University of Mississippi

Nano-Enhanced and Bio-Inspired Composite Materials for Mitigation and Protection of TIH Railcars and Stationary Tanks against High Power Impact

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Prevent, Protect, Respond, Recover

Homeland Security Challenge:

When either a railroad tank or a stationary tank is accidentally or intentionally punctured with a projectile, there is a high probability that the contents will leak into the environment causing serious human health problems, economic disruption, and environmental devastation. There is a need to develop technologies and methodologies that will reduce or eliminate the release of toxic inhalant hazards (TIH) materials (e.g., gases or liquids determined to be public heath hazards) from railcar tanks and stationary tanks after being subjected to natural or man-made forces, especially those produced by ammunition or by an improvised explosive devise (IED).

Research Project Solution:

The objective of this research project is to exploit the special properties of nano materials to create new, multifunctional nanocomposites to help design the next generation of railroad tank cars used for transporting TIH. The project will study how well nano enhanced composites and other innovative materials will provide ballistic resistance against high power rifle bullet impact and mitigate any fire hazard resulting from puncture or derailment.

National Implications:

The chemical industry transports large amounts of TIH materials in railroad tank cars and stores them in stationary tanks. Under the Hazardous Materials Regulations (49 CFR 171- 180), TIH materials are defined as gases or liquids that are known or presumed to be toxic to humans and to pose a hazard to health in the event of release during transportation. Chlorine is one of several high-volume hazardous chemicals transported by rail. Other TIH materials include anhydrous ammonia, ethylene oxide, hydrogen cyanide, and amorphous hydrogen fluoride, all of which pose danger to those who live near fixed chemical facilities or alongside rail or pipeline routes that transport the chemicals. This research intends to evaluate the success of using nano-enhanced, bio-inspired, and self- healing materials to design more resilient railcars and tanks to transport or store TIH materials.

Example of a TIH Material Leak.

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SERRI is managed by the Department of Energy's Oak Ridge National Laboratory for the U.S. Department of Homeland Security