Guidelines for Collecting Ephemeral Data in the Arctic: ICE

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Note: These guidelines are limited data collection aides that do not necessarily consider all possible scenarios under which samples may be collected. Use best professional judgment to modify these guidelines according to area-specific field conditions.

Guideline Objectives

The primary objective of this document is to provide guidelines on collection of ice samples for chemical and biological analysis during the early stages of an oil spill in the Arctic to support Natural Resource Damage Assessment (NRDA) exposure and injury evaluations.

Sampling Objectives

Characterize oil

- Determine the concentration and composition of oil compounds in the ice compared to background concentrations
- Determine the source of contamination via chemical fingerprinting analysis and characterize oil weathering and fate
- Characterize other sources of oil or hydrocarbons in the environment

Describe habitat

- Characterize the physical characteristics of the ice habitat
- Support oil environmental transport modeling

Study exposure

- Document exposure of ice and under-ice organisms to oil compounds
- Support exposure modeling

Quality assurance/quality control

- Ensure the integrity the sample(s) throughout sampling, transport, and storage
- Ensure the reliability of chemical characterizations

Collaboration

- Support other ongoing efforts including, but not limited to, validation of remote sensing activities , modeling of impacts to water-column resources (see Water guidelines)

Before Field Sampling

- Assure that all personnel have required safety training and protective equipment for Arctic field work (not described in this guideline).
- Arctic weather conditions (e.g., wind direction and speed) are variable within a short timeframe. Be prepared for changing weather conditions, be aware of your surroundings, and take precautions to ensure the safety of the sampling team. Special precautions are necessary for working on sea ice or in ice-infested waters.

- Sampling ice is a highly specialized activity that most field personnel are not familiar with. Plan to involve or consult with experts, such as the University of Alaska Sea Ice Group or others, before undertaking any ice sampling activities.

Study design

- It is important to have a defined sampling strategy prior to conducting fieldwork. Ice samples are difficult to sample because of the inherent heterogeneity of oil distribution over space, depth, and time.
- The following terminology is used to define general to specific sampling geographies:
  - Area = general area of uniform characteristics, such as degree of oil exposure, physical setting, habitat types present, etc.
  - Location = a specific location that is representative of the area and contains the type of habitat to be sampled
  - Site = a specific point at which samples are collected or observations are made
- Plan ahead the number of locations and number of sites per location, taking into account level of effort, potential logistical limitations, weather conditions, and other issues that may compromise sample integrity.
- Review the guideline and resolve any area-specific issues. Area-specific modification of the guideline may be needed based on environmental conditions, geography, access to remote areas, and shipping capabilities.
- Information about the location and movement of oil under ice may be available from the emergency response effort. Oil is difficult to detect under ice and will tend to concentrate in certain areas depending on the under-ice roughness. Oil would be unlikely to spread evenly.
- Use a computer or conceptual model of the extent of ice contamination or an appropriate power analysis to estimate the number of locations and number of sites per location needed to respond to the sampling objectives.
- Contact the laboratories that will be receiving field samples for analysis and assure that they have the capacity to receive and analyze samples from the study. Follow relevant guidelines from the laboratory and consult with them about necessary modifications.
- Information from the national ice center, emergency response or other sources should be used to develop a sampling strategy and estimate distances and number of sampling locations before going into the field.
- The sampling strategy should have flexibility to be adjusted based on conditions in the field.
- Consult appropriate guidelines for the collection of other environmental media and biota concurrent with ice sampling. If observed during ice sampling, tarballs, sheens or other oil residues can be collected opportunistically for chemical analysis and fingerprinting.

Equipment

- Review the list of sampling equipment/containers, make adjustments as needed, and assure that all essential field materials are ready to be taken to the field.
- If not all sampling equipment is available, consult the alternative equipment guidelines or determine if other appropriate options are available.
- Consider area-specific conditions for remote Arctic regions and make adjustments in methodology and equipment as necessary.
- It may be necessary to coordinate with the laboratory that will receive the samples to assure that acceptable materials and conditions are used for sampling and sample storage and shipping.
- Do as much material preparation prior to field deployment, including: labeling sample jars using permanent markers or laboratory labels (e.g., peel and stick waterproof labels); solvent rinsing of jars for total hydrocarbons (THC) and polycyclic aromatic hydrocarbons (PAH) analyses, etc.

- Make sure that all essential equipment is in working order and operational under Arctic field conditions, and that spare equipment and/materials are available.
- Store solvents carefully to prevent spillage. Follow regulations regarding the shipment of chemicals.

Sampling Areas and Timing

- Follow a sampling plan/work plan if one is available.
- If a sampling plan is not available for ephemeral data collection immediately after a spill, data collection should focus on collecting samples from a range of unoiled, likely to be oiled, and already oiled areas.
- Oil will not weather under ice at the rate that it does when exposed to air. Consider the stability of the oil contamination and ice-associated biological communities when planning ephemeral data collection in ice habitats. During freeze-up and break-up ice conditions may change very rapidly, which could influence sample timing.
- It is important to obtain reliable information and analytical chemistry data that account for spatial and temporal variations of oil impacts.
- When sampling in remote areas with limited shipping capabilities, plan ahead to make sure that the integrity of samples is not compromised by ensuring that the processing laboratory receives the samples within their recommended holding time. Remember that it may take multiple days for shipments from remote areas to reach a laboratory facility. This last stage is the most important and requires due diligence until the samples are safely delivered.
- The number of locations and number of sites per location need to be considered accordingly, making sure that there is enough space in the coolers to accommodate all samples without sacrificing their integrity.
- Plan all sampling strategies within daylight hours; sampling in the dark, even with headlamps, is not recommended. This guideline may not apply during winter or much of the fall.
- Ideally, ice cores should be collected separately for chemical and biological analysis. However, under some circumstances (including limited storage capacity; see below), the same ice core can be used for both chemical and biological analyses.
- If space is limited or time constraints exist, prioritize sample collection to obtain as much information as practical about resources at risk and their exposure to oil.
- The challenges of collecting samples in remote areas, particularly during winter, are great and require adequate planning and careful field implementation to attain the data quality required to meet the objectives of the sampling plan.

Area selection

- Sampling locations should be representative of areas that have been or may be oiled by the spill and unoiled reference locations.
- Use trajectory models, conceptual models, overflight information, remote sensing data or other tools to determine what areas have been oiled and which ones are likely to be oiled.
- Samples should also be collected from locations known or suspected to be impacted by other natural or anthropogenic sources of contamination (e.g., oil seeps, coal, peat, mining, combustion engines), as these will be important to differentiate background sources and levels of contamination.
- It may be necessary to prioritize sampling locations. In this case, highest priority samples are to be collected from oiled ice areas that are known to be biologically productive, or highly relevant for human use. Collecting pre-oiled ice from sensitive/productive areas that are likely to be oiled by the spill in the near future is also a priority. Sampling at unoiled “control” areas and sampling other sources of contamination should be prioritized based on the ephemerality of the data and relative importance to developing a NRDA case.

- Ice samples should be collected pre-oiling, if possible, as soon as practical after oiling, and periodically thereafter. The number of locations and number of sites per location should be defined in the study design. A minimum guideline for collecting ice samples is at least three samples per location of relatively uniform oiling exposure.
- Sample along exposure gradients, starting in the cleanest zone, at regular intervals proportional to the exposure area.

Collaboration
- Ice samples can be collected in conjunction with water samples.
- Close collaboration and coordination with other ongoing ephemeral sampling efforts is important.

Field Sampling Methods

Sampling Equipment/Containers
Note: The amount of equipment required depends on the sampling plan, desired sample volumes, and logistics. Analytical laboratories may provide required sampling and sample storage and transport materials – contact the receiving lab before preparing to collect samples in the field.
- Coolers – for sample storage and transport
- Ice packs/Collapsible jugs − for storage temperature regulation (if ambient temperature exceeds 4°C)
- Thermometer or temperature logger (1 per cooler)
- Disposable nitrile gloves (preferred), insulated nitrile-coated gloves (less ideal)
- Insulated shoulder-length rubberized gloves preferred for water sampling under extreme cold conditions
- Sampling jars – certified organic-clean glass jars (solvent rinsed) with Teflon-lined lids and labels:
  - 1 L glass jars, amber glass preferred. ***Note:*** The mouth of the jar must be large enough to fit ice core without resourcing to core sectioning
- Shovel
- Ice drills including augers (mechanical or manual)/corers – for collecting ice cores
- Ice saw or knife– for ice core sectioning
- Teflon (PTFE) bags – 60 x 60 cm, organic clean (solvent rinsed) with closures or cable ties (preferred). Smaller sizes are also needed for ice-core segment storage
- Ice core storage boxes– for biological samples
- Ice probe for measurement of ice core temperature and salinity (preferred); a quick reading thermometer and a handheld salinometer (less ideal)
- 10 and 20 micron pore filters
- Glass or plastic vials- for sea-ice flora preservation
- Lugol, 10% buffered formalin (preferred), 95% ethanol (less ideal) – for sample preservation
- Field Sample Forms (template in Appendix A)
- Chain of Custody forms (see Chain of Custody guideline)
- Evidence tape (see Chain of Custody guidelines)
- Field notebook (waterproof paper)
- Pencils, waterproof pens, waterproof labels, markers
- Sorbent pads
- GPS, camera (with spare batteries), and photo scales
- Small drop camera with underwater capabilities (e.g., GoPro) – for under ice photography
- Packaging materials for glass jars (e.g., bubble wrap, sorbent pads, tape) – may be provided by the analytic laboratory
- Suitable disposal bags for oiled PPE and disposable sampling materials

Optional (if single-use sampling equipment is not available):

- Sufficient quantities of pre-cleaned or disposable single-use equipment are preferable. If equipment will be reused in the field, decontamination is necessary and will require the following materials:
  - Reusable sampling equipment
  - Laboratory-grade detergent (Liquinox or similar)
  - Solvents for cleaning sampling equipment – acetone, methanol, or hexane (Capillary GC Pesticide Residue Grade or equivalent) – consider shipping/airline regulations for solvents
  - Teflon solvent squirt bottles
  - Laboratory-grade, certified-clean distilled water (preferred), store-bought distilled water (less ideal); laboratory-grade detergent
  - Approved, sealed container for collecting solvent rinsate for disposal

Quality Assurance/Control

- Obtaining an adequate number of quality control samples is essential. At a minimum, a trip blank (accounts for contamination introduced during shipping and handling) and field blank (accounts for contamination introduced during sampling) should be maintained for each sampling effort and generally be collected at a rate of 5% and 10%, respectively, of all samples.
- Ideally, trip and field blanks are a sampling jar containing ultra-pure or distilled water. Blanks may be provided by the receiving laboratory.
- A trip blank is an unopened sampling jar and should be transported with the samples and remain sealed in the cooler during sampling activities.
- A field blank should be collected at approximately every third sampling site, or at least at an "un-oiled" and "oiled" site, by leaving the field blank sample jar open for the duration of the sampling period at that site. Record the site where field blanks were taken on the field sample form.
- Rinsate blanks should be collected if there is a risk of cross contamination from reuse of sampling equipment. After cleaning the equipment in accordance with the procedures described in this method, rinse the clean equipment with solvent or cleaning solution and collect the rinsate in a sample jar. Note on the field sample form where and how rinsate blanks were collected.
- Duplicate samples should be collected at every third sampling site or following the specifications of the work plan. A duplicate sample is collected from the same location and following the same steps as the preceding sample. This is not the same as collecting replicates from each site/depth. Duplicates should account for 10% of all samples, but consideration should be given to sample storage capacity. Do not split samples unless specified in the work plan.

Good Sampling Practices and Decontamination

- Good field practices and the development of a consistent sampling routine will help provide for the integrity of the samples and their validity in environmental assessments.
- Disposable nitrile gloves should be worn when sampling and changed between each sample collected or as necessary to prevent cross contamination.
- Disposable nitrile gloves can be worn over low-profile insulated gloves (e.g., neoprene gloves) in cold conditions and should be changed between samples to prevent cross contamination if they become contaminated or damaged. If nitrile gloves are not available or will not fit over insulated gloves in cold conditions, insulated nitrile-coated gloves may be an alternative, but extra precautions will have to be taken to prevent sample contamination; gloves will need to be cleaned with soap and clean water between samples and should not come in contact with the sample or with the surfaces of glassware or tools that will be in direct contact with the sample. Similar precautions should be taken when using insulated shoulder-length rubberized gloves.
- To reduce the need for field decontamination, use pre-cleaned and/or disposable equipment and tools.

- The only types of equipment to be used between sites are ice drills/corers and saw or knife, which should be cleaned with soap and clean water. Alternatively, use a clean dry towel or other dry material to clean the equipment before its next use.
- Additional decontamination steps MUST be taken when using ice drills/corers and saw or knife when these become contaminated, and particularly when sampling in oiled sites. To decontaminate these tools prior to each use:
  - Wash sampling equipment with laboratory-grade detergent and clean with a triple clean-water rinse. Cleaning with laboratory-grade water is preferred, though store-bought distilled water is a less ideal alternative and, as a last resort, "background" water from an up-current clean area can be used. If unfrozen water is not available, snow can also provide significant cleaning
  - Rinse with methanol or acetone, followed by hexane (Capillary GC Pesticide Residue Grade or equivalent). Collect solvent rinsate for proper disposal or shipment to the lab as a rinsate blank. Allow solvents to evaporate from equipment before use. Do not work with solvents downwind of exhaust or other airborne hydrocarbon source. If solvents are not available, use a diluted detergent solution and fresh water, followed by a distilled water rinse. If transporting solvents is not feasible, use single-use sampling material
- Potential sources of contamination while sampling from vessels or vehicles (exhaust fumes, oily surfaces) are a concern. Work up-wind of any exhausts, consider using non-motorized vehicles to access offshore ice sampling locations, and designate clean areas for sampling. Park aircraft, snow machines, boats or other vehicles at least 5 meters away and upwind from the sampling site. If possible, turn off vehicle engines while sampling.
- Take precautions to avoid cross-contamination of the site from oil on personal equipment. Sampling unoiled areas first, then lightly oiled areas and finally heavily oiled areas can minimize cross-contamination. Personal equipment should be exchanged or cleaned between sites if it becomes contaminated.

Sample Collection Methods

- Use field data forms included in the work plan, if one is available. Otherwise, use forms in Appendix A. Coordinate data form development/modification with the data management group.
- Because GPS units will be used to record locations and times, make sure that all units are using the same coordinate system, datum, reporting units, and correct time. Follow the recommended GPS datum of the study plan, if one is available. Alternatively, set the default to WGS84.
- Record GPS coordinates for each sample site.
- Photograph the sampling site prior to sample collection to document the site conditions, as well as the sample collected. Make sure each photograph or series can be later associated with the corresponding sampling locations (e.g., through use of GPS Photo link software or by keeping a detailed photo log with waypoints and/or lat/long). Do not delete or alter any photographs. The numbering sequence of photographs uploaded from your camera must not have any gaps (see Field Photography guideline).
- When photographing areas or locations with sea ice consider including a photo scale, person or object in some pictures for perspective and scale.
- Collection of ice cores is a delicate process that requires previous coring experience or field calibration to ensure that the bottom of the ice core is collected as intact as practical. Note that full speed mechanical drilling disturbs the bottommost few centimeters more than hand drilling. Mechanical drilling may be preferred if the objective is to conduct sampling as quickly as practical, but the tradeoff may be loss of the most oil contaminated and biologically productive skeletal layer of ice.
- When collecting ice cores for chemical or biological analyses:
  - Ice cores can be collected using a wide spectrum of ice drills ranging from hand augers (useful when collecting cores from the top two meters of the ice sheet) to mechanical drills (useful when

collecting cores at greater depths within the ice sheet). Select the appropriate drill/coring device depending on area-specific characteristics and sampling objectives

- Avoid sampling ice cores under sheens and oil slicks, but if unavoidable, clear surface oil prior to sampling by sweeping the area with sorbents. If oil has reached the surface of the ice by moving through brine channels and it is not possible to clear the surface, it may still be important to collect a sample. Note this type of sample contamination in the field data sheet and in the field notebook
- Prior to coring, remove all surface snow and unconsolidated ice with a clean shovel
- Take photographs of the site before and after coring, as well as photographs of the core, and record the GPS coordinates of the core extraction site. In addition, take notes in the field notebook and take a picture of the field book before the core is extracted
- Care should be taken to prevent the contact of the outside of the core with the drilling equipment, drilling fluids, and other sources of contamination
- As soon as a core is taken, make sure that you process it as quickly as practical, as temperature and bulk salinity (brine drainage) will change on a short time scale
- If possible, it is recommended that one core be taken for temperature profiles and one for bulk salinity as recording the temperature can take a while and brine drainage can be significant in the bottom segments (see below)
- If possible, use a small drop camera (GoPro or other underwater camera) mounted on a pole to send down the core hole to take pictures of the surrounding ice to provide some indication of the representativeness of your sample. Biologically, the spatial scales of variability can be very small and influenced by the amount of snow overhead
- Record the external temperature at the time of core collection and extraction
- Following recovery, ice cores should remain in a frozen state until analysis, typically in a laboratory off the ice (preferred)
- Alternatively, ice cores can be melted and water stored for analysis (less ideal); however, all precautions have to be taken to avoid any sample contamination
- Do not expose any core collected for biological sampling to direct sunlight, as this can alter their biological makeup
- Collect at least three replicate sets of cores per location of homogenous oil exposure. Because even level sea ice is not homogenous at the ice-air interface, protuberances extending into the water column may keep cores oil free. Underwater photography may be important in this case.
- All cores need to be stored in insulated waterproof storage containers maintained at or near the lowest in-situ temperature. Remember that cores leak brine and will flush out even at very cold temperatures. Ideally, put cores into clean Teflon bags, then into a core tube, and finally into a cooler for transportation
- Make sure you maintain the orientation of the ice core during processing, storing, and labeling
- The same core can be used to take samples for biological and chemical analyses, only when there is sufficient material for both types of analyses, and when cores do not break during extraction

Note: The bottom of the ice can be very loose and will break up and drain while pulling the core up. This causes a significant loss of biological materials and oil. If this is the case, collect a surface water sample after removing the core to test for the presence of oil.

- On a single core per site, measure the temperature of the ice core immediately after coring:
  - Use the small drill to make a hole half way through the core. Insert the temperature sensor into the hole and take a reading. Once inserted, plugging the hole with the ice shavings adds an insulating layer aiding in temperature stability
  - Repeat this process over the entire ice thickness with a vertical resolution of 10 cm. If time allows, take greater resolution in the bottom 20 cm, at 1, 5, 10 15 and 20 cm from the ice-air interface to gain a better understanding of brine exchange with the underlying water. This may be important to understanding the degree of exchange with potential accommodated oil in the water.

In addition, ice core temperature allows for a greater understanding about brine volume fraction, ice porosity, etc.
  - Measuring the ice core temperature will allow you to make temperature adjustments during ice core storage and transportation to make sure that temperatures are kept as close as practical as the temperature of the ice. Remember that the colder the better to limit brine mobilization (non-biological sections)
- If possible, measure salinity from thawed ice samples using a handheld salinometer. Direct measurement of the brine presents specific challenges and might not give a representative salinity reading of the core sampled.
- After completing the temperature profile, store core samples as intact as practical. If space is limited or if indicated in the work plan, cut the ice core with an acetone-cleaned saw or knife into 2-10 cm long sections (depending on the total length), and place them in Teflon bags inside labeled core-storage boxes. These core segments can be used for biological or chemical analyses, noting that this was the core used for temperature profiles.
- In cores collected specifically for biological analyses:
  - Do not take a second temperature profile
  - Intact cores can be placed in Teflon bags inside labeled core-storage boxes, and stored for further processing in the laboratory (preferred)
  - Alternatively, cut cores into 2-10 cm sections (less ideal), place them in Teflon bags inside labeled core-storage boxes
  - If storage space is of concern, melt individual core section in 0.2 µm filtered seawater at 4°C and at the appropriate in-situ salinity, and concentrate fauna into 20 micron pore filter, and preserve with buffer formaldehyde (least ideal). As a rule of thumb, 1 cm of bottom ice (9-10 cm diameter corer) corresponds to 100 ml. Collect as many melted cores as practically feasible
- To sample ice plankton:
  - Collect a 7.5-10.5 cm diameter core and place it intact in a Teflon bag, inside of a labeled core-storage box, and stored for further processing in the laboratory. Depending on the length of the ice core, it may be necessary to segment the ice core with an acetone-cleaned saw or knife by cutting 2-10 cm long sections (or a longer section if specified in the work plan). Place each segment in individual Teflon bags inside labeled core-storage boxes until processed in the laboratory. Sectioning in the field reduces the spread of potential oil contamination as oil would likely leak from the brine channels oiling the entire length of the ice core
  - If sample storage space is a concern, melt the ice in surface water filtered through 0.2 µm polycarbonate membranes, recording the volume of water used (least ideal). If oil sheens or slicks are present, use reference surface water at the appropriate salinity and temperature (to avoid cell stress)
  - Melted ice samples for biological analysis should be preserved as follows:
    - For phytoplankton analysis with Lugol's solution followed by an acidified formalin solution (see Plankton guidelines)
    - For zooplankton analysis in 5% formaldehyde (preferred) or in 95% ethanol
    - Cap sample jars and place them a cooler, avoiding direct exposure to light
- Analyses performed in samples collected for biological metrics include:
  - Sea-ice flora:
    - Chlorophyll *a* profiles (via fluorescence) for biomass assessment and identification of species distribution within sea ice thickness (essential)
    - Sea-ice flora sample can be condensed by settling or by filtration throughout 10 micron pore filters and used for identification (species level) under light and electronic microscopy (suggested). Preserve samples by adding 38% formaldehyde at 1-4% final concentration (10% of total melted volume) and store in a glass or plastic vial until sorting
  - Sea-ice fauna:

- Identification of species distribution within sea ice thickness, biomass, and abundance with focus on specific groups (i.e., nematode, a main component of cryopelagic community) (essential). If possible DO THIS LIVE as a method of pre-sorting as several taxa (e.g., the marine flat worms Platyhelminthes and Acoela) do not preserve well. Information can be gathered before preservation and more specific (species level) can be determined through observation or dissection
- Reverse-flow filtration can be used to concentrate the invertebrate community throughout 20 micron pore filters to 5-10 ml volume, followed by preservation in 4 % formalin. These samples can be used for fauna enumeration using Bogorov's device and light microscopy (suggested). This type of analysis should be performed in a processing laboratory

Note: Most of the analyses for ice-flora can be performed in the field, but if time is of concern, samples can be processed in a laboratory as soon as practical

- To collect cores for chemical analysis:
  - Collect a 7.5-10.5 cm diameter core and place them intact in Teflon bags inside labeled core-storage boxes, and stored for further processing in the laboratory (preferred)
  - Alternatively, cut the core into approximately 3 cm sections (or other if specified in the work plan) (less ideal) and place cores in Teflon bags inside labeled core-storage boxes until processed in the laboratory. Care should be taken to keep track of the depth of each stored ice core section
  - Place sectioned ice cores in clean glass jar (amber preferred), cover the bottle with aluminum foil and leave at ambient temperature (only if ambient temperature is <5°C) until melted (least ideal). DO NOT expose the melted ice to ambient air. The jar must remain closed until processed in the laboratory
  - Make sure enough ice core sections are collected to meet volume requirements for chemical analyses
- For each ice core, record:
  - Date, time, and weather conditions (e.g., wind direction and speed)
  - Physical setting (shoreline orientation, exposure, etc.)
  - Ice core total depth, ice ore section depth range
  - Description of oiling conditions, using standard shoreline assessment terminology
  - Characteristics of the area surrounding the coring site: texture, color, biota, vegetation, debris, odor, presence of oil under the ice, etc.
  - Indicate if samples were melted with ambient temperature or filtered water
- If water samples are collected, wait ~10 min after coring to allow any disturbed under ice oil to dissipate in the area before taking samples.
- Discrete samples from a single sample point may be collected to represent a specific condition, such as a tarball for fingerprinting and source identification (see Stranded Oil guideline).

Sample Labeling and Record Keeping

- Verify that all samples are properly labeled, and that field sample forms are properly filled out.
- Follow chain of custody procedures for securing samples and complete chain of custody forms (See Chain of Custody guidelines).
- Complete the Chain of Custody form, noting where each ice core sample was collected, sampling equipment used, time/date of collection, size and container type, and sampler name.
- Make special notation on the Chain of Custody form about any problems or observations during sampling.
- Maintain strict chain of custody during sample storage and transportation.
- Record the sample number on both the sample jar label and lid, and ice core boxes. Record the following on the field sample form:
  - Sample collection site (NRDA sample grid ID and GPS coordinates)

  - Sample matrix (ice)
  - Sample #, date/time
  - Sampling method (drill). Note if sample is for QA/QC (field blank, trip blank, rinsate blank)
  - Ice oiling conditions (using standard shoreline assessment terminology), tidal elevation, weather conditions (e.g., wind direction and speed), ice characteristics, vertical changes in ice characteristics, presence of biota, vegetation or debris, odors and other relevant information on the field data sheet
- All sample numbers must be unique. Use the sample number convention provided by data management if available. Otherwise, the sample number should consist of a sample team ID and sequential numbers. For example AKA-0001, AKA-0002, etc.
- Documenting oil distribution on ice/under ice is best accomplished with photography, video, and good field notes and sketches using standard shoreline assessment methods. These data may be collected by SCAT teams and available to support environmental assessments. Samples may be needed for fingerprinting or monitoring weathering, to correlate a degree of oiling term with oil loading, to confirm the presence of oil, or for bioassay purposes.
- Make a quick sketch in a field logbook or sketch form showing the sampling locations in enough detail that the location could be re-occupied by someone else.
- Keep a detailed photo log so that each photograph can be labeled.
- Note any deviations from the recommended guidelines in the field book.

Sample Preservation, Recommended Holding Times and Shipping

- Keep all cores in coolers maintained at a temperature at or near the lowest in-situ temperature. Make sure storage procedures are sufficient to maintain the integrity of the cores. Refrigeration temperature shall be recorded upon sample storage, and monitored and recorded periodically to ensure proper refrigeration. Samples are to be excised from the core only at the processing laboratory.
- Immediately following collection, place all ice-melted samples collected for biological analyses in a cooler and keep at 6°C, and all ice-melted samples collected for chemical analyses in a cooler and keep at 4°C. DO NOT FREEZE. Store all samples in the dark. Refrigeration temperature shall be recorded upon sample storage and monitored and recorded periodically to ensure proper refrigeration.
- Do not use freshwater when sampling and preserving ice plankton samples.
- In below-freezing temperatures, collapsible jugs of warm water can be used in the cooler between ice-melted samples to prevent them from freezing.
- Water samples collected for chemical analysis can be held at 4°C in the dark for up to 7 days (includes recommended holding time in the field and receiving laboratory) without loss of sample integrity.
- THC and PAH: can add 1 mL of 6 N HCl/liter of sample within 2 hours of sampling to inhibit microbiological activity. Not required by EPA.
- Use packing material, such as bubble wrap or sorbent pads, around glass jars to prevent breakage during transport and shipping. The receiving laboratory may provide packaging materials and shipping containers.
- Ship samples directly to the laboratory as soon as practical with complete chain of custody forms. If necessary, samples can be stored under specified conditions and with complete chain of custody until they can be shipped. Assure that samples are packaged to protect them from breakage, shipping containers are sealed and use ice packs or dry ice to maintain storage temperatures during shipment to the lab.
- Ship highly oil-contaminated samples separate from non-contaminated or low-contaminated samples to reduce risk of cross contamination.
- NEVER discard any samples even if these have exceeded their recommended holding times or storage temperatures.

Sample Volume and Requirements

Analytical Method	Sample Volume	Minimum Detection Levels [a]	Recommended Holding Time [b]	Minimum No. of Samples per Location [d]
BTEX (SIM)	1 liter [c]	0.1-1 µg/L	7 days	3 ice core replicates of at least 10 cm in length, or segmented ice cores per location; will depend on the total core depth
Total Hydrocarbons (THC) by GC/FID		15 µg/L		
PAH (including alkylated PAHs) by GC/MS-SIM		0.001-0.01 µg/L		
Chemical biomarkers (fingerprinting)		0.001-0.01 µg/L		

[a] µg/L= ppb; [b] Store at 4°C in the dark; [c] Several analyses can be made from a single sample; [d] 1 L of melted ice per sample type, 3 replicates per location– for biological analyses (see Plankton guidelines)

Analytical Methods

- Refer to those under Water and Plankton guidelines, if applicable

Key References

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Appendix A
Supporting Documentation - Field Data Form Examples

Unique field data forms may be included in the work plan if one has been developed, otherwise, use the attached form.

- Print the form on weather-resistant paper (if available). Make more than enough copies of the form before going into the field.
- Fill out forms with waterproof pen or permanent marker. Do not use pencil or biro (erasable) ink.
- Make any additional notes that do not fit on the form in a field notebook and indicate the presence of associated additional notes on the field data form.
- Fill in blanks with "N/A" if data are not applicable or not available. Avoid leaving blank values on data forms.
- Do not erase or black out erroneous entries on the field data forms. Errors should be corrected by crossing out the entry with a single line and signing and dating the strike-through.
- Electronic versions of field data forms are available. Coordinate data entry with NRDA data management personnel.

Attached form:
- Ice Sample Collection Form

Sample Collection Form - ICE										
Lead Sampler's Name/Phone								Sampler Team Code		
Lead Sampler's Affiliation								Resource Group		
NRDA Contact/Phone								Resource Group Leader		
Incident Name								Habitat (e.g., ice)		
General Location Description								Sample date (mm/dd/yyyy)		
Location Code	**Matrix**	**Sample Number (two digits)**	**Sample Time**	**Sampling Method**	**Sample Position/ Depth**	**Sample Size and Units**	**Sample QA/QC Type**	**Latitude**	**Longitude**	**Sample Notes**
NRDA Sample Grid ID	*Ice (I)*	*Sample # and A, B, or C for portion of composite*	*(24-hr clock, local time)*	*Method of sampling (i.e., core)*	*Core depth*	*Core size and units*	*Normal sample or Field QA/QC type*	*Latitude in DD XX.XXXXXX*	*Longitude in DD - YYY.YYYYYY*	*Description of sample, equipment used, photo numbers, etc.*

Survey Notes - (weather, wildlife, field team composition, sampling design changes, photos, etc.)

Samples Relinquished by:				Received by:			
Date	**Time**	**Signature - Field Sampler**	**Print Name- Field Sampler**	**Date**	**Time**	**Signature - Sample Runner/ Command Post**	**Print Name - Sample Runner/ Command Post**

Matrix	Sample methods and descriptions		Sample Area Sketch
Sediment or Soil	**Sampling Method**	**Depth units**	
(S)ediment Soil (L) Blan(K) Water	(GR)ab (CO)re	(c)m (m) (i)nches (f)eet	
Oil, Tarball, Water, Snow, Ice, Sheen	**Sampling Method**	**Sample Position/Depth**	
(O)il Tarball (B) (W)ater Blan(K) Water Other (H) (SN)ow (I)ce (SH)een	(GR)ab (SC)rape (OT)her	(FLOAT)ing (SUB)merged (STRAND)ed (COV)ering 0 - (Surf)ace <depth in meters> m	
Tissue or Wrack	**Tissue Type**	**Tissue Type (Continued)**	
(T)issue Wrack (R) Blan(K) Water	(WH)ole body Whole body w/o shell (WNS) Chorioallantoic Membrane (CAM) Egg (EM)bryo Fillet with skin (FS) Fillet without skin (FWOS) Gall Bladder (GB) Leaves (LEV) Leaves and stems (LVS) (LI)ver	(MU)scle Yolk NA <for Wrack only> **Species** <enter species> NA <for Wrack only>	
Sample Identifier system			
Sample IDs : Team ID-Sequential Numbers (ex. AKA-0001) QA/QC types: Field Blank (FB) Trip Blank (TB)	Rinsate Blank (RB)	Other sample types: (S)plit	