GC-2 Transit Line Spill
Tundra Treatment Plan Rev.1 (3/18/06)

Plan Objectives

The overall goal is to minimize further long term damage to the tundra during oil spill cleanup operations and to help restore the tundra damaged from the oil spill.

The guiding principles for selecting tundra cleanup, treatment and monitoring tactics are the following:

- Collect as much gross oil contamination as possible while to the maximum extent practicable minimizing destruction of the root zone of the tundra grasses, unless it is determined that the oil has thoroughly saturated the root zone and it will not be viable in the future.
- Plan and select tactics to minimize tundra erosion, thermokarsting and creating a 'lake effect' at the spill site.
- Capture and understand lessons learned from other tundra cleanup operations, especially winter operations, to improve success
- Protect lake at Q Pad from oil migration from site, especially during breakup or through the employ of any flooding techniques
- Minimize mobilization of oil and contamination of previously low, or un-contaminated areas of tundra
- Progress the understanding and knowledge around the use of ACS tactics relating to oil spill response on tundra.

The following plan was developed in coordination with the Alaska Department of Environmental Conservation (ADEC) and is based on methods outlined in ADEC's Tundra Treatment Guidelines with peer review from EPA and NSB.

Oil Removal and Tundra Cleanup

Stage I: Gross Oil Removal

Three primary techniques will be used for gross oil removal as follows:

- Direct suction will be used to collect free oil (T7). This technique will be used throughout all stages of cleanup.
- Oil contaminated snow will be removed using mechanical means (T10).
- Gross oil remaining on the tundra surface after free oil has been removed will be collected by placing clean snow as a sorbent layer on the area. The subsequent contaminated snow will be removed by mechanical means (T4, T10).

Stage II: Oiled Tundra Cleanup

Stage IIA: Trimming Contaminated Snow and Vegetation Canopy (T24)

Trimming is the preferred method to remove the contaminated snow and vegetation canopy, and will be used wherever possible throughout the entire contaminated area, with the possible exception of a test cell to evaluate the effectiveness of the flushing tactic, as described in Item 3 below.

1. Trimming will go down to the ground surface and part of the organic peat layer may also be removed in the trimming process, but care will be taken to avoid removal of the organic layer and mineral soil as much as possible.
2. In order to maximize the removal of contaminant, shaving of small hummocks of high ground may be unavoidable. If the removal process reveals a solid path of brown moss behind the trimmer, then the operation will be examined to determine if hydrocarbon removal has been adequately accomplished and/or if other removal tactics would be preferable to avoid damage to the vegetation and soil. Other removal tactics, and criteria for when they may be used, are described in Section IIC (Selection/Application of Other Treatment Options) below.
3. A test of the flushing tactic may be conducted to evaluate the effectiveness of this technique, most likely in an area determined to have moderate to low contamination. Methodology may include:
    - Establish a test cell; cell dimensions will be determined in the field.
    - A map of possible test locations will be provided by Alaska Biological Resources (ABR) to Environmental Unit.
    - Timing of any test flush will be coordinated with ABR to occur just prior to the site assessment.
    - Special measures will be taken to ensure that flushing does not mobilize oil into previously clean areas. These measures may include use of topography to ensure water flow is away from cleaned areas, careful balance of additional water (flushing) and subsequent removal (pumping or vacuuming), and/or putting down boom to divert flush water from cleaned areas.

Rationale/Considerations Applied in Selection of Trimming Treatment

To achieve the objectives of this Plan, it is imperative to remove as much of the contaminant as possible before breakup. While the tundra vegetation is dormant and tundra travel is permitted, the most should be made of these conditions for cleanup. Once spring growth begins and the soil thaws, activity on the tundra will cause damage that may persist for several years. The tundra vegetation is most susceptible to traffic as it commences spring growth and least susceptible when dormant.

Some cleanup options, such as burning and tundra excavation, should only be used after gross removal has been accomplished, and in any case are only feasible after breakup and spring thaw. Other options, such as flooding or flushing, require significantly more time than trimming to complete to the same level of effectiveness, unnecessarily consuming

the valuable time that remains before breakup. In addition, flooding or flushing can remove soil particles from around the root systems of the plants, compromising the viability of the vegetation. Trimming can be done now while the tundra is still frozen and snow-covered, and it can be done in a relatively short period of time, leaving time for assessment and subsequent cleanup options to be implemented as needed.

Physically removing contaminated snow down to the vegetation canopy should have little impact on the vegetation. Removing the plant canopy (leaves and stems above ground) above the organic peat layer at the surface of the soil will not cause major damage to the tundra vegetation, but removal of peat and soil would result in some loss of tundra vegetation. In order to maximize the removal of contaminant, shaving of small hummocks of high ground and inadvertent removal of the organic peat layer and the upper soil layer in some areas may occur. Nevertheless, revegetation is more easily accomplished than dealing with long-term hydrocarbon contamination.

Stage IIB: Site Assessment

After trimming of the contaminated snow is completed, a site assessment will be conducted to assess residual surface oil and infiltration depths into the tundra throughout the site, as follows:

- Site assessment will be based on 25' grid pattern, and will include visual observation and/or agreed upon field screening measurements such as photoionization detector (PID), Petroflag, etc.
- The site assessment results will be used to subdivide the contaminated site into areas of like contamination, and a map will be produced of low, medium and high contaminated areas.

Stage IIC: Selection/Application of Other Treatment Options

The following treatment tactics have been identified as potential options for removal of contamination remaining after trimming:

- Tundra Trimming (Organic Layer and Mineral Soil) (T24)
    - Trimming would be used to remove the remaining organic layer above the soil if saturated with oil. Past experience shows that the organic layer (mostly dead moss) is very absorbent and holds moisture and hydrocarbons readily. Removal of contaminated organic matter on the surface of the soil would prevent contamination migration to the mineral soil, which should be avoided if possible since cleanup and *in situ* decomposition is very difficult once contamination reaches this portion of the tundra soil profile.
    - If contaminated, the top 1-3 inches of soil would also be removed. Care would be taken to avoid excavation of undamaged root zones, although

loss of some roots and loss of the seed bank are inevitable results of trimming.

- Most likely this option will be used in at least part of the spill area where oil has penetrated into the tundra mat, and other tactics less damaging to the tundra vegetation are determined to be ineffective due to the level of contamination and the plant community's tolerance to oiling.

- Transplant Tundra Sod (T22)

  Transplanting tundra sod may be conducted in a test cell or cells to evaluate the effectiveness of this technique as compared to seeding or other methods. The test cell or cells will be located either in a highly-contaminated area that required excavation or in an area where trimming activities removed vegetative root mass or both. Sod for this test may be collected from river banks where sloughing has occurred due to water erosion during spring run-off, from existing overburden stockpiles, or from future pad construction, provided that applicable permits can be obtained.

  This method is advocated by the Local On-Scene Coordinator, and Charles Hopson, with LCMF, Inc, who administers the Village Response Team program with Alaska Clean Seas. This method has traditionally been used effectively by native groups to sod ice cellars. As reported in the ADEC Tundra Treatment Manual, Tactic T22, "no test data exist which document whether the use of these techniques results in long-term benefits to tundra restoration compared with other tactics, combinations of tactics, or 'no-action.'" Consequently it is more desirable to attempt this treatment on a test-scale and measure the success before attempting wide-scale application.

  Methodology may include:

  - Establish a test cell or cells; cell dimensions will be determined in the field.
  - A map of possible test cell locations will be provided by Alaska Biological Resources (ABR) to Environmental Unit. Soil moisture conditions will be considered in selecting the location and tundra sod will be selected to match soil moisture conditions.
  - Safety considerations (i.e. relative hazard of collecting tundra turf along rivers in the spring when they are swollen with run-off vs. later in the summer) will be a factor in timing and selection of tundra sod source(s).
  - Comparisons of percent cover and plant diversity over time for cells with tundra sod, cells using other revegetation methods, and cells without revegetation treatment (controls).
  - Documentation describing collection and application of tundra sod and other methods.

- Flushing (T2)
    - Tundra would be divided into manageable cells and flushed with warm water (<106°) to allow free oil to float which can then be removed with skimmers or suction.

    - This option may be used in areas where the oil has not penetrated into the tundra mat. Criteria applied in selecting this tactic in a given area will include the level of contamination (i.e. less likely to be effective in highly contaminated areas), technical feasibility (i.e. local topography with trenches or swales for flush water recovery), potential for contamination of adjacent clean areas, and other practical considerations (e.g. water handling and processing, and storage/tankage). These considerations render application of flooding on a large-scale impractical. Ambient temperatures in current winter conditions would likely render this alternative impractical.

- Vegetative Burning (T6)
    - This tactic will only be used with prior approval of the designated State spill response coordinator. Request for approval would include a description of the area(s) desired to burn, and an explanation of why it is the preferred option for these areas.
    - Use of this tactic would involve the following decision logic:
        1) Is mechanical containment and recovery feasible and adequate? If yes, do not burn. If no;
        2) Do fire/safety hazards preclude the use of burning, after consultation with Safety personnel as to the risks presented by piping, utilities, etc.? If yes, do not burn. If no:
        3) Is vegetative burning feasible? If no, do not burn. If yes;
        4) Will humans be exposed to smoke/particulates of more than 150 $\mu g/m^3$? If yes, can they be protected by secondary controls? If no, do not burn. If yes, then obtain State approval and proceed with burn.
    - This tactic would most likely be limited to spot burning with a weed-burner, in areas where removal of petroleum residue is needed following gross removal with other tactics. This procedure is meant to only burn surface contaminated vegetation and not damage the root system. Burn would be monitored, and constant watch maintained on the fire and smoke plume, and other safety hazards and issues.

- Tundra Excavation (13)
    - This tactic will only be used in extreme circumstances as defined in ADEC's Tundra Treatment Guidelines, when no other treatment would be effective and in very limited areas, and only with prior approval of the designated State spill response coordinator. Request for approval would include a description of the area(s) desired to excavate, and an explanation of why no other treatment tactics will work.
    - Removal of soil below the root structure with subsequent backfilling with clean fill material. There is more than enough overburden stockpiled from creation of gravel cells at the gravel mine site available for fill.
    - Should be considered only when contamination levels are toxic to all plant growth. An on-site tundra vegetation expert will make such determination.
    - Could be considered in heavily contaminated tundra near the Q Pad lake to reduce migration of contamination to the lake.

Which of these treatment tactics would be best in any given area can not be determined until initial cleanup (Stage I and Stage IIA) has been completed and a site assessment has been done. Tentative cleanup options for contaminated areas will be identified, based on the following criteria:

1. Level of contamination remaining after Stage I and IIA cleanup;
2. Technical feasibility;
3. Expected effectiveness, given site-specific considerations;
4. Minimization of adverse impacts from cleanup tactics;
5. Potential for contamination of neighboring clean areas and other areas of special concern (e.g. Q Pad lake).

Cleanup tactics may be altered in the field if nature or extent of contamination in a given area is determined to be different than what the selected option is predicated on, or if the selected option is determined to be infeasible, ineffective, or less desirable (based on the criteria described above) than another option, to allow the field cleanup team the flexibility it needs to incorporate new information or respond to changing conditions. Nevertheless, use of burning, flushing, or tundra excavation would not be used without prior State approval.

Stage III: Site Remediation

Site remediation will include the following steps:

- Repeat site assessment from Stage IIB to re-characterize current site conditions and select remediation options.

- This will be done in preparation for spring breakup and summer season.
- Treatments/tactics will include actions to prevent offsite migration of residual hydrocarbons.
- Monitoring protocol will be established and will include:
  - Sampling
  - tundra evaluation by technical expert
- Seeding and fertilization with appropriate species and nutrient mix to be considered in summer 2006 and summer 2007.
- Development of closure criteria for site including performance standards for vegetation community to be developed after clean up is completed and site has stabilized, but no later than Autumn 2007.
- BP will submit a site sampling and analysis plan (SAP) for Alaska Dept. of Environmental Conservation approval. A third party consultant will prepare the SAP and conduct the associated field tasks, including the collection of soils (gravel and tundra) and water (surface and possibly subsurface meltwater) samples to be submitted for laboratory analysis.

Stage IV: Site Monitoring and Management During Breakup

- Regular site inspections will be conducted to ascertain presence of hydrocarbons during break-up. Frequency and methodology of inspections will be determined by site conditions, and will change as needed to respond to changing conditions during break-up.
- Treatments/tactics will include actions to prevent migration and to collect residual hydrocarbons for recycle and/or disposal. This would include:
  1) Possible deployment of containment boom near shore on lake with sorbent boom deployed inside it;
  2) Deployment of sorbent boom in polygonal channels;
  3) Potential use of sorbent pads, pumps and/or vac trucks, if necessary, to mop up or vacuum pools of water with sheens or other visible indications of hydrocarbons on polygonal channel surface water; and
  4) Other strategies as dictated by site conditions.
- BP will minimize any impact to wildlife per an approved wildlife interaction plan; impact prevention techniques will include permitted passive and (if necessary) active hazing. Extra vigilance will be employed during the period of time just prior to and during spring break-up, when most migratory birds typically arrive and congregate; the wildlife plan will be updated accordingly as conditions dictate (e.g., spring break-up).

- Assess effectiveness of site monitoring and maintenance activities.
- May have to incorporate tactics for additional tundra treatment as mentioned in Stages II or III.

Matthew Falk NSB/LOSC 3-18-06

J. E. Spittle 3/18/06

Len Marcus (for EPA FOSC Matt Carr) 3-18-06

Walter Leitch 3-18-06