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THE Current

December 9, 2015
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Pipeline Spill Response

UC Santa Barbara geochemist David Valentine is among the authors of a new report about accidental spills of diluted bitumen from pipelines. The report was prepared for the National Academies of Sciences, Engineering, and Medicine.

According to the investigators, diluted bitumen — a type of crude oil commonly made from bitumen extracted from tar sands — has properties that warrant special preparations to limit environmental damage in the event of a spill. Their report suggests the U.S. Department of Transportation (DOT) modify its regulations in order to strengthen preparedness for potential calamities.

“We’re recommending a number of changes to the current regulations for planning the response to pipeline spills because diluted bitumen is different in some ways than traditional crude oils,” said Valentine, a professor in the Department of Earth Science. “Changes in properties make the diluted bitumen in the environment behave differently than other crude oils. It tends to rapidly become more adhesive and may also become denser than water. Submergence in aquatic environments is thus a major concern.”

Bitumen is used as a feedstock in oil refineries, but it is too viscous to transport by pipeline unless it is diluted with lighter oils or condensed natural gas. Such diluted bitumen has been transported by pipeline in the U.S. for more than 40 years. The amount conveyed has increased recently as a result of improved extraction technologies and production and exportation by Canada. Both new and existing pipelines are being proposed and developed to accommodate this increased

production.

A 2013 study released by the National Academies found that diluted bitumen is no more likely than other crude oils to be released accidentally from a pipeline. As a follow-up to that study, Congress and the DOT directed the academies to further investigate whether — if a spill occurs — the properties of diluted bitumen differ enough from other types of oil to warrant changes to preparedness or cleanup regulations or to spill response plans.

The new report indicates such changes in regulations and planning are warranted. After a spill, diluted bitumen behaves similarly to other crude oils; however, exposure to the environment induces rapid physical and chemical changes known as “weathering” that are unique to diluted bitumen.

“Within days, diluted bitumen starts to turn into a heavy, viscous, particle-laden residue that can be difficult to recover using traditional response techniques,” Valentine explained. “The residue has a strong tendency to adhere to surfaces, and it poses particular challenges if it is spilled into a body of water, because the residues may submerge or sink to the bottom.”

According to the report, the way diluted bitumen changes after weathering calls for greater concerns and special response strategies and tactics compared with those used for commonly transported crude oil. Currently, the regulations and practices of DOT’s Pipeline and Hazardous Materials Safety Administration (PHMSA) do not take into account the unique properties of diluted bitumen, nor do they encourage effective planning for spills of diluted bitumen.

The scientists recommend a more comprehensive and focused approach to improve preparedness for spills of diluted bitumen and to spur more effective cleanup and mitigation measures when spills do occur. They suggest that PHMSA, together with the U.S. Environmental Protection Agency (EPA), the U.S. Coast Guard (USCG) and state and local governments, take advantage of the area response planning process to increase coordination and share lessons learned in order to strengthen preparedness for spills of diluted bitumen.

The report also proposed that the EPA, the USCG and the oil and pipeline industry support the development of effective, environmentally friendly techniques to detect, contain and recover submerged and sunken oils in aquatic environments. In addition, the scientific committee said that the USCG should revise its oil-grouping

classification system to more accurately reflect the properties of diluted bitumen and to recognize it as a potentially nonfloating oil. They also recommended that the National Oceanic and Atmospheric Administration lead an effort to acquire all relevant data that could aid advanced predictive modeling for spills of diluted bitumen being transported by pipeline.

“Although many differences between diluted bitumen and other crude oils are well-established, some remaining areas of uncertainty hamper effective responses to spills,” Valentine said. “Further research is needed in a range of areas, including the ecological and human health risks posed by weathered diluted bitumen, techniques to capture submerged oil in moving water and the application of advanced chemical approaches to understand the compositional changes to diluted bitumen in the environment.”

The study was sponsored by the DOT. The National Academies of Sciences, Engineering, and Medicine operate under an 1863 congressional charter to the National Academy of Sciences signed by President Abraham Lincoln. They are private, nonprofit institutions that provide independent, objective analysis and advice to the nation to solve complex problems and inform public policy decisions related to science, technology and medicine.

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