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16. ABSTRACT

Many hazardous substances and mixtures are immiscible with and more dense than water. When spillages or releases into waterbodies occur, the hazardous materials will disperse in a pattern controlled by physical properties of the material, flow and dispersion effects, and topography of the waterbody bed. Mapping (i.e., location and thickness determination) of the spilled substance is essential for prompt and economical removal to protect biota and ensure minimal contamination of water. Analysis of the reflection patterns of acoustic waves (i.e., 200 kHz) beamed into the water from a boat is shown in this and in previous work to serve as an excellent mapping technique. To properly plot pollutant pool location and depth, the coordinates of the boat position must also be determined. As the acoustic pulse passes through the water, pollutant, and sediment, reflected waves are generated at each interface (water/pollutant; pollutant/sediment). Depth (thickness) is computed from acoustical parameters and from the times between the transmission of the pulse and the detection of the reflected pulses (echoes). The depth and precision of detection is ultimately limited by the attenuation and dispersion of the echoes. By placing the transmitter/detector element at known depths below the boat, detection depth is almost unlimited and the detectable thickness of the pollutant can be as small as 1 cm.

When the project to map pollutants was initiated, no suitable commercial devices were available. A very effective, portable, battery-operated prototype system was constructed. The reflection data (intensity vs time) were displayed on an on-board dual-trace oscilloscope that had time-delay features. Subsequently, a suitable commercial system was test marketed and has been successfully used in the field to locate creosote in a waterbody. Readout is on chart paper. The instrument is operated from a boat, which follows a scanning pattern at speeds up to 8 km/hr (5 mph) for gross evaluation and at much slower speeds for accurate measurements. Once a pool is located, the position can be ascertained by recording the readings from a conductivity meter as the sensor is lowered into (or raised from) the water body. Actual samples of the pollutant can be acquired by standard techniques.

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