Fate and Transport
M/V Selendang Ayu

CHARACTERISTICS OF THE SPILLED OIL

The vessel carried 424,000 gallons of Intermediate Fuel Oil and 18,000 gallons of marine diesel. Typical physical property data for the types of petroleum products loaded on the *M/V Selendang Ayu* were used in this analysis. Actual property information is unknown, but may be determined by chemical analysis if samples can be secured from the vessel.

Intermediate Fuel Oil (IFO 380)

- **Density:** 0.989 g/cc; fresh water is 1.00 and oceanic seawater is 1.025. Therefore, the oil is lighter than both fresh water and seawater.
- P**our Point:** 2 to 10°F and at ambient water temperature (low 40's) will quickly cool and form thick "patties" rather than remaining as a thin film or sheen.
- **Viscosity:** 346 centistokes (cSt) at 122°F and at ambient water temperature greater than 3500 cSt, meaning, when initially spilled, the oil's viscosity would be similar to honey. Spilled oil will undergo chemical and physical changes and the viscosity will increase to be similar to peanut butter.
- **Composition:** the actual chemical composition is unknown, but heavy refined products such as Intermediate Fuel Oils are routinely made by blending a diesel (Fuel Oil No. 2) with a heavy residual oil or with the residuum from the refining process itself.

Marine Diesel

- **Density:** 0.839 g/cc; therefore, diesel oil is lighter than both fresh water and seawater.
- **Viscosity:** ~10 centiStokes (cSt) and at ambient water temperature will spread to form a thin film or sheen.
- **Composition:** the actual chemical composition is not known.

BEHAVIOR OF THE SPILLED OIL

At the spill location, large breaking waves are the primary mixing mechanism. In a high-energy environment, spilled Intermediate Fuel Oil will quickly break into small particles, while the lighter diesel oil will form sheens that easily dissipate. In addition, the viscous nature of Intermediate Fuel Oils will result in discrete "patties" and tarballs rather than a slick with sheens when spilled. These patties may range in size from less than an inch to hundreds of feet in diameter.

One of the key concerns is whether the oil will float and remain floating when spilled. Using the ADIOS oil weathering model for a typical Intermediate Fuel Oil 380, 5 to10% of the oil would evaporate within 5 days of the release. For typical marine diesel, 30 to 60% of the oil could evaporate in 5 days. Even after evaporation, both oils are expected to float on fresh water and seawater. Although the oil will float, observers may have difficulty seeing the oil on the water surface due to the tremendous amount of mixing from breaking waves. Oil may be washed over by waves. The refloat time for a half-inch diameter oil particle is on the order of seconds and may penetrate into the water column at a depth of about one and one-half times the height of the breaking waves.

As the oil drifts into calm water, the oil will be easier to observe. The oil is sticky and may coalesce into larger patties. Natural surface collection areas include convergence zones created by winds, currents, and saltwater/freshwater interfaces. Kelp beds may collect and trap oil.

Scattered tarballs will be difficult to observe by either visual or remote sensing techniques. Tarballs will persist for many months resulting in long-range transport (tens to hundreds of miles) and shoreline oiling.

On-scene characterization of the spill site suggest that the suspended sediment load in the water column is low. Neither the Intermediate Fuel Oil nor the diesel fuel is expected to collect sediment in the water column and sink. However, at a few areas located near the spill site such as heads of bays and streams, oil on the shoreline may pick up sediment. Only a small amount of sediment attached to weathered Intermediate Fuel Oil could increase the density of the tarballs enough to sink. The sediment-laden oil could be washed from the shoreline, tumble along the bottom, and collect in calm areas and subtidal depressions. Over the next few months to a year, small clay particles (less than a hair thickness) will enhance the natural self-cleaning of the oil residue on the shorelines. The particles will reduce the ability of the oil to adhere to the shoreline, enhance bacterial degradation, and minimize oil accumulation in sediments.