WHITE PAPER

SAIE-ESO
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SUBJECT: Camp Minden - Submersion of M6 Propellant in Water

FACTS:

- M-6 propellant is 86.1 percent nitrocellulose. Nitrocellulose, while decomposing, can experience a run-away heating reaction that can result in auto-ignition. Chemical stabilizers, which are added to prevent auto-ignition, will deplete over time.
- For DoD military munitions under its control, the Army maintains a comprehensive surveillance program, which includes a stability monitoring program for propellants, to help ensure the safety of use throughout its lifecycle to include during logistics management activities (e.g., transportation, maintenance, storage, demilitarization).
- The status of stabilizers (stability) of M6 (approximately 15 million pounds) at Camp Minden, which are not DoD munitions, is not known. Explo Systems, Inc., failed to maintain adequate stability monitoring and complicated implementation of a propellant stability monitoring program by mixing propellant LOTS.
- For over two years, no significant action has been taken to establish a propellant stability monitoring program to attempt to determine the relative stability of the M6 at Camp Minden. This has increased the risk of an auto-ignition.
- Past storage practices and other operational and logistics practices at Camp Minden allowed and continue to allow a more rapid depletion of chemical stabilizers in the M6, further increasing the risk. As such, over time, auto-ignition of propellant becomes more and more likely. This is of particular concern because one propellant LOT was determined to be present at Camp Minden for which the loss of stability would, by Army policy, require its destruction within 60 days. Although the LA State Police attempted to ensure this propellant LOT was destroyed, the existence of mixed propellant LOTS at Camp Minden make establishing the fact of this LOT's complete destruction uncertain.
- The U.S. Army Propellant Surveillance Laboratory at Picatinny stated, "submerging M6 in water is not a viable solution for safe, long-term storage. Although the water will act as a heat sink, it will also accelerate the rate of propellant degradation significantly. The resultant constantly increasing amount of NOX (oxides of nitrogen) diffusing into the water will form nitric acid and related compounds that are both oxidizing agents and corrosive. In addition to this effect on the propellant, the contaminated water will present a logistics, safety and environmental problem in itself." It is also not known what ratio, by weight, of water to propellant is required to provide a sufficient heat sink for an exothermic decomposition.
- Submersion of propellant of unknown stability in water as a means of preventing auto-ignition and extending storage life is an unproven procedure that has not been tested.
- A cardinal rule in managing explosives is to minimize exposures consistent with safe and efficient operations (i.e., expose the minimum number of people for the minimum time to the minimum amount of explosives).

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REASONABLE ASSUMPTIONS:

- M6 with known stabilizer content is hazard classified as 1.3C with a proper shipping name of "Propellant, solid." As with every packaging configuration, the overall hazard class will be determined by the highest hazard present.
- The Department of Transportation (DoT), not DoD, will be the responsible authority for assigning the Hazard Classification. DoT will require supporting information, including an analysis and a statement that the material is stable, to justify such a classification. Obtaining a Hazard Classification may require testing and can be a lengthy process, particularly if required information is not readily available.
- Given the unknowns associated with mixing water with propellant, it is possible that DoT will not provide a Hazard Classification. Without this classification and without packaging that meets DoT requirements, the mixture cannot be transported in commerce.
- Submersion in water may reduce the chances of auto ignition in the short term (2 -3 months). Water content will need to be monitored and water levels maintained to prevent additional safety concerns.
- The addition of water to the propellant will add an additional waste stream that is not currently present.

UNKNOWN:

Long-term storage of the M6 in water may significantly change both its physical properties (i.e., it may become a slurry) and its chemical properties (e.g., stability, flammability, reactivity, and corrosivity).

CONSIDERATIONS:

- The ratio of water to propellant is not known. The mix required has not been studied; therefore, there is no empirical data to support covering the M6 with water. Most propellant will sink, with the exception of ball powder that may rest on the surface due to electrostatic charge. Mixing propellant in water proposes the possibility there is a critical mass of submerged propellant that will exceed the ability of the water to sufficiently dissipate heat of decomposition. Even if the ratio were known, the mix would likely be mostly water with an upper mass limit of propellant per container. This could exponentially increase the number of containers required.
- Storage of drums containing propellant with water will need to be frequently monitored to ensure the water has not leaked out or evaporated. Water loss would potentially create a significant risk of auto-ignition. Water levels will need to be maintained and a source of water provided, as necessary to accomplish this.
- The transfer of M6 to barrels and mixing it with water requires selection of an operational location at sufficient distance away or using appropriate protection to prevent propagation of an unplanned explosion or fire, development of standing operating

procedures, and a follow-on storage plan for the M6 mix in barrels. These actions cannot be conducted inside the magazine.

- Repackaging propellant (i.e., from bags, drums or boxes, to a hopper bin, to barrels) may generate static. Conducting this operation in a high humidity-controlled environment at plus 60 percent would significantly reduce static generation.
- Propellant grains can be brittle and can break up. Consequently increased handling may generate combustible or explosive flakes, powders or dust that are more susceptible to static, friction, and impact. Caution needs to be exercised to ensure combustible or explosive flakes, powders, or dust does not collect on surfaces of facility used for packaging.

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