



## Environmental Restoration Technology

### Accident Cleanup:

The Coastal Plain area of the Arctic National Wildlife Refuge is covered mainly by wet tundra. The high water content of this type of tundra provides some protection to the roots of the plants from crude oil spills, which tend to float in the water. Water can also slow the movement of non-water soluble substances into the soil pore spaces, and while the leaves of the plants might be killed by the spill, the roots may survive and grow during the next spring. Wet tundra is also very sensible to physical damage, but it can also recover more quickly from it than drier types of tundra do.

When treating a spill in wet tundra, the possibility of contamination of water sources should be taken into consideration, since the water in the soil might move the spilled substance. If the drainage transect the spill site, diverting the water flow may be required to treat the site. Frozen wet tundra facilitates the recovery of a spill because it prevents the substance from penetrating the ground.

The possible damages caused when responding to a spill need to be weighed against the benefits of removing additional crude oil. It has been proven that a spill of 250 barrels per acre, or 10 mm in height, recovers completely without treatment in 24 years. However, larger spills don't show the same rate of recovery.

The initial response to any spill should be to stop the spread of the substance across the tundra, to prevent wildlife injury, and to recover as much free material as possible to minimize soil penetration.

### Crude oil spills:

Winter: The months when the coastal plain is covered by snow are the ones when it is easier to recover from an oil spill. The crude oil will be absorbed by the snow, making it easy to remove using hand tools or heavy equipment in rolligon tires, depending on the extent of the spill. If the crude is doesn't land directly on snow,

this method can still be used by applying snow to the substance and recovering the mixture by the same method. The saturated snow should be recovered in plastic bags or disposal drums and transported to offsite facilities for treatment and/or disposal.

If the ground is frozen and the crude oil has reached the soil, it is necessary to scrape the top 1 to 3 inches of surface contamination to remove contaminated material while preserving some of the roots and stem bases of plants to allow for re-sprouting. It is first necessary to clear the area of snow using a front-end loader to expose the tundra. Then the top 1 to 3 inches of vegetation are removed and transported to waste disposal facilities.

Spring, Summer & Fall: The first measure that should be taken during a crude oil spill during the warmer months is to contain and stabilize the contaminated area using large-diameter water-filler hoses. Sand bags can also be used but may contaminate an area during storage since they can't be properly cleaned and may not be reused multiple times. Once the area is surrounded by the land barrier, fresh warm water should be used to flood the spill site. This will reduce the infiltration of oil into the root zone and the amount of oil in contact with vegetation. The floating oil can be recovered by using skimmers such as a portable rope-mop or vacuums. After the majority of the spilled substance has been removed, the surface can be flushed with commercially available surfactants to increase the ability of water to dissolve non-miscible products and reduce the adhesion of crude oil to vegetation. Using warm water at low pressure, flush towards a lined depression or trench and shored with a land barrier. The ground may be agitated while flushing using the water flow or a squeegee. The flush water should be recovered from the depression with a pump and disposed of.

Saline water spills: Saline water comes to the surface during oil production and its frequently used for enhanced recovery. Fire-fighting chemicals also contain large quantities of salt and represent the same threat to the environment.

Salt increases the osmotic potential of soil water, making it impossible for plants to absorb it. It spreads rapidly in wet tundra, covering a larger region each season and reducing plant coverage by as much as 80%. In mixed spills of crude oil and saline water, the clean up should start with the salt water since it spreads more easily and it is not biodegradable.

The immediate measures taken during a saline water spill should be to contain it using land barriers like large-diameter water-filled hoses or sandbags, and vacuuming as much salt water as possible. Then it is necessary to repeatedly flood and vacuum the spill site to dilute the salt and minimize the effects it will have on the soil. If all measures fail and the salinity of the soil is extreme, gypsum can be added to counteract the effects of the salt and salt-resistant plants can be planted to populate the area.

Mud spills: Mud spills occur from dripping mud reserve tanks and from well blowouts. During the winter months, the mud will freeze in contact with the snow and can be recovered by scrapping down to 1 or 2 inches from the soil and vacuuming the rest of the frozen substance. During the warm months, the mud spills can be treated like saline water spills and recovered by flooding and vacuuming.

## Significance of bigelow sedges in revegetation program

Sedges are also found to be important in the arctic Alaskan vegetation. A type of sedge is called Bigelow Sedge (*Carex bigelowii*), which is though not considerably consumed by herbivores, but is important to the area in terms of revegetation. When oil exploration occurs, this sedge is found to colonize the land quickly after the destruction. This is partly due to their strong resistance to weather and low requirement of nutrients (so itself is not highly nutritious) It helps "rebuild" the ecosystem after devastation or human impact. Observations have shown that they can quickly recolonize the damaged areas of oil spills or sulphur pollution within 2 months, which is very rapid in terms of ecological scale. They then become the primary food source and later on allow successions of other plants to take place. The ecosystems can then be significantly resumed. So it is suggested that it may be used as a tool to recover the damage to ecosystems after oil explorations. (Bliss, L. C.; Wein, R. W., 1972)

Further information about its physiology, distribution, values and uses can be found at the following website:

<http://www.lupinfo.com/wildlife-plants-animals/plants/graminoid/carbig/all.html>

### Reference:

1. Bliss, L. C.; Wein, R. W. (1972). Plant community responses to disturbances in the western Canadian Arctic. *Canadian Journal of Botany*.  
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