**Appendix A: EPA Basic Oil Spill Cost Estimation Model (BOSCEM) Methodology**

BOSCEM was developed to provide the US Environmental Protection Agency Program with a methodology for estimating oil spill costs. The model parameters are based on hypothetical spills in Etkin *et al.* (2002, 2003) with oil fate modeling by Applied Science Associates’ SIMAP in French-McCay *et al.* 2002. These parameters can be adjusted to accommodate the socio-economic, environmental and oil response costs along the TAPS right of way. Below is a brief description of BOSCEM (Etkin, 2004). This version of BOSCEM considers three separate contributions to the total oil spill cost: spill response, socio-economic and environmental.

Where the spill response cost (CR ), socio-economic cost (CS ) and environmental cost (CE ) are given below:

In the event that there is a spill that covers multiple area types calculate the cost associated with each area type individually and then aggregate the costs. Suggested values for the per volume cost ( ), and multipliers (α, β) are given intables 1-6.

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| **Table 1: Per-Gallon Oil Spill Response Costs Applied in EPA BOSCEM1 ()** | | | | | | | | | |
| **Oil Type** | **Volume (gallons)** | **Mechanical2,4** | | | | **Dispersants3,4** | | **In-Situ Burn5** | |
| **0%** | **10%** | **20%** | **50%** | **Low** | **High** | **50%** | **80%** |
| **Crude Oil8** | **<500** | $220 | **$199** | $189 | $153 | $85 | $53 | $75 | $48 |
| **500-1,000** | $218 | **$197** | $187 | $151 | $84 | $52 | $74 | $47 |
| **1,000-10,000** | $215 | **$195** | $185 | $149 | $82 | $51 | $72 | $46 |
| **10,000-100,000** | $195 | **$185** | $174 | $138 | $74 | $31 | $62 | $31 |
| **100,000-1,000,000** | $123 | **$118** | $113 | $92 | $49 | $29 | $36 | $16 |
| **>1,000,000** | $92 | **$82** | $76 | $64 | $58 | $13 | $22 | $11 |
| 1Per-gallon cost based on hypothetical modeling in Etkin *et al.* (2002,2003) with shoreline oil removal costs adjusted by % reduction of oiling. Modeling included fate by oil type and trajectory (French-McCay *et al.* 2002). 2Per-gallon costs include on-water mechanical recovery, shoreline oil removal, mobilization, source control, protective booming. 3Per-gallon costs include on-water dispersant response, shoreline oil removal, mobilization, source control, protective booming. 4Removal assumed for on-water recovery or dispersants. Shoreline oiling assumed reduced by % on-water oil removal. Low/high removal by dispersants for light fuel/crude 40%/80%, for heavy oil 35%/70% (Pond *et al*. 2000). 5ISB costs based on per-gallon operations costs in Allen and Ferek (1993), plus costs of shoreline cleanup of unburned oil. 8Crude (except specifically-identified heavy- or light- crudes, intermediate fuel oils, waxes, animal fats, other oils, edible oils, non-edible vegitable oils, and mineral oils. Default values are shaded. | | | | | | | | | |

Table from Etkin et al., 2004.

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| **Table 2: Socioeconomic and Environmental Base Per-Gallon Cost For Use in EPA BOSCEM1** | | | |
| **Oil Type** | **Volume (gallons)** | **Base Cost ($/gallon)** | |
| **Socioeconomic ()** | **Environmental ()** |
| **Crude Oil5** | **<500** | $50 | $90 |
| **500-1,000** | $200 | $87 |
| **1,000-10,000** | $300 | $80 |
| **10,000-100,000** | $140 | $73 |
| **100,000-1,000,000** | $70 | $35 |
| **>1,000,000** | $60 | $30 |
| 1Based on hypothetical spills in Etkin *et al.* (2002,2003) with oil fate modeling as in French-McCay *et al*., 2002, and historical cases with oil type impact based on characterisitcs as modeled by NOAA ADIOS 2. 5Crude (except specifically-identified heavy- or light- crudes, intermediate fuel oils, waxes, animal fats, other oils, edible oils, non-edible vegitable oils, and mineral oils. | | | |

Table from Etkin et al., 2004.

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| **Table 3: EPA BOSCEM Response Cost Modifiers for Location Medium Type Categories1 ()** | |
| **Category** | **Cost Modifier Value2** |
| **Open Water/Shore\*** | 1.0 |
| **Soil/Sand** | 0.6 |
| **Pavement/Rock** | 0.5 |
| **Wetland** | 1.6 |
| **Mudflat** | 1.4 |
| **Grassland** | 0.7 |
| **Forest** | 0.8 |
| **Taiga** | 0.9 |
| **Tundra** | 1.3 |
| 1Category description in Table 2. 2Based on tendency for oil spread or deep penetration in area sensitive to impact of response equipment/personnel (higher values). \*Default value. | |

Table from Etkin et al., 2004.

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| **Table 4: EPA BOSCEM Socioeconomic & Cultural Value Rankings1 ()** | | | |
| **Value Rank** | **Spill Impact Site(s) Description** | **Examples** | **Cost Modifier Value** |
| **Extreme** | Predominated by areas with high socioeconomic value that may potentially experience a large degree of *long-term­*2 impact if oiled. | Subsistence/ commercial fishing, aquaculture areas | 2.0 |
| **Very High** | Predominated by areas with high socioeconomic value that may potentially experience some *long-term*2 impact if oiled. | National park/ reserves for ecotourism/nature viewing; historic areas | 1.7 |
| **High** | Predominated by areas with medium socioeconomic value that may potentially experience some *long-term*2 impact if oiled. | Recreational areas; sport fishing, farm/ranchland | 1.0 |
| **Moderate** | Predominated by areas with medium socioeconomic value that may potentially experience *short-term*3 impact if oiling occurs. | Residential areas; urban/suburban parks; roadsides | 0.7\* |
| **Minimal** | Predominated by areas with a small amount of socioeconomic value that may potentially experience *short-term*3 impact if oiling occurs. | Light industrial areas; commercial zones; urban areas | 0.3 |
| **None** | Predominated by areas already moderately to highly polluted or contaminated or of little socioeconomic or cultural import that would experience little short- or long-term impact if oiled. | Heavy industrial areas; designated dump sites | 0.1 |
| 1Default value is shaded. 2Long-term impacts are those impacts that are expected to last *months to years* after the spill or be relatively irreversible. 3Short-term impacts are those impacts that are expected to *last days to weeks* after the spill occurs and are generally considered to be reasonable reversible. \*Default value. | | | |

Table from Etkin et al., 2004.