent pads. Sonar will likely not pick up submerged oil. The question goes back to how fast it sinks? Can divers work down there? 5-10 m/s? man submersible? Would the oil be detectable by fluorometers. What conditions would induce submerged oil.

Pompom snares work during tidal cycle to catch oil in rivers & inlets.

Gears and mechanical gear would be out there. Can contain and skim at lee. Teams doing salvage work teams. Would Coast Guard be activating every available resource? (Yes!) and dispersants. US plan would be activated.

Would we plan for the oil sands to sink?

Air quality issue*

Diver and ROV incidents are available. We need to know about the air monitoring issue. Decant oil is in the area. Other group is as well.

- **What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these scenarios?**

Environmental Unit –

- Submergence monitoring and response of oil
- shoreline cleanup of heavy/sticky oil – disposal and collection.
- oil sands toxicity (seafood contamination)?? Elevated benzene levels in shell fish? No thorough toxicity studies. Consider benthic creatures if submerged.
- Access to Best available science. (submergence, dispersants, toxicity)
- *in situ* burning
- Wildlife rehab

Logistics –

- Benzene monitoring equipment
- Appropriate equipment and thresholds for responders

Human Dimension –

- Training of local health departments
- Public perceptions of tar sands
- Develop liaison group and trusted sources
- Languages (Spanish)

Health and Safety –

- air monitoring
- responder and public safety
- seafood contamination

Precise definition of what the crude oil is. Need to monitor at water surface and water bottom.

Response tactics of submerged oil fluorometers, laser instruments. Real time mass spectrometery. You need to cover a large area. Pompoms, anchors, towing, show where it isn't if you can't show where it is. Remote sensing from aircraft? Visibility will likely be an issue. Once it is submerged you won't be able to use aerial tactics. ROV and man submersible and bottom trawler were proposed. International maritime organization hasn't done too much either. When will the different types of oil sink? No aerial tactics because of visibility. Lidar – Germans. IMO report coming out in MAY.

- *In situ* burning can be an issue with the public

Beaches accreting may collect more oil

There is little predictability of where the debris oil will go.

- **What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).**
- equipment inventory for responding to submerged oil for recovery and modeling (now), air monitoring inventory on wide level.
- know your oil and the science (now)
- terminology

- Messaging (now)
- engaging local health officials
- best available science
- capturing lessons learned from previous spills
- How and when shoreline cleaning agents are used (9580, cytosol)
- Behavior model of oil sands (submergence)
- Knowledge of dispersants and burning

Will we have submerged oil? We do not know, but this is an information need!

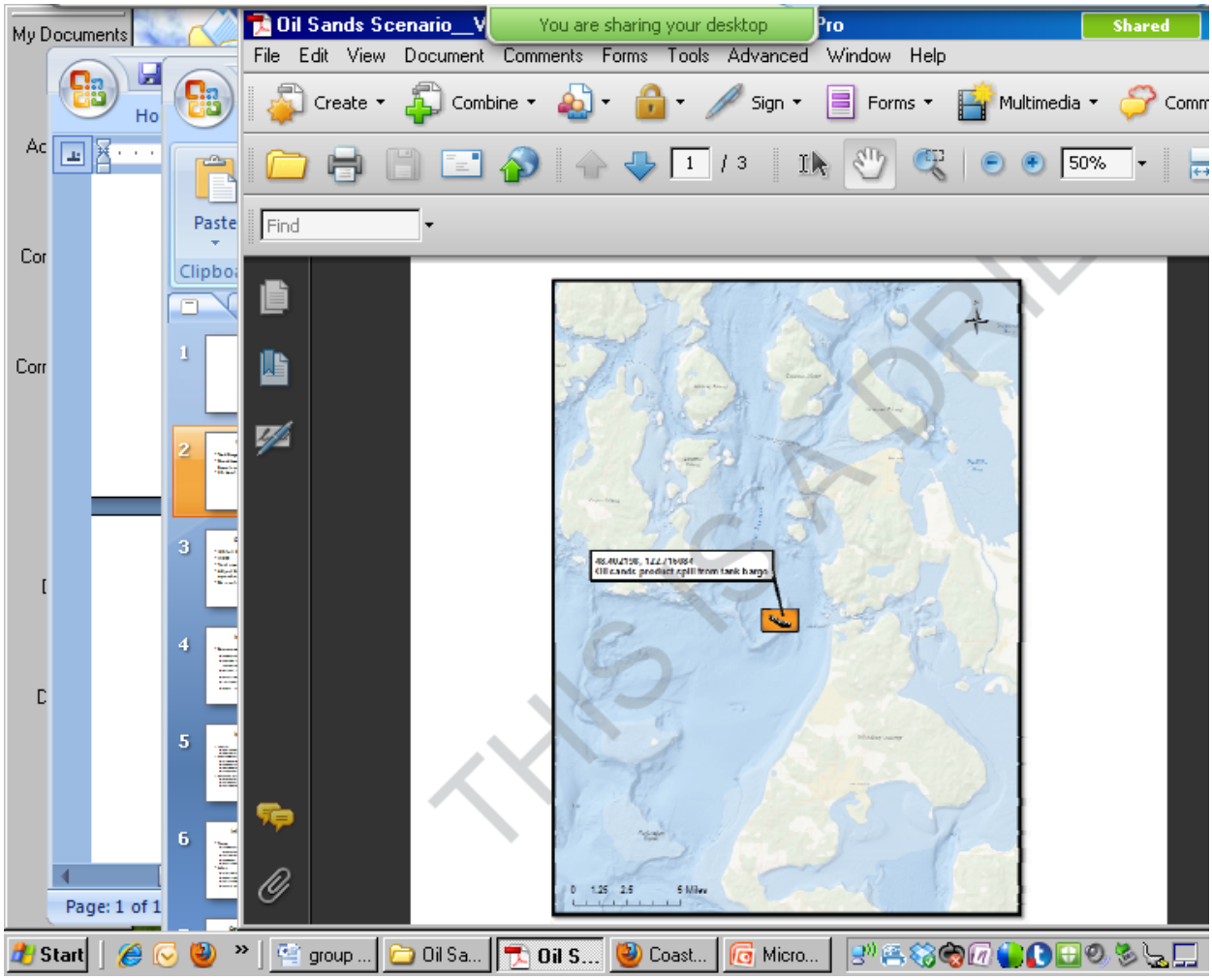
- Natural biodegradation of oils sand products? Long term persistent of product is a function of this and how aggressive you need to be to clean up.
- Much of microbial biodegradation that can happen has already happened in its formation in the ground.
- Aerobic vs. anaerobic degradation? Beach vs. 600 ft deep.
- Public perception! Sheening may not be an issue, but it scares the public.
- Monitoring may help with this. No one is capable of Deepwater monitoring, dispersant monitors don't go down far enough.
- Have a dialogue with the biologists and scientists to help with unified message. Do the outreach and communication ahead of time! Explain to public how spill actually works.

- Contract OSRO
- true toxicology of product and what level of safety protection is need. May not B or A, but need monitors
- Crab pots will locate submerged oil, but maybe not suspended oil. A plan to be able to have platform, equipment, and sampling strategy to get at submerged oil.
- Vessel response plan, brp, communication plan. Communication contingency plan.
- How much time will it take the oil to weather…will it sink?
- What is the best way to recover submerged oil? We should talk with public and key decision makers. Large majority of oil will be recovered, but not before it goes on beach. Science knowledge and communication skills to talk with public. Information management (press releases and pre conferences) we should use social media. Explain to public sensitive areas of protected, but will be on beach. Who will do this?
- Marine biologist population is high in area

- The unified message may not be OK with the public.

- **How does Contingency Planning need to change to accommodate an oil sands product spill?**

Air monitoring and subsurface monitoring needs to be part of the contingency plan.
Understanding how the products are shipped
Incorporate OSPs and Drills
Shipments are not taxed to pay into the fund



Other Notes:

Important scenario points:
Tank barges are representative transportation of oils sands.
Puget sound
85,000 barrels on barge
Grounded oil tank barge the response is to 85,000 barrels. Launch everything quickly.
Tank barge is doubled hauled

Sea conditions, 35 knots and tides.
Current and winds drive mobility of oil sands
1 or 2 helicopters mobilize din 8 hours and recovery assets mobilized
Staging area and command post within 8 hours
Damage assessment and fire-fighting to deal with flammable cargo
Wind will be blowing from southwest! San Juan island people will smell this!
600 ft of water

Crude oil vs. bitumen spill? – There will be response to the same initially. At what point can we anticipate a divergence in response and how would we change the response knowing it's an oil sands products.

Do comparison of North Slope Crude with the oil sands product! Alberta light crude?

Sunken oil plan should be in place now, but we don't. Do not have equipment in place now. Divergence of OSP and crude plan should diverge before it sinks! Potential differences in way it behaves in environment. Volatilization?! For safety reasons and then talk about probability of oil sinking. H2S, sulfur, but do not monitor for benzene. PPB rays may be needed and more specialized equipment to monitor benzenes. Worker exposure. Odor occurs before you see it and concerns the public.

In situ burning - there is an air monitoring plan, but not here. Many industries have higher people capability to do widespread monitoring. Maybe government should use the same. State, National Guard have a support team that are good.

When the public response perception comes into play? What would be the response?

Do I clean water first or shoreline first or both? Will this flow away on a tide…yes! Leave it on beach a little longer than a crude oil maybe..

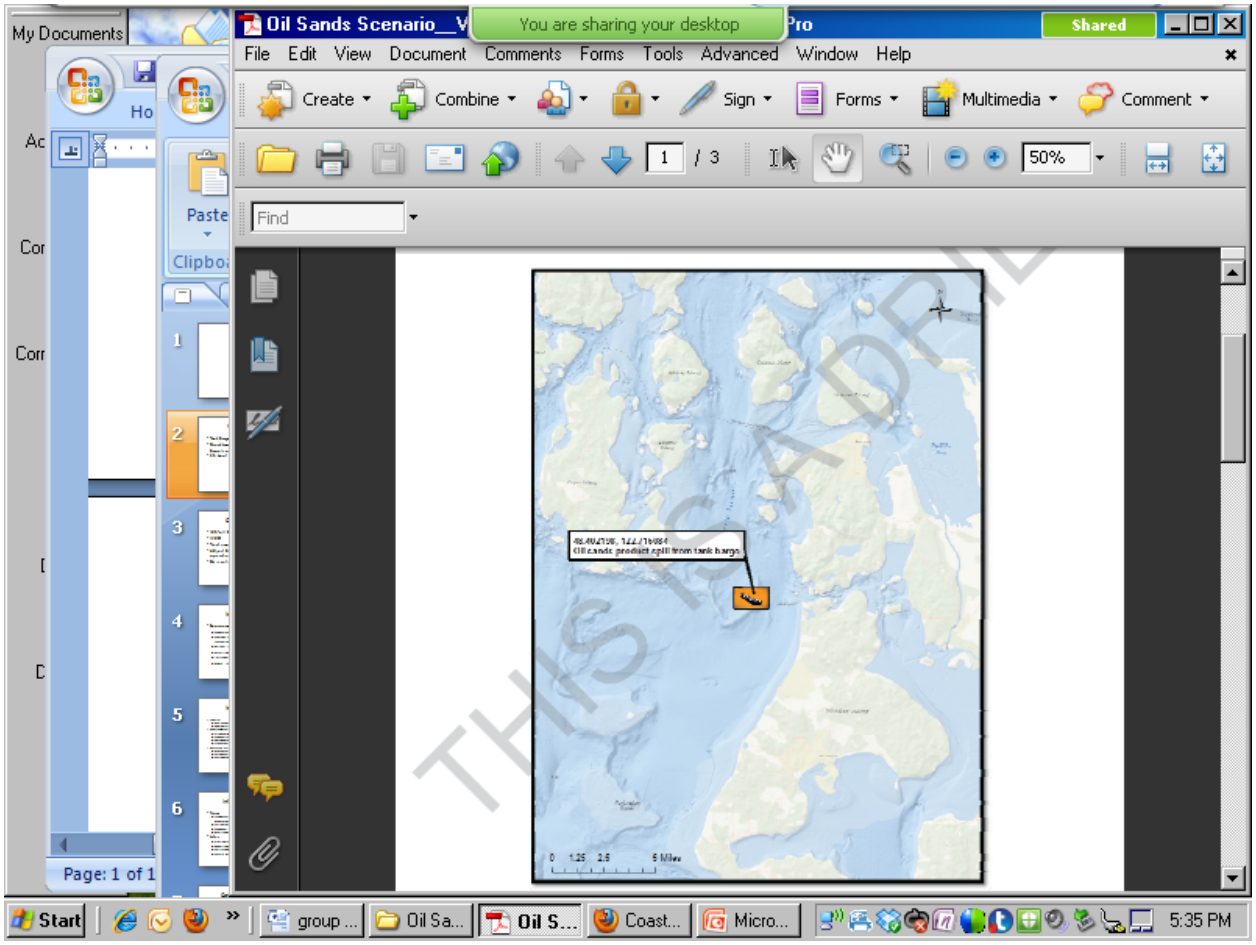
High tide is at 6, so oil is probably on beach by morning. Tide is 2 knots.

The oil sands will likely remobilize. You could get people in, but an issue with how to use and feed them.

Use a delineation strategy. Wave height is very little inland.

Corexit 95…Shoreline cleaning agent never gets into water or applied directly to water and then collected once it washes off beach. Surface cleaning agents go through rot approval.

Natural gas condensate (naptha) or synthetic crude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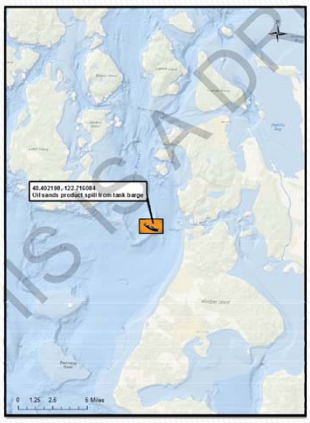
Vessel Spill

Oil Sands Products Work Group
April 17th, 2013

Vessel Scenario

- Tank barge southbound out of Rosario Straight
- Struck Lawson Reef and released 60,000 barrels of OSP
- 35 knot winds and 5-7 foot swells



Current Response

- ICS full blown
- WCD
- Treat similar to crude spill
- Adjust based on "know your oil" and operating environment changes
- EU is critical focus

Issues/Challenges

- Environmental Unit
  - Submergence monitoring and response of OSP
  - Shoreline clean up of heavy/sticky oil – disposal and containment
  - Oil sands toxicity (no thorough toxicity studies)
  - Access to best available science and technical spec
  - In-situ burning and alternative technologies
  - Wildlife rehab-chemical burns

Issues/Challenges

- Logistics
  - Benzene monitoring equipment
  - Appropriate equipment and thresholds for responders
- Human Dimensions
  - Training of local health departments (e.g. OSP, fish, air)
  - Public perception of tar sands
  - Develop liaison groups and trusted sources
  - Languages
- Health and Safety
  - Air monitoring
  - Responder and public safety
  - Seafood contamination

Information Needed

- Now
  - Equipment inventory for air and submerged monitoring
  - Lessons learned from previous spills
  - Know your oil and terminology
  - Messaging (tar sands)
- Later
  - Cross border implications
  - Dispersability and in-situ burning
  - Surface washing agents (9580, Cytosol)
  - Realistic modeling of OSP behavior

Contingency Planning

- Surface response, air monitoring and subsurface monitoring/response
- Understanding how the products are shipped
- Incorporate OSPs into drills
- Payment into federal fund is exempt

Questions?

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Break Out Group Number: B
Breakout Group Scenario: Train derailment – Inland River

Notes:

Scenario clarification:

- Train cars are insulated. Insulation plus exterior heater coils. Will get reheated once it needs to be offloaded but the train cars themselves are not heated. It will slowly cool down while being transported. Initially the dilbit will be aprox. 100 degrees F.

Question: What is the product?

- Undiluted bitumen: Density greater than water. 100 degrees F at load. API <10

Question: Is it immediately sinking?

- Rail cars over turned onto a bank and it ran down into the river.

Question: What is the current condition?

- 50 degrees F. Current conditions.
- Water temperature = 50 F.
- 28-29000 gallons (~600 barrels) of oil per train car.
- Unit train = 1 commodity
- The product will ooze. It is heavy, thick and viscous and will continue to be more so as it cools but as it cools it will also slow down. It will continue to cool once it hits the water.
- This will produce very little sheen. Very little indicator on the surface for any asphalt spill.
- Must assume the some of this may be distributed.

General Questions to Addressed:

For these scenarios, what would the response be now?

-BNSF: Dispatchers will be notified to stop other trains. Mechanical will be notified as they are responsible for clearing wrecks. They will organize heavy equipment to clean up wreck. It is currently in Tacoma. Excavators, etc. They will pull the remaining non derailed train away. Takes about three hours to get equipment there. Hazmat responders from Vancouver. They will setup incident command with the most superior official on site. The contractors are then notified. The NRC and global diving and salvage will be brought in to run cleanup. They will be focused on environmental impact after that. Mechanical may try to control the source if any resources are locally available for this material.

Is it difficult to patch the insulated train car? If possible we will do that. Would have to rely initially on rail to get equipment in but eventually would have to put in temporary road. Fly crews out of Pasco on charter to expedite. Holture is the wrecking contractor. They don't do cleanup.

-Containment: We would need heavy equipment on the bank. Try to build a dike or berm to contain the bitumen which hasn't flowed in. Bring excavators in to either remove bitumen which is there or to build the dike for containment. Start booming off areas. They will see some sheen. Once it begins weathering you will start to get some tar balls as it is cooling on the top. Once it hits the water, it takes a while to cool and it begins to spread. You need to call in divers and salvage specialists with barges, long reach excavators. This can take 6-8 hours to get this equipment on scene. Should begin to order the geographic response teams in case it does spread. Need to respond to sheen. We will initially focus on the first few miles downriver and then begin to monitor further downstream with flyovers and looking for sheens. May put out a sediment trap type device (screens) to try and catch submerged oil similar to what was deployed at Kalamazoo. Immediately deploy GRP's and start working our way down stream. Could try to use eco blocks or whatever we can to try and slow it down. The landslide part of the scenario will complicate things. Emergency permits will need to be issued to start digging things up. They will try to do whatever possible to stop the initial spread. A turbidity curtain will be used. You can order different lengths. You can install them. This is the first line to put in. Work with the asphalt responders. They will fabricate a security type fencing with pompoms to try and capture the tar balls. Start with the curtain and build out from there with the fencing and pompoms. It may take a while to get the turbidity curtains though as they need to be ordered. There may be some locally but need to determine who might have it locally.

-Recovery: Long arm excavators for removal from river. Regular excavators for the shoreline. Bring in divers. There may be a super sucker that may recover product off the bottom. Assume you are moving pliable solids, not a liquid. Pretty sure much of it may sink but must also be ready to collect floating oil. After 6 hours though, the length to get people and equipment in place, the bitumen in the water will be cool and fairly solid. There is a challenge after this much time responding because of the nature of the bitumen. The starting point will be at 4 miles downriver and then start working downriver setting up deployment sites and looking for sheen and tar balls. At best, we can only speculate how to remove the submerged oil. We will use sorbents and skimmers to remove the sheen and any surface oil that is present. The sinking oil will need to be contracted out to people who specialize in cleaning up that product. The best immediate approach is to attack it like you would a

standard floating oil spill from our point of view.

What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these scenarios?

-Safety: Is it safe to work around. They need to do air monitoring. The mechanical crew and the contractors will do air monitoring. BNSF would bring in geo tech people to stabilize the slide to make sure it is safe for responders. This is standard protocol for BNSF. They will bring out eco-tox people as well for monitoring in a spill into a river because of the issue of drinking water. They would establish a safety zone (Coast guard) shutting down traffic. Would need to practice site control. BNSF doesn't do this, they rely on fire departments and state patrol as BNSF doesn't have authority to do this. They have a safety officer that is on site and then have specialist contractors brought on site for doing the air and water monitoring (NRC). The PPE may be very specific depending on who is doing the work. Does an adaptation need to be made to the PPE since it is potentially a hot oil sands product. Unknown how the temperature of the oil sands could affect responders (don't want people to get burned).

-Liaison: Key messages developed, websites produced with the information. The PIO's will be working the media side. The LIO's will be working with the local governments. Need to have stakeholder messages going out initially (most likely through webpage). They would want claims information up immediately. BNSF's claims department gets notified immediately and they set up a hotline for people to call. Being that it is on BNSF's rail, they will initiate the response regardless of whether it is their train or not. Must answer questions about drinking water from the river. They also have a responsibility to work with tribes from a federal approach. There will be a variety of ways that tribes will get involved through consultation. They should be included in the UC.

-Planning: From environment side, put of GRP's. Do over flights. Standard oil spill response. They will want samples of source oil for health and safety as well as to characterize the physical and chemical properties. Identify the resources at risk to make sure appropriate precautions are taken. Resources at risk may change given the nature of this product. Possibly pull in additional resources again because of nature of product. They will need to come up with some methods for tracking the subsurface oil. Asphalt would fluoresce so underwater ROV's may work. A weighted diaper has been used on the Columbia before to monitor submerged oil. Could set up some traps with sorbents in them. Try to use this as an opportunity to collect data which can be used to assist

in response in the future. The sample specialists with the EU should be collecting samples to obtain this data already. Would need to use an Archimedes pump with divers if the stuff is still fluid. Need to look down river and determine if there is a place that you want to establish that the oil will be stopped by that point. This is often places where the layout of the river or topography can assist in stopping the product. This is a deep draft river though which makes this response problematic. BNSF environmental group operates a bit outside transportation, engineering, and mechanical. They will bring in their environmental specialists along with additional resources to supplement this response. There will be a big push to get the rail back open, but they will focus on the environmental issues as well. A component of the BNSF response will be getting the rail line back up and running. That is a separate piece of response from the response to the actual spill. The NTSB probably would not get involved in this spill, but it is possible. It depends on whether it meets certain criteria. Will pull the cars off right away and work on repairing track would be almost immediate after stabilizing the slope. There will be questions about fisheries closures. Partial or all. Standard wildlife monitoring would need to occur as well. They can run bottom trawls with snare in it and keep running transects until you can determine encounter rate. This might not work in the Columbia river though because of all the downed snags. Perhaps you could try and put traps at specific locations and keep checking until you can determine where it is. Figuring out where it is is another unknown and unproven technology. Understanding what characterizes the river bottom will be difficult in this response. Probably need to pull together many of the people who are working this section of the river to help determine areas which will be problematic and areas which could be helpful for spill response. The bottom bathymetry will alter both methods for detecting it as well as responding to it. Would need to bring in a rapid assessment bathymetry team to characterize the bottom. NOAA has these capabilities, and could also contract out. Is there any sort of subsurface tracking tools like the buoys they have for surface oil? Probably not.

-Logistics: Same as a fairly standard spill.

-Operations: Tracking the leading edge of the underwater sinking oil. Understanding where the equipment is located so they can develop a timeline. There is already some planning occurring for response to group V oils so many of those may be able to be applied to this. Equipment must be available within 12 hours (dredges, sonar, ROV’s, silt curtain). There is no defined response to a group V oil because it is dependent on where you are. There is no consensus response. It is best to try and pool all available info and equipment so that it is easier to respond to a specific spill.

Planning is moving in that direction but very much still a work in progress. All crude oils will at some point sink because of weathering. Need to be proactive in researching technology so possibly prepared to respond accordingly instead of reactively responding after a spill. Have to rely on contractor's knowledge of response technology. It would be good to better understand the available technology so that one can assist in response. There is no specialist in group V oil response. There are lessons learned from previous spills but no expertise resulting from a lack of experience with spills of these types of oils. The real question is, what should we think about in advance so that we have as many tools ready as possible to respond to a spill of group V oil. It would be beneficial to continue discussions with responders so that questions can be answered and hypotheticals approached. Preplanning for access to equipment and technology is probably the best response versus what the actual response is.

-Safety issues/gaps: Need a safety operator that knows diving operations. BNSF would treat it as a crude oil spill. Need to assess bank stability. Need to think about the temp in case the product is still hot.

-Liaison: Need to be prepared for misinformation because of the product. We have some fact sheets in work with NOAA. Will need to be prepared to answer questions about how you are going to track it and what the human health hazards are. Work with community health workers to educate. What could be the impact of people using the stream downstream and what is the need for potential fisheries closures.

-Planning: Identify strategies for where oil is and trying to determine how much is underwater and how far it spreads. It will be a prolonged response. Determine sediment loads which may assist in the potential for sinking. There may be less product per train car because of the weight of the product so the exact amount may be variable. **Identifying the resources at risk in the subsurface as well as species within the water column.** Salmon, sturgeon, spawning problems. **Need to establish the river bathymetry and possibly the substrate. What type of equipment should be brought out to answer these physical questions. Need to develop a long-term monitoring strategy.** Create a connection with the NOAA rapid response team to determine the bathymetry. The corps of engineers and other local monitors may be able to assist with this information. Could also help determine current flow rates. Develop a list of specialists that would be able to assist in a sub-surface spill. Think about looking at current equipment and assess how it could be altered or applied to this type of spill. **Need to ID subsurface resources at risk, where**

cable/pipeline crossings are, anything that may potentially block the oil or get in the way of the cleanup process. Also, should already have identified subsurface intakes. Response will need to be two headed. One dealing with the surface spill and the second will be approaching the subsurface and sunken oil. **Have contact information in place for information which is protected (water intake, other info not for the general public, infrastructure info, etc.). Need protective strategies for the water intakes. May need a testing strategy in place if the sunken oil ends up persisting in the environment for years. Need to identify and remain in contact with experts so that everyone is on the same page during a response. Need to identify the available data sources and then continue to update the information so everything continues to be current.**

- **What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).**

  Need to get information out into the public from the historical spills so can look at responses and look at potential environmental and human health impacts. Should draw on other examples that are available for spills with sinking oil including spills which were not bitumen products.

  12 Months:
  2-3 Years:
  4+ years

- **How does Contingency Planning need to change to accommodate an oil sands product spill?**

Key Points

Red = High priority
Amber = Medium
Green = Low

Assumptions:

Conditions current real time - 50 degrees air/water temp

Train cars are insulted. Material comes out at 90 degrees F.

When material hits water, the majority sinks and creates a significant sheen.

Resulting from the current, we assume that the submerged and surface oil will migrate some distance downstream, different rates.

Current Response:
-Implement strategies you would as a floating oil to handle sheen and any floating oil using existing GRPs and NWACP strategies.
-Railroad would handle source control. Bring in contractors that specialize in subsurface oil for recovery.
-Unique response needs due to subsurface oil. Includes need to locate and track the oil as well as recovering the oil.
-Need to determine and assess the water intakes because of the submerged nature of the oil.
-Need resource trustees to think about organisms living within the water column and on river floor instead of just surface species.
-Sampling: Samples need to be collected initially to understand potential environmental impacts as well as the chemical and physical properties. Also, continue collection is good to determine impact of weathering and so data can be applied toward future potential spills.
-Safety: The railroad would bring in safety officials to handle the landslide and to support air monitoring.
-Special messaging needs: Impact of group V oil on water intakes and potential need to close partial or full fisheries. Also, need to understand and communicate the potential toxicity.
-Special information needs: The river bathymetry. Knowledge of potential natural collection points from experts.

Operations:
Tracking the leading edge of the underwater sinking oil.
Understanding where the equipment is located so they can develop a timeline.
Have to rely on contractor's knowledge of response technology.
There is no specialist in group V oil response. There are lessons learned from previous spills but no expertise resulting from a lack of experience with spills of these type of oils.
There is no defined response to a group V oil because it is dependent on where you are. There is no consensus response.

Information needs:

-Where is submerged oil containment and recovery equipment located.

-List of effective initial surveillance and monitoring techniques for group V oil

-What are the long term surveillance techniques and monitoring protocols.

-What containment and recovery techniques are available for submerged (group V) oil and what are their limitations.

-Identifying who has experience with submerged (group V) oil response.

-Understanding the fate and transport of group V oils in river and other freshwater environments.

-Protective strategies for water intakes for submerged oils.

-Toxicity of group V oils.

-Summary of case studies for submerged oils.

Contingency planning (Northwest Area Committee, will occur during 2014 planning cycle)

-Develop fact sheets for oil sands products (first see NOAA's one pagers)

-Put together a summary of the available technical reports.

-Develop a list of experts to call on for group V oil response including:

    -Subsurface and river bed resources at risk

    -Geomorphologists and other river sediment transport specialists

    -Bathymetry

-Establish a task force to consolidate the relevant information about group V oils into an area contingency plan.

-Best achievable technology workshops for submerged oil response

-Create a connection with NOAA's Navigation Response Team

OIL SANDS PRODUCTS FORUM
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Meeting Notes

April 17, 2013
Breakout Sessions Notes

Break Out Group Number: Group C
Breakout Group Scenario: Pipeline – Inland

Assumptions:

- Not at flood stage. Therefore response to focus on lake and wetlands. No oil impacts in Nooksack R. yet.
- Planning release volume: worst case scenario 7,000 barrels ~ 294,000 gallons
- Effective shutdown

Product Assumption:

- Dilbit
- How are we going to get information about what was in the pipeline? This is a large data gap – who are we to call to get product information.
- MSD information will not provide enough information
- Even knowing it is Dilbit – how do we learn about exact specifications? To get the details to manage the response

General Questions to be Addressed:
For these scenarios, what would the response be now?

Responding authority and resources

- UC Inland spill – Tribal (Lummi and Nooksack), State, resource experts, RP (Kinder Morgan), refinery staff, county/city for local (Whatcom Co.), EPA
- Other responder agencies – State and Fed Trustees – ie: USFWS, State Agencies.
- County Health Dept and County Fire
- Citizen groups
- NOAA Trustee role
- EPA for SSC role.
- Mobilize USCG strike team for resource support, response tactics

PRCs – primary response contractors (OSROs)

- MRSC
- NRC – may have more assets for inland spill
- Most likely both MRSC and NRC would be used.
- EPA – has two mechanisms – START-

Health and Safety Concerns

- Fire will be on scene and monitor air
- Benzene concentrations (large data gaps)– currently the State does not have monitors for this. This is a possible area were the refinery could be of assistance to provide equipment to monitor.
- ATSDR
- You are going to have to make proactive decisions regarding unknown around this subject. (ie: evacuating neighborhoods)
- Response Contractors – MRSC would be entering area with monitor,
- In Kalamazoo spill– response contractors wore respiratory protection for nine days.
- UC will inform RP to get Benzene monitoring equipment (question – do C-plans require these?).
- Air Sampling – EPA – within 24 hrs can get information in even if there is not benzene monitors are not present.
- State is going to keep lead in key positions in UC – fill it out, then allow RP to backfill
- Response surge capacity – EPA
- SCAT – NOAA possible lead

Question – response net-environmental benefit – who makes the call?
Experts within the environmental unit. NOAA may be key. Key then is to make sure to fill out the environmental unit.
In – situ burn issues – not an option here

Wildlife Response

- Focus Wildlife will most likely be the lead wildlife response.
- Hazers - USFWS would lead hazing plan

Response

- Nooksack – very important community resource
- Source Control
- Containment
- Outflow issue – possible groundwater

Staging area – parking lot, access issues

- Wetland response – do we have equipment?
- Do we have the right kind of boom? We have a lot of boom in the area.
- Absorbents – lots of them
- Access – airboat? Hovercraft
- Finding out the extent of the spill
- Vac-truck and access.

Where do we turn to for locating equipment? The WRRL! - quick and robust way to locate equipment (question- is EPA equipment in here?)

- there is shallow water boats in the WRRL

Skimming Resources

- Again we turn to the WRRL

- Possible belt skimmers, and disc skimmers. Weir skimmer – very portable

Security and flight restrictions – as a result of expected large media interest. Public/Stakeholder information

Dispersants – not an option
Shoreline cleanup and oiled vegetation- Are there GRPs in the area? In the Nooksack and downstream. Collection points.

Oil behavior information

In this response there is going to be a lot of boom – hard and absorbent boom – this is a line of defense to prevent transport into the Nooksack River.

Options – for response/treatment actions of oiled habitat

- Clipping veg
- Sediment removal
- removal of large debris
- Flushing
- passive absorbents and wiping vegetation

These actions would require an ESA consult, this would occur in the Environmental Unit in the UC. Environmental Unit comes up with response actions and work with Trustees to recommend actions. Tribal consultant would be done via FOSC. Tribes need to be on scene to have a say in the decision making process.

Divide the response into segments – this would be done via vegetation types and other issues such as an access.

Monitoring sunken oil – Is there a contact to help monitor? Do C-plans regard these issues? There were some C-Plans changes – groundwater impacts, how they are going to assess and notify. Having access to respond to group-5 oils

Biggest challenge is access to contractors with capacity to respond to sinking oil.

If we don't know the long term impacts of sinking oil, it may result in different recommendations by the environmental unit regarding net-environmental benefit of response actions

If you stepped on scene after 3 months would not be able to tell it was not average crude

Communication is going to be critical – as there is unknown regarding these products. We are already seeing these with community vocal concerns about the possible increase of this product in Puget Sound.

Are folks looking at what diluent choice is best and creating a standard? No, because it depends on the product and the facility -the receiver (refinery to operate efficiently) is very sensitive to the choice of diluent.

If you have a pipeline or rail spill with this product, it seems there should be a stand-by entity to determine the type of product and how it is going to behave. Refinery knows what the product is -but

not behavior regarding weather etc.

Community Relations:

- With all of this community relations are going to be very important – Oil Sands Stigma. PIO – should have information on these types of product – have to be very aggressive with communication i.e., factsheets for these types of oil.
- Outreach and public information numbers – numbers will be provided for public to call, have to have well staffed JIC – this is a limitation.
- Enbridge – has a great website and is developing factsheet regarding different types of habitat.
- Information management via a website – would be established – WA State and EPA could work together.

Response Disposal Issues:

- WA State cares allot about volume numbers
- Monitoring waste streams to track recovery rates/figures
- An extra steps is dealing with the waste is Benzene levels with these products.

Possible larger spectrum of heavy metals in these products.

- Would refineries be interested in taking in recovered oil?
- Generate disposal plan

Information Resource – crudemonitor.ca - pull samples and monitor - post results to this website

PCBs – possible concentrations will want to be known as the RP defensive approach.

Federal NRDA actions – very robust sampling, bulk of chemical data would be generated from the NRDA trustees. WA State NRDA compensation schedule recently raised the costs for larger spills.

Permitting – Section 404 issues

- NCP requires it. Do OPA and CERCLA have the same wavier of permits?
- During response these issues fall to the environmental unit.
- Disposal issues are dealt with in the Planning unit
- Emergency HPA (hydro project approval)

Volunteers – Issue of volunteers will be determined by the UC. Welcome pre-trained wildlife volunteers and then move on from there. No volunteers will get oiled and focus on wildlife recovery efforts.

Decanting policy for this oil? - gets back to knowing what the spilled product was.

Minimizing economic harm – goal to repair pipeline, but first to ensure investigation is able to gather required information. Expected question – what will this do to the price of gas?

Jobs?

Possibility of transportation issues with I-5, may need to close it down

Fishing – Tribal subsistence fisheries – robust rounds of tests needed to demonstrate resources are not impacted (NOAA etc).

Fire dept will be lead safety issues regarding possible fire/explosion risks - flash point would be on MSD sheet.

Command Post locations? – possible sites include hotel, refinery (limited space), Olympic coordination center

What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these scenarios?

- Gaining accurate product characteristics (i.e., diluent), don't know heavy metal and PAHs levels
- Benzene and other monitors - Agency owned versus industry owned.
- Air Sampling – EPA has equipment for air sampling.
- Environmental Unit questions-
- wetland treatment
- decanter issues
- tribal cultural concerns
- impacts to fisheries
- Human Dimensions
- Close park
- volunteers
- protestors
- evacuating of residents
- lodging for responders
- close of local roads – I-5
- not knowing what to tell the public – figuring how to 'say we don't know' without causing panic. Dealing with questions about what caused the pipeline break – i.e., 'sand in the oil'. Dealing with misinformation
- Public information - Is there an industry website that 'dispel' the myths of these issues? There are some Canadian websites, UW report.

Challenge – of recovering sunken oil and any oil bound in sediment

- what are best strategies for recovering sunken oil. How will oil settle on rocky bottom versus silt?
- Some experience in Canadian tailing ponds.
- Problem of trying to collect oil from sediment – also a challenge in the extraction of the product.
- Building downstream capture device? In Kalamazoo- they are dredging out sections of the impacted river (environmental cost net-benefit) – is it bad enough to completely restart (i.e, digging up a wetland)?
- Since this is a slow moving spill – it may allow for some new tactics/strategies. What type of tar boils etc would the dilbit form? Perhaps digging out a sediment trap.

Challenge of Access to the wetland – would air boats really be of use?

- There might be initially a higher recovery rate with the floating oil, but this recovery rate will decrease with settlement.

What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).

<12 months

- Characteristics of oil and diluent
- Do we have benzene?
- Air monitoring for health and safety?
- Sampling for confirmation
- Access to expertise – where do we go? Who has it?
- RP issues – who is in control of the oil. In pipeline – it is the pipeline operator.
- Information in our plans about what diluents are being used - So on a GRP level – you could say it will be one of these various products – overtime this list will become smaller. On the C-Plan level this information is going to become available this year.

2-3 year

- Chronic toxicity
- Need these studies for net-environmental analysis
- Sinking Time line
- Dispersant effectiveness
- Weathering data

4+ years

- Toxicity and Behavior models
- Building information access requirement regarding products into a C-Plan
- Sunken oil recovery tactics – (timeline: it is expected this will occur on the next spill of these products)
- invasive and non-invasive
- assessment strategies
- possibility of new sonar/fish finder use to locate sunken oil, ROV – camera use
- Groundwater impacts (timeline: or next spills)

List of Diluent's being used - right now it is a big list because the market is evolving. Overtime this list of products will become more consistent and the diversity of product will become smaller.

How does Contingency Planning need to change to accommodate an oil sands product spill?

- Information in our plans about what diluents are being used - On the C-Plan level this information is going to become available this year.
- Groundwater impacts
- Sub-oil recovery tactics
- Available expertise
- Air monitoring and health and safety equipment - fire safety
- evacuation – as there is a claims process
- identification of response equipment

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Break Out Group Number: Group D
Breakout Group Scenario: Facility - Marine
Notes:

I. Key Issues for Spill
- What spilled? – product type characterization, boiling point
- Where is it going?
- What is in its way
- Volume – quantity
- Inputs for initial and trajectory modeling
- Day time weather
- time of day
- water temperature
- when will it hit shoreline
- What are basic shoreline types projected to get hit in 8-12 increments
- Is the source contained?
- Tides, current atlas, GRP
- Potential product on water depths
- Residents
- Sediment levels on water
- Fresh water impacts, river flow
- Response to river flooding and levels with storms
- Issues with wildlife exclusion
- Presence of juvenile herring and salmon
- Resources as risk
- What birds are there now, nesting, etc.
- Wildlife restrictions on response activities
- Cultural or historic sites
- Anything to restrict immediate deployment
- Date and season
- Subsistence issues and fishery closures
- Proximity to wildlife care facilities
- Notifications – will area be closed down to traffic?

Response equipment/materials and what responders will be available in next 24 hours

Breakout Sessions Notes

General Questions to Addressed:

- **For these scenarios, what would the response be now? – What would deviate from a normal response? What makes this different?**

  Assume response in the first 12 hours

- First step for response:
  - Characterize product,
  - where is it going,
  - who spilt it,
  - how much spilt,
  - where did it spill,
  - what is at risk
  - who will be impacted(people and critters)
  - what are we going to do about it,

- New assumptions will need to be made for OSP spills. This is similar to any other oil product, with concerns of possible sinking, and when the sinking will occur.
  - Scenario is not unique, but maybe different for sinking or floating product
  - Response is likely to be identical to heavy oil, but volatiles may come off faster
- Health and safety issues will be the same for any other oil spill, but response may need to be a different type of outreach for public
  - recognize public perception and how it is managed for response will be different for OSP
  - Dealing with human dimensions of a spill, getting out early saying, “this is dilbit”. Holding public meetings on what is going on, worst case scenarios, how it is different from other oils.
  - Public concerns of dilbit and air quality might speed up priority for getting air equipment out to site. Public outreach could change priorities of response.

    - Political and public perception will be one of the more different issues with OSP spills. Bigger shift in thinking is around political ramifications due to being a different product.
    - Getting snares out before they are needed (before we think they will be needed), to be prepared to public questions
    - Evacuations versus shelters in place for public safety
        - Would this product necessitate create a public health effect over a broader scope of area and time. Specifically air quality.
    - Decision for evacuation is made by state and county, monitoring for parameters and OSHA limits.
    - New dialogue with response community and responders
    - BP Poster -> outreach to community
    - Issues with MSDS, where are they, and do they have the correct information? Need to characterize properties

- Response options must include:
    - Booming
    - Skimming
    - Burning
        - Is it burnable? Plausibility?
        - NEBA analysis will be considered for advantages of burning versus other techniques of removing oil and causing impact to mud flats
        - Potential for burning would depend on quantity of oil spilt. More equipment available within 18hrs.
        - Would need to corral to accommodate tides and currents
    - Dispersants
        - Not allowed in bay
    - Response decisions will be influenced by the heavy currents and tide changes in the bay
    - Public concerns of dilbit and air quality might speed up priority for getting air equipment out to site. Public outreach could change priorities of response.
    - Prepare for higher likelihood of sinking
    - Mobilization of additional equipment may be required for OSP spills -> shallow dredging, silt curtains, sampling equipment

    - Timing of how product will change in the environment will change making sure that the appropriate response techniques are on hand. Having the information needed on hand.
    - Issues with MSDS, where are they, and do they have the correct information? Need to characterize properties

- Contingency plans need to be reanalyzed

- Influence of tides and potential for oil sinking -> becomes a mud flat twice a day
    - oil will become stranded on sediments, some will refloat, some will be neutrally buoyant, some will re-float
    - What are the effects on models?

- Dilbit is diluted with naptha, with H2S content which leads to odor complaints. Will there be issues with H2S, and will it restrict ability to respond?
    - H2S should never be over 2ppm, mercaptans 20-80ppm total. Could cause issues with odor, but not health and safety.

- Monitoring issues:
    - As with other spills, aerial observations will be done as soon as possible, but may need to calibrate for differences in characteristics of OSP
    - Divers going to bottom for confirmation of oil on the sediment at different times
    - Photo oxidation impacts on the mudflats – tends to become a sinker faster. Some will refloat, some will stay on sediment.
    - Monitoring, depending on weather and where the oil is will affect the modeling, adjustments need to be made. Characterize how the material is changing in the environment. How to start feeding back the change of the oil properties to modelers, cannot assume consistent behavior.
    - SMART implemented quickly
    - Need to immediately look what resources for detecting and recovering submerged oil. Will we use divers?
    - Do models deal well with submerged oil? -> need to calibrate models
    - Capabilities to do on scene treatability studies to look at benefit of dispersants…not realistic for response because not rigorous enough, need answers ahead of time

- Will there be a difference in rehabilitation of birds and animals?
    - Prewashing with a different solvent to soften oil before washing? Issues with toxicity. Will it "burn" the animals?

- Will oil sinking faster change how we think about response with dilbit and tides emptying out. -> will it better to keep it in deep water and away from shorelines?
    - Response priorities currently dictate to keep oil in open waters and off shorelines.
        - With the potential for sinking oil, do we need to rethink those priorities for desire to keep potentially sinking oil in shallow waters where it has higher probability of recovery?

- **What issues/challenges would the response face (e.g. for the environmental unit, logistics, human dimension, health and safety) that are unique to these scenarios?**
- **What information is needed and what questions should be answered to improve the response to these scenarios? Prioritize theses needs /answers (i.e. 12 months, 2-3 years, and 4+ years).**

<u>What was spilled?</u>

- MSDS
    - do not provide all the information needed
- Fact sheets for public information, and a separate fact sheet for responders
- OSP Needs to be added ADIOS database
    - Physical and chemical properties of the oil
    - For modeling and quantity and monitoring
- Carriers need to know what they are carrying.
- Who is responsible for MSDS when product is transferring between carriers? Is it the carriers responsibility to request it, should the manufacturer provide it?
- MSDS do not completely cover what is being spilt
    - Percentages of components
- Is automatic evacuation necessary?
- Treatability of oil, options for response
- Is there anything in the product that will change whether dispersing or burning are possible

Recommendations

- OSP Needs to be added ADIOS database
- Scott McCleary BP will ask his industrial hygiene team what information would be needed about the product.
- Less generic MSDS
    - Different objective.
    - Be able to break up range of products into human health effects, fate and transport of products
        - How many hours before sink or submerge will occur
    - Go to manufacturer for details of product for modeling, response.
    - Generate a list of needed information to get from manufacturer in the event of a spill
        - Is there something different in batch that is different that we should be monitoring? For worker and public health and safety
        - Mainly the diluent
    - Need to know what the immediate evacuation zone is, is immediate evacuation needed?
    - Data set needed on dispersant and in situ burning practices on the dilbit/synbit products

Where is it going?

- Specifics of the oil
    - What is different about this oil product
- Readjusting models
    - Changes in chemical and physical properties over time
    - Naturally dispersed and sinking
- Watch more carefully for indications of oil sinking
- Modeling for sunken oil is needed
    - What makes submerged oil move again
- How much will stay in mudflat, how much will go out with tide and come back in with tide?
- Where will sunken oil go
    - Power plant intake
- New and emerging technologies for location and tracking sunken oil

Who is going to get hit – impacted resources?

- Mindful of increased bottom impacts if oil sinks – not different from other oils.

How does it hurt?

- Acute toxicity, routes of exposure
- Smothering

- What will be the nature of exposure?
    - Duration, concentration
- Photo oxidation and increased toxicity associated with it
    - Acute and chronic
- Inhalation by marine mammals
    - Will it impact less or more than other oils

What do we do about it?

- Approach similar to any other oil response
- Asking the same questions
    - Will it disperse
    - Can we burn it
    - Equipment needed
    - Timing of response (how long it takes for material to sink)
- Monitoring all different compartments where oil might be
- Is it cheaper to upgrade to synthetic, and not have to worry about diluted bitumen?
    - Building/upgrading of refineries to produce synthetics
    - What is required to have a refinery produce the synthetic
- Case studies, and lessons learned from past spills
    - Knowing what was done why for future reference
    - Understanding for public response
    - Having common terminology

How clean is clean?

- Is this different from other spills?
- Did it sink and where?
    - What impact is it having?
    - Is it refloating and “pop-ups”?
- Are metrics different from any other oil spill?
    - Would be joint decisions and unified command driven by regulators towards a final end point

- **How does Contingency Planning need to change to accommodate an oil sands product spill?**

Summary

- Response is the same for other oil spills
- Human dimensions will be different because of the dilbit
- How helpful will the MSDS be for response
- Data sets are needed on dispersant and in situ burning practices on the dilbit synbit products
- Need to define products into classes based on human impacts and characteristics
- Models need to be improved to make predictions for fate and transport
    - Need to be able to update models as time goes on
- Differences of dilbit/synbit and other products did not have a large influence on response
    - Tidal changes empty out bay
- Case studies, and lessons learned from past spills
    - Knowing what was done why for future reference
    - Understanding for public response
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Recommendations

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Breakout Group Scenario: Facility - Marine

Scenario

- a tank barge is on the outside berth at the March Point refinery dock offloading oil sands
- The facility is located in Skagit County.
- The weather is relatively calm until approximately 0047, when a high-intensity storm comes through the area,
- Boom is compromised and placed around transfer site
- the pump on the tank barge suffers a catastrophic failure and spews oil sands product onto the deck and into the water.
- The boom traps some of the oil, but the majority escapes. Winds are driving the oil east, towards Padilla Bay.

Summary

- **Response is the same for other oil spills**
- **Human dimensions will be different because of the dilbit**
- **How helpful will the MSDS be for response**
- **Data sets are needed on dispersant and in situ burning practices on the dilbit synbit products**
- **Need to define products into classes based on human impacts and characteristics**

- **Models need to be improved to make predictions for fate and transport**
  - **Need to be able to update models as time goes on**
- **Differences of dilbit/synbit and other products did not have a large influence on response**
  - **Tidal changes empty out bay**
- **Case studies, and lessons learned from past spills**
  - **Knowing what was done why for future reference**
  - **Understanding for public response**
  - **Having common terminology**

Recommendations

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- **Less generic MSDS**
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