

## Attachment G

### Summary of Fate and Behavior and Potential Adverse Effects on Environment for Major Oil Types (adapted from Polaris 2013<sup>5</sup>)

Oil Type	Fate / Behavior	Adverse Effects on Environment
Light to volatile oils (includes Bakken crude)	<ul style="list-style-type: none"> <li>• Spread rapidly</li> <li>• Tend to form unstable emulsions</li> <li>• High evaporation and solubility</li> <li>• May penetrate substrate</li> <li>• Removed from surfaces by agitation and low-pressure flushing</li> </ul>	<ul style="list-style-type: none"> <li>• Toxicity is related to the type and concentration of aromatic fractions: 1) naphthalene, 2) benzene</li> <li>• Toxicity of aromatic fractions depends on their biological half- lives in different species</li> <li>• Toxic to biota when fresh</li> <li>• Marsh plants may be chronically affected due to penetration and persistence of aromatic compounds in sediments</li> </ul>
Moderate to heavy oils (with notes re dilbits)	<ul style="list-style-type: none"> <li>• Moderate to high viscosity</li> <li>• Tend to form stable emulsions under high energy marine environments (dependent on type of dilbit)</li> <li>• Penetration depends on substrate particle size (dilbit appears to have less penetration than comparable viscosity crude)</li> <li>• Weathered residue may sink and be absorbed by sediment (may become neutrally buoyant to sink, depending on degree of weathering, type of dilbit, and receiving water)</li> <li>• Immiscibility assists in separation from water</li> <li>• Weather to tar balls</li> </ul>	<ul style="list-style-type: none"> <li>• Adverse effects in marine organisms result from chemical toxicity and smothering</li> <li>• Toxicity depends on size of light fraction (dilbit formulation dependent but typically very light end diluents are rapidly lost through evaporation)</li> <li>• Low toxicity residue tends to smother plants or animals</li> <li>• Light fractions contaminate interstitial waters</li> </ul>
Asphalt, #6 fuel-oil, Bunker C, waste oil	<ul style="list-style-type: none"> <li>• Form tar balls at ambient temperatures</li> <li>• Resist spreading and may sink</li> <li>• May soften and flow when exposed to sunlight</li> <li>• Very difficult to recover from the water</li> <li>• Easy to remove manually from beach surface with conventional equipment</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate and delayed adverse effects due to small aromatic fractions and smothering</li> <li>• Most toxic effects due to incorporation in sediment</li> <li>• Absorption of radiated heat places thermal stress on the environment</li> <li>• Lower toxicity on marine plants than mobile animals</li> </ul>

<sup>5</sup> Polaris Applied Sciences, Inc., 2013. A Comparison of the Properties of Diluted Bitumen Crudes with other Oils (accessed June 2014)

[http://www.crrc.unh.edu/sites/crrc.unh.edu/files/comparison\\_bitumen\\_other\\_oils\\_polaris\\_2014.pdf](http://www.crrc.unh.edu/sites/crrc.unh.edu/files/comparison_bitumen_other_oils_polaris_2014.pdf)