Alaska Oil Spill Technology Symposium



March 6-7, 2014

Fairbanks, Alaska

Birch Hill Recreation Ski Center

Department of Environmental Conservation, State of Alaska

Prince William Sound Oil Spill Recovery Institute

UAF University of Alaska Fairbanks

Welcome to the Alaska Oil Spill Technology Symposium

Welcome to beautiful Fairbanks, Alaska, and thanks for participating in the first Alaska Oil Spill Technology Symposium. Over the next two days, you'll be among some of the country's leading arctic and sub-arctic oil spill researchers, preparedness specialists, and response professionals. You'll hear about cutting edge research being performed at the University of Alaska Fairbanks, and you'll hear about top research at the national and international levels. We'll get a glimpse at emerging technologies, some of which are certain to play a dominant role in oil spill tracking, monitoring, and response well into the future.

You've heard that Alaska's concerns are often different from those in the lower 48. Those factors will become abundantly clear as we hear about hydrocarbon transport through sea ice and permafrost, marine biodegradation at –1C, vessel traffic through extremely remote passages, and more. Alaska is a land of extremes with 120mph chinooks, 40' seas, –50°F to –80°F temperatures with dark winters and blowing snow to hamper fuel delivery and spill response efforts. Our unique challenges become apparent when one considers our vast expanses of roadless mountain ranges, taiga, and tundra between remote communities. These unique challenges require unique solutions. Therefore we will discuss efforts to counter these challenges, such as for deploying spill prevention and response equipment, working with professional oil spill response organizations who've created tiered response networks to help one another when needs arise. You'll learn about state and federal oversight and monitoring programs; vessel tracking systems; vessel, facility, subarea, regional, and national contingency plans; drills and exercises that use a predictable management structure to practice, evaluate, and improve spill response planning. You'll learn about recent breakthroughs with response technologies and new application techniques. These technologies and this research should build confidence in state, federal, and private response capabilities, but there's always room for improvement. We're glad you've chosen to participate in the Alaska Oil Spill Technology Symposium and use it as a chance to share your accomplishments with an appreciative audience. Please take this opportunity to offer constructive criticism, make new connections with those who share your interests, and learn from one another; but most of all, enjoy yourself in the land of the midnight sun.

-Sincerely,

Dr. Richard Bernhardt

Alaska Department of Environmental Conservation

Division of Spill Prevention and Response

Preparedness Section Manager

Welcome, and thank you for joining us here in Fairbanks at Birch Hill. I would also like to thank Rick for calling me up in January and sharing his idea for this meeting, and all of the people at the University of Alaska Fairbanks (UAF), Alaska Department of Environmental Conservation (ADEC), and the Oil Spill Recovery Institute who have made this symposium happen. I am grateful for this opportunity to feature oil-spill response practices and science in this great city on the edge of the Arctic.

UAF scientists have been seeking a better understanding of, and solutions to, Alaskan oil spills for over 40 years. Collaborations among federal, state, and university scientists fueled an entire issue of the journal Arctic in 1976 examining the effects of Alaska North Slope (ANS) crude oil and various remediation efforts on the Arctic and sub-Arctic ecosystems along the pipeline corridor. One of these sites, which was not remediated, remains up the road at the Caribou-Poker Creek Research Watershed, a research forest belonging to the State of Alaska and managed by UAF. A different site, the former Naval Arctic Research Laboratory in Barrow, which was contaminated with diesel and aviation fuel, was remediated through landfarming experiments conducted by university, Ukpeagvik Inupiat Corporation, State of Alaska, U.S. Geological Survey, and U.S. Department of the Navy collaborators.

Other snapshots of the extensive oil-spill research legacy based at America's Arctic University, UAF, include responses to the 1989 grounding of the Exxon Valdez oil tanker. Take, for example, the development of novel approaches to measuring oil biodegradation in Dr. Ed Brown's lab in the I nstitute of Northern Engineering (INE), with the application of radio respirometry techniques – techniques that have evolved into the much safer, stable-isotope tracer studies we employ today in the Alaska Stable Isotope Facility, housed in the Water and Environmental Research Center on the UAF campus. Another experimental effort out of INE at UAF examined the effectiveness of Corexit 9500 on ANS crude in Prince William Sound seawater. Reported to the Alaska Department of Environmental Conservation (ADEC) in 1999, that work still elicits emails and phone calls from scientists from around the globe.

Today, we continue to learn and build upon these partnerships and our exceptional science legacy, as innovative technologies and climate shifts open up the Arctic to new opportunities in resource development, international shipping, and tourism. I am excited to help facilitate the sharing of UAF's current research in oil-spill science and technology over the next two days, but not nearly as excited as I am to integrate this science into quality decision making by stakeholders in the future of America's Arctic.

We are fortunate to be here together to share our expertise and ideas, and I look forward to our discussions. Let's begin.

-Sincerely,

Jessica Garron

University of Alaska Fairbanks

Alaska Satellite Facility

Senior Science Consultant

Welcome to the Alaska Oil Spill Technology Symposium in beautiful Fairbanks, Alaska. The next two days will be filled with sharing of knowledge and collaboration with academia, industry, regulatory agencies and a diverse group of organizations. Dr. Bernhardt, Ms. Garron, Dr. Pegau and I have spent the last few months coordinating and developing a discussion between what we believe to be a world class group of individuals.

I would like to take a moment to say thank you to Ms. Jessica Starsman, Mr. Patrik Sartz and Ms. Latrisha Jennings of the ADEC's Prevention and Emergency Response Program for additional support in the planning and execution of many of the details of this symposium.

Because this is the first year that we have all come together, we really value your feedback as participants and speakers. We have been completely overwhelmed, in a good way, by the enthusiasm this symposium has created throughout the spill response community. We look forward to future coordination between all of our programs and agencies to enhance Alaska's response capabilities from planning to prevention to recovery and remediation. Please take a moment to speak with one of the organizers to let us know what information was most valuable and how we may improve the discussion for the next time we get the opportunity to gather.

We hope you enjoy your time here at the symposium. We sincerely thank you for taking time out of your busy schedules to participate in the Alaska Oil Spill Technology Symposium. The symposium would not be possible without your participation.

-Sincerely,

Ashley Adamczak

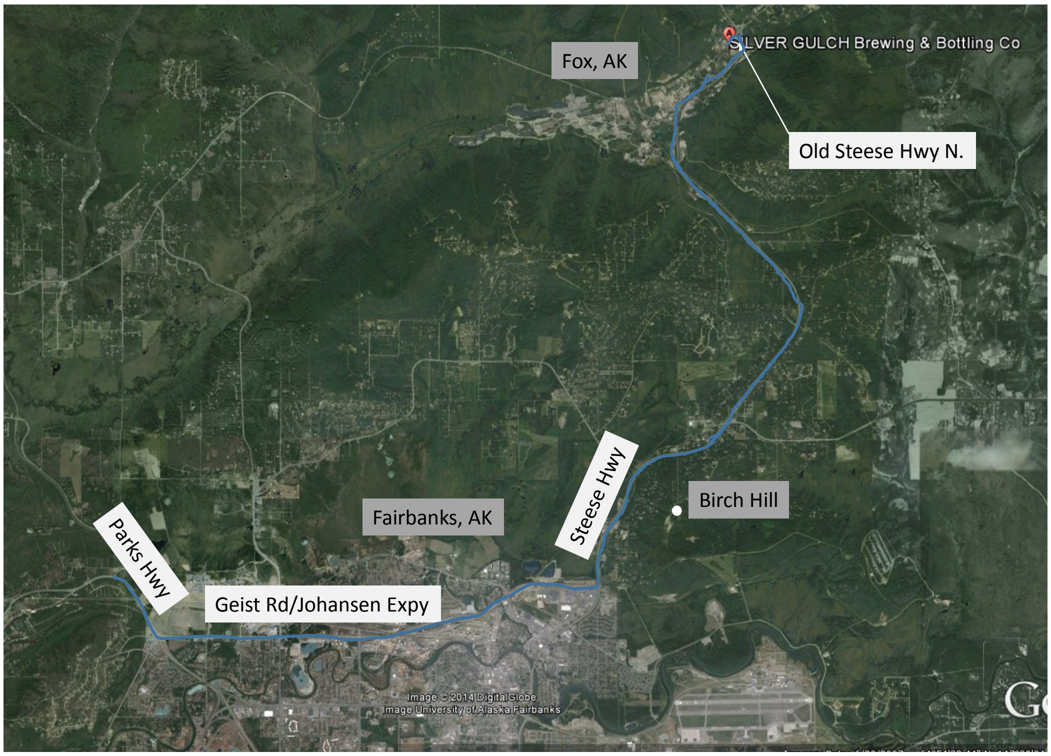
Alaska Department of Environmental Conservation

Prevention and Emergency Response

Northern Area Response Team

Things to Enjoy While in Fairbanks

Silver Gulch Brewing & Bottling Co. Please join us Thursday evening from 5:30—7:30 p.m. for a fun filled meet and greet session.

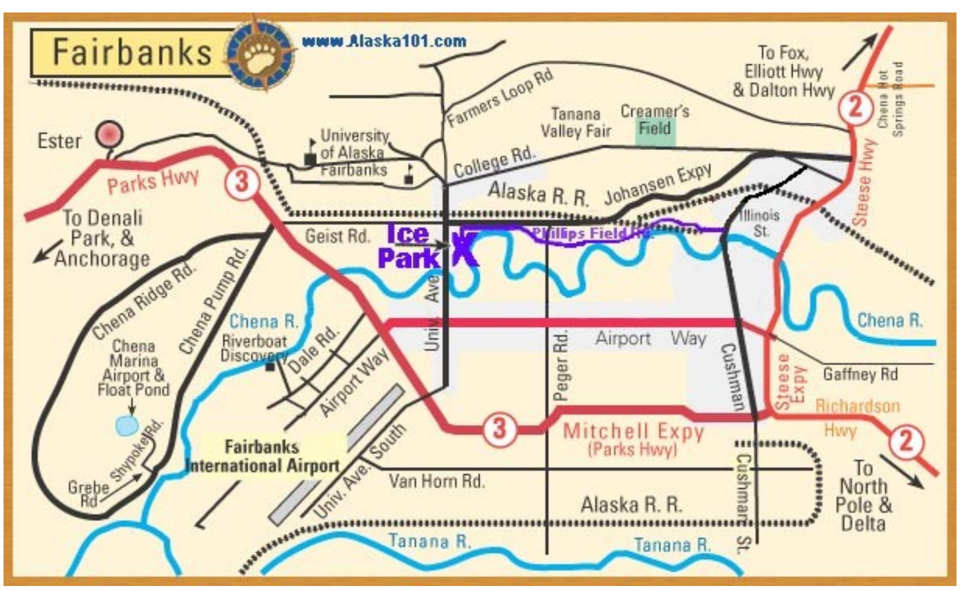


Silver Gulch Brewery
2195 Old Steese Hwy N.
Fox, AK

Johansen Expressway East to Steese Hwy. Then go ~9 miles north to the Old Steese Hwy N.

Turn lf (SE) onto Old Steese Hwy N. & turn Rt (W) into Silver Gulch's parking lot after ~0.15 miles.

World Ice Art Championships



World Ice Art Championships
3050 Phillips Field Rd

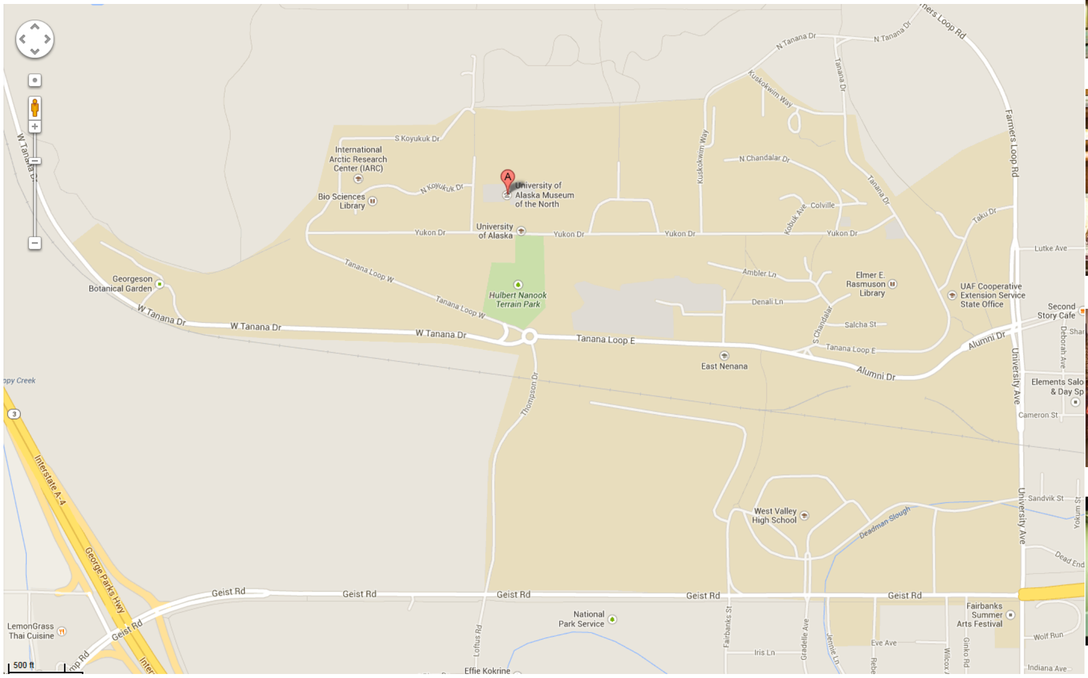
Geist Rd East (becomes Johansen Expy).

- Turn Rt (S) onto Peger Rd.
- Turn Rt (W) onto Phillips Field Rd/Morian Dr. after ~0.13 miles
- Follow Phillips Field Rd ~3/4 mile to ice park.

Day rates (10AM – 10PM)
$15 per adult
$8 per child (8-17)

University of Alaska Museum of the North

University of Alaska – Museum of the North



Mammoth display. Photo by P. Fisher

Alaska's largest public gold display

Tlingit regalia gallery

Pleistocene era displays

AGENDA Day 1

Thursday March 6, 2014

8:00 a.m Introductions

8:20 a.m. Dr. Nettie LaBelle-Hamer: A-CORE Program Overview and University Goals

8:50 a.m. Marty Rogers: Various Sensors, Capabilities & Previous Oil Spill Support

9:25 a.m. Kelly McFarlin: The Acute Toxicity of Chemically and Physically Dispersed Crude Oil to Key Arcitc Species Under Conditions During the Open Water Season

10:10 a.m. Dr. Dave Barnes: Movement of Oil and Petroleum Products in Permafrost Impacted Soils

10.:40 a.m. 15 Minute Break

10:55 a.m. Jessica Garron: Remote Sensing for Arctic Oil Spill Research

11:30 a.m. Dr. Terry Witledge: NSF's Polar Research Vessel "Sikuliaq"

12:10 p.m. 1 Hour for Lunch

1:10 p.m. Dr. Eric Collins: Oil Biodegradation Potential of Sea Ice Microbial Communities

1:45 p.m. Dr. Peter Winsor: Applications for Mapping Spilled Oil in Arctic Waters

2:10 p.m. 10 Minute Break

2:20 p.m. Dr. Tom Weingartner: Circulation Processes on Alaska's Shelf Seas

3:00 p.m. Dr. Mary Beth Leigh: Oil Biodegradation in Alaskan Soils and Seas

3:30 p.m. Kelly McFarlin: Biodegradation of Dispersed Oil in Arctic Seawater at –1°C

4:05 p.m. Marc Oggier: Sea Ice Microstructure, Oil Migration Through Brine Channels

5:30 p.m. Silver Gulch Brewing & Bottling Co. Meet and Greet

AGENDA Day 2

Friday March 7, 2014

8:00 a.m. Welcome Back

8:20 a.m. Dr. Rick Bernhardt: Overview of Select Oil Spill Preparedness, Prevention & Response Initiatives

8:45 a.m. Nick Knowles: EPA Oil Spill Responsibilities & Initiatives

9:10 a.m. USCG CDR Shawn Decker: USCG's Oil Spill Responsibilities & Initiatives

9:35 a.m. Dr. Sarah Allan: Natural Resource Damage Assessment and Restoration: The Role of NOAA's Office of Response and Restoration

10:20 a.m. 10 Minute Break

10:35 a.m. Barkley Lloyd: ACS's Tiered Response Protocol for Small, Medium, and Large Spills

11:10 a.m. Christy Bohl: Oil Spill Response Research for Alaska Outer Continental Shelf Oil and Gas Activities

11:50 a.m. Dan Gallagher: ARO's Training & Development Program for New Responders

12:05 p.m. 1 1/2 Hour for Lunch and Poster Session

1:05 p.m. Tim Nedwed: Enhanced ISB with Herders, More Effective Cold-Water Dispersants, Measuring Slick Thickness

1:35 p.m. Tim Nedwed on behalf of Victoria Broje: JIP Program Goals and Key Findings, Oil Recovery in Ice

2:15 p.m. Jim Butler: APC 101 and Marine Exchange's Vessel Tracking Capabilities

2:45 p.m. 15 Minute Break

3:00 p.m. Dr. Scott Pegau: OSRI's Mission/Response Strategy in PWS, Research Needs

3:30 p.m. Gary Folley: Facilitated Discussion About Program Priorities, Unanswered Questions & Direction Forward

Speaker Abstracts

A-CORE Program Overview and University Goals

Dr. Nettie La Belle-Hamer

The University of Alaska Fairbanks (UAF) is dedicated to research and education focused on the Arctic. As America's Arctic University, UAF is poised to lead the nation with the first research and education center dedicated to Arctic oil spills. The Alaska Center for Oil-spill Research and Education (A-CORE) will link affected local communities, industry, state and federal agencies, and international partners through effective communication of information and dissemination of knowledge. Ecosystem baseline studies, remote-sensing applications, and basic research about natural resource development in the Arctic environments are key to increased Arctic domain awareness. Through a multifaceted research, education, and outreach program, A-CORE will support wise decision-making concerning Arctic oil spill prevention and response. The Center will focus on the preparedness, prevention, response, monitoring, and mitigation of oil spills in the Arctic by working to fill gaps in knowledge needed by Alaskans, agencies, industry, oil-spill responders, and the public.

The Acute Toxicity of Chemically and Physically Dispersed Crude Oil to Key Arctic Species Under Conditions During the Open Water Season

William Gardiner,[1] Jack Q. Word,[1] Jack D. Word,[1] Robert Perkins,[2] Kelly McFarlin,[2*] Brian Hester,[1] Lucinda Word,[1] and Collin Ray[1]

[1]NewFields Northwest, Port Gamble, Washington

[2]Institute of Northern Engineering and Institute of Arctic Biology, University of Alaska Fairbanks

Chemical dispersants are used in oil spill response to minimize surface slicks by reducing the interfacial surface tensions between the water and the oil, allowing the oil to become mixed into the water column as tiny droplets. The acute toxicity of Alaska North Slope crude oil (ANS), the chemical dispersant Corexit 9500, and chemically dispersed ANS to key Arctic species was assessed during the ice-free season. Species used in the toxicity tests were collected from the Beaufort and Chukchi Seas and included the copepod *Calanus glacialis*, juvenile Arctic cod (*Boreogadus saida*), and larval sculpin (*Myoxocephalus sp.*). The toxicity of three types of water-accommodated fractions (WAF) containing ANS was examined with spiked, declining exposures: WAF, breaking wave WAF [BWWAF], and chemically enhanced WAF [CEWAF]. A dispersant-only spiked toxicity test with declining exposures was also conducted with the copepod *C. glacialis*. Total Petroleum Hydrocarbons (TPH) and individual analytes were measured in 100% stock solutions and diluted exposures with GC/MS analysis. Prior to dilution, the different types of WAFs contained distinct chemical patterns of hydrocarbon constituents. As expected, total concentrations of oil were lowest in WAF and highest in CEWAF preparations. The relative sensitivity for the different species and age classes was similar within each WAF type. Median lethal concentration values based on TPH ranged from 1.6 mg/L to 4.0 mg/L for WAF and BWWAF treatments, while lethal concentration values ranged from 22 mg/L to 62 mg/L for CEWAF. For Corexit 9500 only exposures, median lethal concentration values ranged from 17 mg/L to 50 mg/L. On a per unit oil basis, the results suggest that the majority of petroleum hydrocarbons in the CEWAF are in less acutely toxic forms than the components that dominate the WAF or BWWAF, although it is important to note that more oil is introduced into the water column when using a chemical dispersant. Further evaluation suggested that the parent polycyclic aromatic hydrocarbon compounds, specifically naphthalene, were highly correlated to acute toxicity. Physically and chemically dispersed oil were found to have similar toxicities to Arctic and temperate species.

Gardiner WW, Word JQ, Word JD, Perkins RA, McFarlin KM, Hester BW, Word LS, Ray CM (2013) The Acute Toxicity of Chemically and Physically Dispersed Crude Oil to Key Arctic Species Under Arctic Conditions During the Open Water Season. Environ. Toxicol. Chem. 32(10): 2284-2300.

Movement of Oil and Petroleum Products in Permafrost Impacted Soils

David L. Barnes, Ph.D., P.E.
Water and Environmental Research Center
University of Alaska Fairbanks

An extensive amount of effort has been undertaken by many over the last three or more decades to better understand the movement of crude oil and petroleum products through terrestrial environments. This effort is based on a desire to better characterize and remediate environments that have been impacted by releases of these substances. The presence of ice in Arctic soils, the influence seasonal freeze and thaw cycling has on fluid movement, and the typically shallow active layers found in these environments all impact the movement of fluids in these soils in manner not found in soils that do not experience deep freezing. How the unique Arctic conditions affect the movement of petroleum-related substances in this environment will be discussed in this presentation.

Remote Sensing for Arctic Oil Spill Research

Jessica Garron

The Arctic is a large, remote, ecologically diverse environment well suited for remote-sensing applications in oil-spill detection and mapping. However, some remote sensors and their supporting platforms are better suited than others for integration into spill detection and response strategies. This presentation will highlight sensors with proven success in oil-spill detection, as well as their platforms. Featured data, data-access points, and partnerships at the University Alaska Fairbanks will be discussed, including collaborative remote-sensing science in the Arctic oil-spill research realm.

Oil Biodegradation Potential of Sea Ice Microbial Communities

Dr. Eric Collins

Sea ice microbial communities entrained during sea ice formation are structured by their environment and respond to changing conditions over the course of the seasonal cycle. Changes in light, salinity, and nutrient availability vary with time and ice thickness, driven by strong temperature gradients within the ice. The temperature varies from the freezing point of seawater at the ice-water interface (−2°C) to −20°C or −30°C at the ice-air or ice-snow interface, leading to a gradient in brine salinity from 50‰ in the lower few centimeters of ice to more than 200‰ at the surface. High salinity and low temperature both inhibit microbial activity. There are very few studies of microbial community responses to oil contamination of sea ice, and of these many have inadequacies relating to spill scenarios considered likely for Arctic offshore drilling. This presentation will address the existing studies and put forward recommendations for future research needed to fill in the gaps.

Applications for Mapping Spilled Oil in Arctic Waters

Dr. Peter Winsor

We present techniques and applications for monitoring ocean conditions and oil spills at high latitudes. Applications include High-Frequency Radar, Remote Power Modules, satellite-tracked drifters, Automated Underwater Vehicle (AUV) gliders, towed instruments and other real-time enabled platforms. We present unique high-resolution data from these platforms from the Chukchi Sea, and discuss how they can be used to track a potential oil spill over short time and small space scales. We also highlight the upcoming dye release study in the Arctic, slated to begin in 2014, simulating an oil spill and providing real time data to response agencies.

Circulation Processes on Alaska's Shelf Seas

Dr. Thomas Weingartner

This talk reviews the dominant forces controlling the circulation on Alaska's shelves. These circulation processes are largely a consequence of the bathymetry of the continental shelf and adjacent slope and the strength and position of the Aleutian Low, which controls patterns of runoff, heating, and cooling. The net flow involves a northward transport of water from the Gulf of Alaska, across the Bering Sea and through Bering Strait, and thence across the Chukchi Sea into the Arctic Ocean, including the Beaufort Sea shelf.

Circulation on the Gulf of Alaska shelf is largely a response to the winds and the high rates of coastal runoff. The latter is particularly important in setting horizontal and vertical controls on the ocean density distribution. In the Bering Sea, tides and winds primarily affect the circulation and, in conjunction with the seasonal cycles of heating and cooling (including ice formation), control the formation and location of stratification and fronts. These processes also affect the properties of the water that flow northward (on average) through Bering Strait. The flow through Bering Strait and across the Chukchi Sea is a result of the large-scale pressure gradient between the Pacific and Arctic Oceans, while flow variations are primarily wind-driven. Flow across the northeastern Chukchi Sea shelf is northeastward and into the Arctic Ocean through Barrow Canyon. Circulation on the Beaufort Sea shelf is wind driven, but its water properties are an amalgamation of waters from the Chukchi Sea, the Mackenzie shelf, upwelling along the continental slope, and the brief, but intense, runoff in late spring.

Sea ice is a major component of the Bering, Chukchi, and Beaufort seas. Skill in ice forecasting on these shelves is variable. The highest skill is on the Bering shelf since ice formation largely depends upon atmospheric cooling. The lowest skill appears to be on the Chukchi shelf, since the advance and retreat of sea ice here is also dependent upon the oceanic transport of heat and salt, which are much harder to predict accurately in circulation models.

Oil Spill Biodegradation in Alaskan Soils and Seas

Mary Beth Leigh[1], Kelly McFarlin[1], Mary-Cathrine Leewis[1] and Silke Schiewer[2]

[1]Institute of Arctic Biology, University of Alaska Fairbanks

[2]Institute of Northern Engineering, University of Alaska Fairbanks

Petroleum contamination is a critical issue in Alaska, where spills are often located in remote, extreme environments. This presentation highlights several research projects investigating petroleum biodegradation in Alaskan marine and terrestrial environments at the University of Alaska Fairbanks.

As offshore oil exploration in the Arctic Ocean expands, there is a need to understand oil biodegradation potential in seawater and on shorelines, and to assess the effects and biodegradability of chemical dispersants (Corexit 9500). We are assessing the potential for microbes indigenous to arctic seawater (Chukchi Sea) to biodegrade crude oil, chemically dispersed oil and Corexit 9500 at near-freezing temperatures (-1 to 4˚C). Microorganisms and genes involved in oil biodegradation are being identified using advanced molecular genetic techniques, and are enabling comparisons with those active in the Deepwater Horizon oil spill. The transport and biodegradation of crude oil in arctic shoreline material are also being actively investigated to predict the fate of oil that makes landfall.

In the terrestrial environment, remediation of petroleum contamination using conventional *ex situ* physical chemical methods can be prohibitively expensive, especially in remote regions. Phytoremediation using plants native to Alaska may offer an affordable, long-term means to remediate petroleum-contaminated soils. Studies ranging from lab to field scale indicate that some Alaskan plant species have the potential to stimulate the growth and activity of contaminant-degrading microbes in soil. Felt leaf willow (*Salix alaxensis*) appears to accelerate diesel biodegradation in soil by shifting the structure of petroleum-degrading microbial communities. A long-term petroleum phytoremediation site naturally colonized with native/local Alaska plants reduced contaminant levels to below regulatory limits with minimal site management.

Together, these studies provide new insight into methods for accelerating bioremediation in marine and terrestrial environments and into the fundamental microbial ecology of petroleum biodegradation.

Selected References

McFarlin, K.M., R.C. Prince, R. Perkins and M.B. Leigh. 2013. Biodegradation of dispersed oil in arctic seawater at -1°C. *PLoS ONE. 2014, 9, 1: e84297. doi:10.1371/journal.pone.0084297*

Leewis, M.-C., C.M. Reynolds and M.B. Leigh. 2013. Long term effects of nutrient addition and phytoremediation on diesel and crude oil contaminated soils in subarctic Alaska. *Cold Regions Science and Technology.* 96:129-137.

Biodegradation of Dispersed Oil in Arctic Seawater at –1°C

Kelly M. McFarlin,[1] Roger C. Prince,[2] Robert Perkins,[3] Mary Beth Leigh[1]

[1] Institute of Arctic Biology, University of Alaska Fairbanks, Fairbanks, Alaska
[2] ExxonMobil Biomedical Sciences, Inc., Annandale, New Jersey
[3] Institute of Northern Engineering, University of Alaska Fairbanks, Fairbanks, Alaska

As oil and gas exploration expands in the Arctic, it is important to understand the fate and effects of oil and chemically dispersed oil in cold water marine environments. We conducted incubation experiments with Arctic seawater from the Alaskan Chukchi Sea to quantify the biodegradation of oil in the water column following the successful dispersion of a surface slick. The effects of oil on the microbial community were also determined in order to identify active oil-degrading microorganisms. Arctic seawater was incubated with Alaskan North Slope (ANS) crude oil at the temperature of the ocean at the time of collection (-1°C). Incubations were conducted with minimal nutrient addition and sampled over a time course for up to 60 days. Primary biodegradation was quantified using GC-MS analysis and mineralization was measured with respirometry. Microbial samples were filtered (0.2 µm) and frozen (-80˚C) for DNA extraction. Pyrosequencing of 16S rRNA genes provided taxonomic information to determine bacterial community structure during the incubations and identify bacteria that grew in response to oil. Arctic marine microorganisms degraded both fresh and weathered oil, in the presence and absence of Corexit 9500, with oil losses ranging from 46-61% and up to 11% mineralization over 60 days. In non-oiled incubations containing the dispersant, 14% of 50 ppm Corexit 9500 was mineralized within 60 days. The indigenous Arctic marine microbial community was found to shift in response to the presence of oil, providing an indication of the identity of oil-degraders, some of which were taxonomically related to those active in biodegradation of the Deepwater Horizon oil spill. This study reveals that Arctic marine microorganisms are capable of performing extensive biodegradation of chemically and physically dispersed oil at an environmentally relevant temperature (-1°C) without any additional nutrients. Future studies are needed to better understand the role of season and location on oil biodegradation potential in Arctic seawater as well as in ice-covered waters and on shorelines.

McFarlin, K.M.; Prince, R.C.; Perkins, R.; Leigh, M.B. Biodegradation of Dispersed Oil in Arctic Seawater at -1C. PLoS ONE. 2014, 9, 1: e84297. doi:10.1371/journal.pone.0084297

Sea Ice Microstructure Oil Migration Through Brine Channels

Marc Oggier
Geophysical Institute (GI), Snow Ice and Permafrost
University of Alaska Fairbanks, 903 Koyukuk Drive, USA
http://www.gi.alaska.edu/

Retreat of summer sea ice extent and the continued exploration of oil and gas reserves in the Arctic will likely drive an increase of oil extraction and transport throughout the maritime Arctic and thus the likelihood of an oil spill in ice infested waters. Sea ice is a major hazard to marine operations and can exacerbate oil spill risk and significantly complicate clean-up operations. Should a spill occur, substantial amounts of oil can become trapped in open flaw leads, at the ice-water interface and within the ice itself. Sea ice also serves as an important habitat for microbial communities that are key elements of Arctic foodwebs which can be negatively impacted by oil absorbed into the ice. Porosity and microstructure evolution in sea ice is dominated by the combination of ice temperature and bulk salinity, which are therefore key variables for assessing the potential for oil entrainment. Brine is mainly contained is small pores, aligned vertically. During warming events, or seasonal melting (mid- to late spring), the brine volume fraction increases and pores interconnect, leading to a higher permeability.

Oil entrapped in sea ice during the growing season remains confined in the pore network as long as the microstructure does not undergo strong evolution. Brine movement is predicted as the porosity reaches a value of 5%, but laboratory studies show that this threshold rises to 15% for oil migration in ice. Entrainment of oil is driven by physical drivers such as surface tension and buoyancy, as well as ice microstructure including pore geometry and phase transition. To enable predictions of oil movement in ice we will conduct a comparative study by mathematical modelling of sea ice brine channels containing oil combined with laboratory studies and x-ray.

Overview of Select Oil Spill Preparedness, Prevention & Response Initiatives

Dr. Richard Bernhardt

Under Alaska law, all oil and hazardous substance spills must be reported to the Alaska Department of Environmental Conservation (ADEC), and over 2,000 spills are reported each year. Anyone who causes or permits an oil or hazardous substance release to occur must clean it up immediately, unless in ADEC's judgment, cleanup is technically infeasible or would cause greater harm to human health or the environment, than good. To expand the network of resources available to protect human health and the environment from risks associated with oil and hazardous substance releases and to provide coordinated and effective responses management in a timely manner, ADEC forms partnerships with Federal, State, and private entities. ADEC also oversees Oil Discharge Prevention and Contingency Plans (C-Plans) to ensure spill prevention and response planning efforts conform to regulatory requirements.

Industry, Agencies, and Oil Spill Response Organizations (OSROs) all forward deploys emergency response equipment at strategic locations throughout the state and local response agreements ensure that remote communities have access to State assets in times of need. The State works with locals in remote communities, professional spill response organizations, and others to identify and develop protective spill response strategies, called Geographical Response Strategies, from negative impacts following oil spills throughout the State. These GRS save time and resources, and essentially help to automate certain spill response decisions during the first, critical hours of an oil spill.

Likewise, the state works with community leaders, natural resource managers, and agency counterparts to produce Potential Places of Refuges (PPORs) where vessels in distress can be secured to minimize potential environmental impacts if its petroleum or hazardous cargo is threatened. Vessels that are unable to navigate under their own power may be able to use one of our forward deployed emergency towing system packages to reach a nearby PPOR. Like GRS, PPORs are included in Subarea Contingency Plans (SCPs).

The state master plan, referred to as the Unified Plan and the 10 regional master plans, referred to as SCPs pre-identify sensitive areas, resources, response tactics, contact information, and roles for responders and potentially affected stakeholders in each subarea. Each SCP is reviewed and updated at five year intervals by work group members who represent federal/state/local agencies, oil companies, spill cooperatives, and others.

When large or significantly hazardous spills occur, ADEC utilizes a management system known as the Incident Command System (ICS) to respond. The ICS provides a defined organizational structure, yet remains highly adaptable for a variety of incident types. The ICS is scalable to accommodate more personnel during large, complex events, or shrink during smaller events. Personnel assigned to an ICS may differ, but the roles and responsibilities assigned to its personnel remain similar, regardless of spill location or release volume. The command cell at the top of an ICS includes On-scene Coordinators (OSC) from the responsible party, State, EPA or U.S. Coast Guard, and may include a Local On-scene Coordinator from a nearby community.

Natural Resource Damage Assessment and Restoration: The Role of NOAA's Office of Response and Restoration

Dr. Sarah E. Allan

The National Oceanic and Atmospheric Administration's (NOAA) Office of Response and Restoration (OR&R) is a center of expertise in preparing for, evaluating, and responding to threats to coastal environments including oil and chemical spills, releases from hazardous waste sites and marine debris. Every year OR&R's Emergency Response Division responds to more than a hundred oil and chemical spills in U.S. waters. During an oil spill, the Emergency Response Division provides scientific support to the U.S. Coast Guard, which focuses on removing oil from the environment and reducing risks to environmental and human health. In the event that public resources are injured by an oil spill, the Oil Pollution Act (OPA) authorizes certain federal, state and tribal natural resource trustees to conduct Natural Resource Damage Assessment (NRDA). Through the NRDA process, OR&R's Assessment and Restoration Division works cooperatively with co-trustees to assess the nature, extent and severity of injuries to natural resources and determine the type and amount of restoration required to restore those resources and compensate the public for interim losses. The trustees may work cooperatively with the responsible parties or pursue other strategies to resolve resource liability. Damage assessment can begin during the emergency response to a spill and ephemeral data collection, injury assessment and emergency restoration may be done concurrently with response activities as feasible.

The NRDA process is carried out in three phases. During the pre-assessment, natural resource trustees determine whether an injury to public trust resources has occurred. This work includes collecting time-sensitive data and reviewing scientific literature about the released substance and its impact on trust resources to determine the extent and severity of injury. If resources are determined to have been injured then trustees proceed to the next step. During injury assessment and restoration planning the trustees quantify injuries and identify possible restoration projects. Economic and scientific studies assess the injuries to natural resources and the loss of services. These studies are also used to develop a restoration plan that outlines alternative approaches to speed the recovery of injured resources and compensate for their loss or impairment from the time of injury to recovery. The final step is restoration implementation and monitoring, in which the trustees work with the public to select and implement restoration projects and monitor their effectiveness.

Though the NRDA process may sounds straight forward, understanding complex ecosystems, the services they provide, and the injuries caused by an oil spill is challenging and takes time. The rigorous scientific studies that are necessary to prove injury to resources and services, and withstand scrutiny in a court of law, may take years to implement and complete. The process is even more challenging in environments where baseline data on resources is limited or highly variable and information on oil transport, fate and toxicity is incomplete. NRDA scientists rely on data and research from a range of sources, including academia, agencies and industry to plan for NRDA and assess injuries to natural resources and develop restoration plans in the event of a spill. Having an understanding about current and past research and collaborating on addressing gaps in knowledge about resources and impacts that are relevant to NRDA is advantageous for trustees, potentially responsible parties and other stakeholders involved in pre-spill planning, oil spill response and injury assessment. Furthermore, collaboration with experts in academia, industry and State and Federal agencies on designing and implementing injury assessment and restoration projects after a spill is essential and ensures that the highest quality science is used to support NRDA.

NOAA's Assessment and Restoration Division has participated in four NRDA cases in Alaska: Exxon Valdez, Kuroshima, Selendang Ayu and Adak. Planning for future spills is an ongoing effort and special focus is being given to the Arctic because of the growing risk of an oil spill and inherent challenges of conducting NRDA in the region. Collaborations with scientists from universities and research groups in Alaska and around the world are ongoing and the Assessment and Restoration Division participates in the Alaska Joint Assessment Team, where we work with Federal trustees (USFWS, BLM, NPS, and BIA), State trustees (ADEC, ADFG, ADNR, ADOL), and oil, gas and shipping companies (BP, ConocoPhillips, Shell, Chevron, ExxonMobil, Pioneer Natural Resources, Shell, Alyeska Pipeline Services Company and the International tanker Owners Pollution Federation) to prepare to conduct cooperative NRDA in Alaska.

Oil Spill Response Research for Alaska Outer Continental Shelf Oil and Gas Activities

Christy A. Bohl

Senior Analyst, Bureau of Safety and Environmental Enforcement, Oil Spill Response Division, Alaska Region Unit, 3801 Centerpoint Drive, Suite 500, Anchorage, AK, 99503

The Bureau of Safety and Environmental Enforcement (BSEE) is the Federal agency assigned to regulate and manage industry exploration and development of energy resources on the Outer Continental Shelf (OCS). The agency is organized into three divisions to oversee the regulatory mandates and requirements for safe and environmentally compliant operations in the OCS. The three divisions are the Office of Offshore Regulatory Programs, which manages rules, standards and compliance programs governing oil, gas and mineral operations; the Environmental Enforcement Division which monitors environmental compliance of permits that BSEE issues to energy developers and the Oil Spill Response Division (OSRD) which is responsible for carrying out BSEE authorities related to oil spill research, planning, preparedness and response. Currently BSEE oversees operations on OCS leases occurring in the Beaufort and Chukchi Seas off Alaska's North Slope.

For over 25 years, BSEE has aggressively maintained a comprehensive, long-term research program dedicated to improving oil spill response options. The major focus of the program is to improve methods and technologies used for oil spill detection, containment, treatment, recovery and cleanup. The Research Response Unit manages the funding of numerous research projects chosen to meet selected major topics each year, and in 2014 BSEE received $7 Million to fund research efforts. In addition to research the RRU is responsible for management of the Ohmsett facility, the largest outdoor saltwater wave/tow tank facility in North America where full-scale oil spill response equipment testing, training and research can be conducted in a marine environment with oil.

BSEE has made a concerted effort to purse response research that specifically address the issues unique to oil spill response in the Arctic environment. Research projects have included dispersant effectiveness in cold water environments, detection of oil in and under ice, in-situ burning in ice conditions, and detection of oil in low-light conditions to name a few. A comprehensive listing of current and past projects funded by BSEE along with project reports is available on the BSEE website at: http://www.bsee.gov/Research-and-Training/Oil-Spill-Response-Research/index/.

Joint Industry Program Goals and Key Findings

Victoria Broje (Presented by Tim Nedwed)

The oil and gas industry has made significant advances in being able to detect, contain and clean up spills in arctic environments. To further build on existing research and improve the technologies and methodologies for arctic oil spill response, nine oil and gas companies (BP, Chevron, ConocoPhillips, Eni, ExxonMobil, North Caspian Operating Company, Shell, Statoil, and Total) established the Arctic Oil Spill Response Technology Joint Industry Programme (JIP). The goal of the JIP is to advance arctic oil spill response strategies and equipment as well as to increase understanding of potential impacts of oil on the arctic marine environment. Officially launched in January 2012 at the Arctic Frontiers Conference in Tromsø, Norway, the JIP has six technical working groups (TWG) each focusing on a different key area of oil spill response: dispersants; environmental effects; trajectory modeling; remote sensing; mechanical recovery and in-situ burning (ISB). There is also a field research TWG to pursue opportunities for field releases for validation of response technologies and strategies. Each TWG is led by recognized subject matter experts with years of experience in oil spill response research and operations. This JIP is bringing together the world's foremost experts on oil spill response research, development, and operations from across industry, academia, and independent research centers. Research integrity will be ensured through technical peer review and public dissemination of results.

APC 101—Alaska Maritime Prevention and Response Network
Jim Butler

Pursuant to federal oil spill regulations owners or operators of tank or nontank vessel who operate "in remote areas, where response resources are not available, or the available commercial resources do not meet the national planning criteria, may request acceptance of alternative planning criteria by the Coast Guard."

In most parts of Western Alaska, tank and nontank vessel compliance is not feasible. This reality is due to the immense size of the area, the lack of infrastructure to support or stage oil spill equipment and the exorbitant cost of acquiring equipment spread across the few vessels that operate in the area.

The Alaska Maritime Prevention and Response Network is a non-profit organization established to implement an *"Alternative Planning Criteria"* (APC) through alternative spill response and prevention measures that most cost effectively meet the environmental protection objectives of federal regulations.

After being vetted and reviewed by industry and various agencies, the U.S. Coast Guard approved the Network nontank vessel APC on 20 Dec 2013. That APC enhances maritime safety by:

1. Participating vessels sail on reduced risks routes on all voyages
2. Provide early notification of all incident
3. Fund Network "safety net" comprised of;
    a. Expanding and operating 24/7 vessel monitoring system
    b. Monitoring availability of emergency assist vessels
    c. Implement shore side vessel assist tools
4. Fund strategic enhancement of oil spill response resources

This presentation will provide background on the regulatory basis and requirements for an APC and explain the operational components of the Network Western Alaska APC for tank and non tank vessels.

Facilitated Discussion About Program Priorities, Unanswered Questions & Direction Forward
Gary Folley

Gary Folley will conclude the symposium with a facilitated conversation about oil-related preparedness, research, and response priorities in the 49th state. Please contribute ideas about future research priorities, knowledge/resource gaps, and/or ways to improve Alaska's prevention, preparedness, and response initiatives. How can the existing consortium of spill prevention and response partners incorporate the University's resources, and how can we, in turn, support the University's growth and development?

Poster Abstracts

Potential of a Native Alaskan Fungal Species to Clean Diesel Contaminated Soil

Christin Anderson

Oil spills are almost an inevitability in Alaska, where the majority of infrastructure requires oil for heating. Current remediation methods are capping or hauling away for physical and chemical treatment, both energy-intensive and expensive. The Dept. of Environmental Conservation has shown increasing interest in natural methods of cleaning up oil spills, including bioremediation. However, one important method has been neglected. White-rot fungi are the only group of organisms known to completely degrade lignin, which is chemically similar to hydrocarbons. Studies have shown that white-rot fungi can degrade hydrocarbons with extracellular enzymes. There are technical hurdles to overcome with introducing any species to a new habitat, so I propose to test a method of bioremediation with native Alaskan fungi in contaminated soil collected from interior Alaska.

The Potential of Remote Sensing Approaches in the Study of Arctic Sea Ice Use

Dyre O. Dammann, Hajo Eicken, Andy Mahoney, and Franz J. Meyer

Geophysical Institute, University of Alaska Fairbanks, PO Box 757320, Fairbanks, Alaska 99775-7000, USA.

The potential impacts of rapidly changing Arctic sea ice conditions on people and ecosystems are receiving increasing attention. At the same time, sea ice is seeing increasing use due to growing industrial activities and the convergence of a range of other ice uses into smaller areas. Here we propose to focus on the role of sea ice as a platform, in particular the direct consequences of altered ice conditions for transportation across sea ice by industry.

On the North Slope of Alaska sea ice roads play an important role in construction of offshore islands and economical transport to drilling sites. By documenting sea ice use in a geophysical context we can establish critical ice properties of high concern to future ice trafficability. This study explores the potential of establishing the significance of roughness and thickness distribution, as well as small-scale deformation leading to weaker ice and break out events in relation to trafficability.

Specifically we explore remote sensing as a tool to monitor changes in ice use potential across the Arctic for multiple stakeholders. We find SAR interferometry (InSAR) to hold promise as a tool to detect ice deformation as well as bottomfast ice extent, which in turn can inform planning and management of transportation. The ultimate goal is to investigate long-term ice use changes and to develop methods to ensure safe and economical sea ice transportation in the future.

Sea Ice Biology: Effects of Biota on and to Oil Permeation in Sea Ice

Kyle Dilliplaine[1], Marc Oggier[2]

[1] School of Fisheries and Ocean Sciences, University of Alaska Fairbanks, Fairbanks, Alaska 99775, USA.

[2] Geophysical Institute, University of Alaska Fairbanks, PO Box 757320, Fairbanks, Alaska 99775, USA.

The trending retreat of the Arctic sea ice extent has led to greater accessibility of oil and gas reserves and opened new maritime routes. Exploitation of the changing ice cover is reflected locally as increased interest of Arctic shelf petroleum extraction and the proposal of a deepwater port near the Bering Strait. Increasing anthropogenic activity in this region elevates the risk of an oil spill scenario. Oil released under ice originally collects at the ice-water interface and may be advected from the spill zone, corralled in open leads, or become entrained in the Brine Channel System (BCS). The infiltration of oil into sea ice poses significant risk to the ice algae and invertebrates that inhabit the BCS. In spring, the ice algae bloom provides a substantial pulse of food to under-ice grazers and benthic epi- and infauna. Toxicological impacts to the ice system may influence the success of these dependent communities through tight trophic coupling. Ice biota play another major role in the sea ice system by modifying the BCS through exuviates like the structurally complex extracellular polymeric substances. Laboratory studies indicate bulk oil entrainment as ice porosity reaches a value of 15% which is dependent on temperature and salinity. Biological modification of the BCS microstructure has been neglected in previous studies of oil migration and may significantly alter the fate of crude oil in ice covered seas. This study aims to describe the toxicological impact of crude oil on sea ice biota as it infiltrates the ice as well as determine the influence of biomass on oil migration by conducting a series of ice growth experiments in the laboratory.

A New Alaska, US, and Global Capability: Near-real-time, Multi-satellite, Optical and Radar Satellite Data and Imagery

Tom Heinrichs, Director, UAF Geographic Information Network of Alaska

Real-time satellite data is of tremendous utility during oil spill response. During the Deepwater Horizon incident, thousands of near-real-time optical and radar satellite images were used for applications ranging from tracking oil over the broad expanse of the Gulf to preparing briefings and outreach materials presented daily by the media. The University of Alaska Fairbanks (UAF) already captures, creates products, and delivers data in near-real-time from NASA and NOAA satellites. A new capacity is being installed in Fairbanks that expands capabilities for near-real-time satellite data provision to include synthetic aperture radar (SAR) data and high-resolution optical data. Tatitlek Corporation's GeoNorth division has entered into agreements with Astrium and the University of Alaska Fairbanks to bring a globally unique, real-time satellite data capacity to Alaska. A multi-satellite terminal owned by GeoNorth and operated by UAF will capture and process data in near-real-time from the Astrium satellite constellation, including TerraSAR-X, TanDEM-X, Pleiades 1A and 1B, and SPOT 5, 6, and 7. Fairbanks is an established center for satellite reception due to its high latitude and well-trained workforce who work at several major NASA, NOAA, University, and private sector ground receiving stations. Satellite data will be captured in real-time as the satellite passes over Alaska, providing an immediate view of Alaska and Arctic land and oceans. Satellite data recorders will also be downlinked to Fairbanks, allowing very low latencies between the time and capture and product generation for data captured anywhere globally. The combination of technical expertise, real-time access to data from numerous satellites, and a strong distribution network will enable remote sensing applications to be delivered rapidly in support of oil spill response.

Assessing the Fate and Transport of Crude Oil Through an Arctic Coastline, Based on Sediment Structure and Wave Action

Anna Iverson

Offshore oil production along Alaska's arctic coast is expected to increase in coming years. While this is expected to create large economic benefits for the state, crude oil spills may occur. An oil spill may reach the shoreline, where it could create adverse short and long-term ecological effects. Especially in remote locations such as Alaska's northern coast, clean-up encounters logistical challenges. Mass transfer processes play an important role in determining the fate of crude oil along shorelines. Mass transfer processes (diffusion, dispersion, viscosity) are strongly temperature dependent. Nutrients added to stimulate bioremediation may be washed out with waves and tides. It is necessary to study how factors such as the beach matrix and temperature affect hydrocarbon and nutrient distribution.

The project looks specifically at the shores near Barrow, AK. With the hopes that data can be used to project how oil will react along other arctic shorelines. Two different experimental designs will be implemented to help better understand how the soil composition and tidal action will alter the oil's movement through the shoreline. A microcosm study using a PVC pipe set-up, will be used to simulate a more in-depth look at the transport of oil through the soil profile, based on the rise and fall of the tidal zone. A wave tank will be used to illustrate a scale model of an actual shore environment, composed with both crashing waves and tidal action.

This experiment will allow a better understanding of how crude oil interacts with the shoreline. Identifying the location of oil pools will help future research isolate microorganisms in the soil that are capable of degrading hydrocarbons. This knowledge, along with the ability to predict how an environment will react to a spill under specific environmental conditions, will help to create a better environmental response plan.

Measuring and Modeling Freshwater Flows to Promote Informed Development of North Slope Resources

Erica Lamb

Understanding freshwater flows is critical to the development and management of oil and gas resources on the North Slope. Freshwater flows, for instance, play a critical role in infrastructure design, ice road construction, and terrestrial oil spill management. The UAF Water and Environmental Research Center (WERC) has been a key player in evaluating North Slope freshwater processes for over a quarter century. Early (1970s) hydrologic data collection on the North Slope of Alaska consisted of a few stream gauging stations and fewer climatic stations, all located along the coast. Spatially distributed at the watershed scale complementary data was totally absent. Starting in 1985 through a series of research projects, WERC personnel built a meteorological network consisting of a maximum of 40 stations distributed from the coast to the drainage divide in the Brooks Range (see map to right). Available data include hourly air temperature, relative humidity, wind speed and direction, summer net radiation, summer precipitation, and winter snow depth. Other data included discharge of several streams and rivers, some soil temperature and moisture data and some suspended and bedload sediment measurements. Once per year near the end of April a survey of snow-on-the-ground is made to evaluate the amount of moisture contributing to spring breakup floods. The timing and location of observations is dependant upon research funding. The availability of this spatially distributed data set allows us to gain a much better understanding of the hydrologic response of these Arctic watersheds through water balance studies, flow frequency analysis, as input into hydrologic models, and insight into ungauged watersheds.

Automatic Change Detection in Series of Synthetic Aperture Radar Data Using a Scale Driven Approach

Ajadi Olaniyi

In this paper we present a promising new algorithm for change detection from SAR that is based on a multi-scale analysis of a times series of SAR images. Our approach is composed of two steps, including (1) data enhancement and filtering, (2) creation of multi-scale change detection maps. In the data enhancement and filtering step, we first form time-series of ratio images by dividing all SAR images by a reference acquisition to suppress stationary image information and enhance change signatures. The generated ratio images are further log-transformed to create near-Gaussian data and to convert the originally multiplicative noise into additive noise. A subsequent fast nonlocal mean filter is applied to reduce image noise whilst preserving most of the image details. The filtered log-ratio images are then inserted into a multi-scale change detection algorithm that is composed of: (1) a multi-scale decomposition of the input images using a two-dimensional discrete stationary wavelet transform (2D-SWT); (2) a multi-resolution classification (adaptive scale selection) into “change” and “no-change” areas; and (3) a scale-driven fusion of the classification results. We propose an iterative method based on the Expectation-Maximization (EM) algorithm for thresholding in the multi-scale change detection stage. Validation results show excellent performance of the developed technology.

In-Situ Measurements of the Dielectric Permittivity of Arctic Landfast Sea Ice in the kHz and GHz Range

M. O’Sadnick1*, H. Wakabayashi2, M. Ingham3, H. Eicken1

1 Geophysical Institute, University of Alaska Fairbanks, 903 Koyukuk Drive, Fairbanks, AK, 99775-7320, USA

2 Department of Computer Science, College of Engineering, Nihon University, 1 Nakagawara, Tokusada, Tamura-machi, Koriyama, Fukushima 963-8642, Japan

3 School of Chemical & Physical Sciences, Victoria University of Wellington, PO Box 600, Wellington 6140, New Zealand

*Email: meosadnick@alaska.edu, Phone: (907) 474-5648

Abstract: Sea-ice complex permittivity is controlled by ice temperature, salinity and microstructure. Hence, in-situ permittivity measurements may help track the seasonal evolution of key ice properties. Such data are lacking, but are of value for sub-surface geophysical sounding and microwave remote sensing of sea ice. In spring of 2013, ice permittivity was measured at frequencies of 10 Hz to 95 kHz and 4 to 6 GHz in landfast sea ice at Barrow, AK. We examine high and low frequency permittivities to gain insights into the property evolution of the upper ice layers during spring warming. The low frequency complex permittivity, particularly below 1 kHz, is found to increase between March and June. This finding is attributed to changes in the physical properties of the ice and the seasonal evolution of sea-ice microstructure. High frequency permittivity measurements are examined to better understand the C-band backscatter coefficient of March sea ice. Analysis shows dielectric permittivity to be closely related to ice surface salinity. Measured values of high frequency dielectric permittivity are compared to values derived using a model created by Vant et al. (1978).

Where's Walrus? Image Analysis Tools to Assist Identification of Walrus in Digital Aerial Photography and Analyze Surrounding Sea-Ice Preferences

Alexander Sacco

The Pacific Walrus is currently being considered for listing as threatened under the Endangered Species Act due to recent and predicted loss of habitat caused by Arctic sea ice retreat. However, walrus use only a small fraction of the total area of ocean covered by sea ice and so the relationship between sea ice retreat and habitat loss is not well quantified. Using a subset of NOAA's Loss of Sea Ice (LOSI) aerial imagery from 2012 in the Bering Sea shelf, we developed a 3-band multispectral filter to identify pixels corresponding to the skin tones of walrus. The filter identified walrus-colored pixels in 52,596 images out of 354,043 images, of which 159 were found to contain walrus upon manual inspection, representing an over 85% reduction in the number of images requiring manual inspection. Manual inspection of the filter's results is not complete yet, however. Moreover, many of the scenes that did not contain walrus exhibited other information pertinent to population assessments such as blood and scat. More than 260 walruses were found with a mean of 5 walruses per aerial scene. We also computed floe properties of sea ice from scenes occupied by walrus and compare them with those of unoccupied sea ice. In occupied images, mean floe area was 18 m2 (2-477 m2 range), while mean perimeter was 24 m (5-308 m range). By comparison, mean unoccupied floe area measured 30 m2, while mean perimeter measured 30 m (7-334 m range). Floes that were not fully contained in-image were excluded from this analysis. Improving filter detection to include walrus scat, sediment, and blood identification, as well as increasing more usable data could yield better parameters for walrus floe preferences. With further development, we hope these tools will assist with data analysis for both past and future marine mammal observations.

Shoreline Cleanup Assessment Techniques (SCAT) for Oil Spills in Inland Freshwater Environments

Patrik Sartz

Shoreline cleanup assessment techniques (SCAT) are utilized when spilled oil contaminates shoreline habitats. Responders must then survey the affected areas to determine the appropriate response. Treatment recommendations given by the SCAT team should include field data on shoreline habitats, oil type, degree of shoreline contamination, spill-specific physical processes, and ecological and cultural resource issues. Cleanup endpoints must be established early so that appropriate cleanup tactics can be selected to guide the recovery teams and ensure achievement of cleanup objectives. SCAT has historically been used for spills to marine environments, but was implemented with good results during the 2010 crude oil releases into the Kalamazoo River, Michigan and the Yellowstone River, Montana. Cleanup endpoints are usually more stringent for the low-energy environments found in in streams, rivers, and other freshwaters, due to several factors such as the direct human use of inland waters, lack of physical processes that can speed the rate of natural removal of contaminants, and the potential to affect smaller water bodies with slower rates of dilution and degradation. Future needs include assessing how a petroleum or other hazardous substance release to Alaska's freshwater environment, coupled with on average low temperatures, could affect remediation times and potential risks. Development of Geographic Response Strategies (GRS) for interior and North Slope freshwaters, with current oil exploration and production sites prioritized, is also needed. These GRSs should include shoreline type and accurate description of stream form, as well as access points. Continued training of State and Federal responders to conduct SCAT surveys during an event in to a freshwater environment has also been identified as a priority.

Biodegradation of Crude Oil Near an Alaskan Shoreline

Priyamvada Sharma, Dr. Silke Schiewer

Oil is the most important energy source and an environment pollutant as well. Alaska, a large producer of crude oil, has experienced both marine and terrestrial crude oil spills in the past. As crude oil contamination of the environment is harmful for ecosystems, it is important to develop approaches to remove spilled oil. For oil spills at shoreline, contaminated sediment profile is studied in this research. Biostimulation method is the best in-situ remediation solution for crude oil spill. However, it is known that all metabolic activities slowdown in cold conditions as generally prevailing in Alaska. Therefore, the rate of biodegradation of crude oil by micro-organisms under different environmental parameters has to be studied. One parameter that has so far not been studied systematically is the effect of salinity, which is important for the bioremediation potential of sea shores compared to inland sites. This study will focus on the biostimulation method for bioremediation of crude oil. Laboratory microcosms are set up with varying temperatures, salinity and crude oil concentration with standard concentration of nutrients. The relationship between the nutrient consumption, biomass growth and fuel degradation will be investigated via mass balance equations. Investigating biodegradation under various circumstances will help in determining best suitable conditions for degradation of crude oil at Alaskan seashores. This research will overall focus on determining different environmental conditions that enhance the rate of biodegradation, as a proxy for oil spills in cold seashores areas.

Use of Willows to Enhance the Rhizoremediation of Contaminated Soil From a Remote Alaskan Village

Jessica Starsman, Silke Schiewer, William Schnabel, Mary Beth Leigh

The Yukon Koyukuk Tank Farm was established in Kaltag, Alaska, in the early 1960's. Since that time there have been multiple diesel spills. Thus, the soil in the area has been found to be contaminated with a high concentration of diesel range organics. Due to the presence of weathered diesel, the remote location and costs of ex-situ remediation, the use of Salix alaxensis (felt leaf willow) for rhizoremediation of the site will be studied. The willow Salix alaxensis is commonly found throughout interior Alaska and contains the compound salicylic acid, which it releases through the roots. Salicylic acid has been found to induce the necessary gene activation for diesel degradation. Microcosms will be used to determine the effects of salicylic acid on the remediation of weathered diesel at 4ºC and 20ºC and compared against various soil amendments. Respiration, most probable number counts, gas chromatography mass spectrometry, and microtox analysis will be used to compare effectiveness. If salicylic acid is found to enhance the degradation of the weathered diesel, the use of Salix alaxensis would be advantageous as cuttings could be taken directly from the local population, less maintenance would be required and overall costs reduced.

Gap in GIS Data for Rural Alaskan Communities

Jessica Starsman

During the 2013 Galena flood it was discovered that there was a lack of GIS data for not only this Alaskan community but all of the others. In an emergency response scenario, either man made or natural disaster, GIS information can beneficial in ensuring a quick and effective response. In the Galena case the development of the necessary GIS layers was crucial to the response but also extremely time consuming. Property ownership had to be developed from CAD drawings and a grid designed for inland SCAT operations. It would be helpful to have such information already as GIS layers for individual communities as well as geographical response strategies, places of potential refuge, river/stream data, wildlife data, etc. This data is not only desired by the Alaska Department of Environmental Conservation but by other state agencies as well.

Offshore Drilling in the Arctic

Christina Nicely

Offshore arctic drilling: a dilemma of balancing ecosystem maintenance while using natural resources to sustain an increasing demand of an every-growing population. With a lack of empirical evidence to sufficiently balance the pros and cons of oil exploration in the area

The Arctic Council

A. EPPR protocol (Emergency Preparedness, Prevention and Response)

B. The Salekhard Declaration: a report outlining the unique behavior of chemicals and hydrocarbons in the Arctic environment, interacting with ice and wildlife

Alaska's Department of Environmental Conservation Control

A. Permits required for every action that helps regulation of oil exploration

B. Venues of public concern

Protocol

A. Wells are designed for weather and environmental conditions

    i. Seismic and geological surveys

    ii. Wells equipped with sensors

B. Weather surveillance

C. Blow-out preventers

D. Relief Wells

Recovery and Reaction

A. Mechanical skimmers

B. B. Controlled burning; if the oil is frozen in the ice, it will be burnt later when the ice melts

C. Capping and containment of the well

D. The use of dispersants

Consequences of Spill Protocol

A. Cold temperatures would slow the spread of oil and keep volatile components from evaporating quickly, allowing easier skimming and burning

    i. in controlled burns, the Arctic environment is less tolerant of soot and residue from volatlization

    ii. Skimmers may disrupt vital sea ice habitats

    iii. Currents connecting the world's oceans

B. Most of the detergents have been shown in scientific studies to be dangerous to humans and wildlife. They create a more toxic environment than the spill did

C. Burning oil before the ice-melt could affect the biota in and around sea ice

    i. Oil/ice adhesion behavior is not well studied

D. Lack of infrastructure in remote areas

Thank You to Our Sponsor

We'd like to offer a special thanks to our sponsor at the Oil Spill Research Institute (OSRI) and Midnight Sun Catering. Scott Pegau generously provided funding to secure our venue at the Birch Hill Cross Country Ski Center and worked in partnership with Doug and Sonja Campbell at Midnight Sun Catering to arrange food service for each of us. Lee Williams was exceptionally helpful as we completed the reservation process from out of town, but the symposium would have been nothing without the generous participation of our speakers, who shared their time and energy to write abstracts, prepare presentation, and travel from sometimes distant locales to join us in Fairbanks. Thank you for making the Alaska Oil Spill Technology Symposium a worthwhile venture.

Prince William Sound Oil Spill Recovery Institute

PRINCE WILLIAM SOUND
OIL SPILL RECOVERY INSTITUTE

The Prince William Sound (PWS) Oil Spill Recovery Institute (OSRI) was authorized in 1990 by the United States Congress to "*identify and develop the best available techniques, equipment, and materials for dealing with oil spills in the Arctic and sub-Arctic marine environments*" (Title V, Section 5001, Oil Pollution Act of 1990); and, also to "*determine, document, assess and understand the long range effects of the EXXON VALDEZ oil spill on the natural resources of Prince William Sound. . . and the environment, the economy and the lifestyle and well-being of the people who are dependent on them.*" In 1996, the act was amended to expand the area of emphasis from the Exxon Valdez oil spill region to the Arctic and sub-Arctic marine environments. A 2005 amendment mandates that OSRI continue its programs until one year after the completion of oil exploration and development efforts in Alaska.

Catering provided by Midnight Sun Catering, LLC

MIDNIGHT SUN
NE OBLIVISCARIS
CATERING
FAIRBANKS, ALASKA

2684 Old Steese Hwy, N.

Fairbanks, AK

Phone: (907)457-8508

Email: midnightsuncatering@gmail.com

Thank you to everyone for attending and participating in the 2014 Alaska Oil Spill Technology Symposium

If you have any additional questions or information you would like to follow up on regarding the AOSTS please contact:

Dr. Rick Bernhardt (ADEC) rick.bernhardt@alaska.gov

Ashley Adamczak (ADEC) ashley.adamczak@alaska.gov