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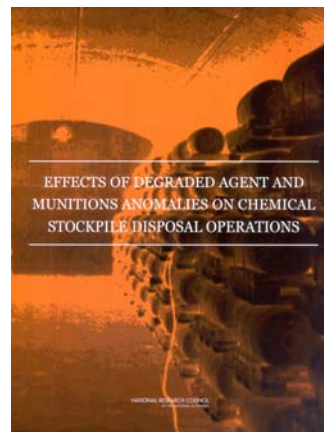
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Effects of Degraded Agent and Munitions Anomalies on Chemical Stockpile Disposal Operations—*Summary*

BOARD ON ARMY SCIENCE AND TECHNOLOGY

Background

The U.S. Army is in the process of destroying its entire stockpile of chemical weapons. The Chemical Weapons Convention Treaty, to which the United States is a signatory, requires complete destruction by April 29, 2007 with a possible extension of five years. Recently, the Army announced that it would ask for an extension. To help with stockpile disposal, the Army's Chemical Stockpile Disposal Program (CSDP), in 1987, asked the National Research Council (NRC) for scientific and technical advice. This report is one in a series of such prepared by the NRC over the last 16 years in response to that request. It presents an examination of the effect of leaking munitions (leakers) and other anomalies in the stockpile on the operation of the chemical agent disposal facilities.



Findings and Recommendations

General Comments. In order to retard the decomposition of nerve agents stored in the munitions, stabilizers were added. These stabilizers, however, have themselves degraded over time probably leading to corrosion and, eventually, agent leakage from the containment vessels. Among the types of munitions stored in the stockpile, the bulk of leakers appear to be concentrated, primarily in those types filled with GB nerve agents. Most of these are M55 rockets. Leakers increase risk to the public, the environment, and those workers carrying out destruction of the stockpile. Stockpile degradation and the appearance of new leakers will continue, possibly at an accelerated rate, for the remaining life of the stockpile. Continued monitoring, testing, data collection, and analysis is needed to determine possible trends. The effects of leakers and other munitions' problems can be minimized by the earliest possible stockpile destruction.

Monitoring Protocols. The Army should continue its current monitoring protocols. Data acquisition should be expanded to permit statistical analyses that can determine important trends such as the relationship between a munitions' age and leaker onset.

VX Munitions. While there are far fewer leaks in munitions containing VX nerve agent than those containing GB agent, the stabilizers in VX munitions may be reaching critical

levels. VX munitions and containers should be more closely monitored than is currently the practice.

Leaker and Other Anomaly Data. Data collected on leaking chemical munitions and containers over the years are of limited value for statistical purposes. The data were good for their originally intended purpose but are not entirely appropriate for analysis of leaking munitions and their effect on disposal operations. The Army should also analyze other data sources, such as end-of-campaign reports, to see if other types of anomalies can be predicted.

Temperature Dependence. Determination of whether leakage frequency exhibits any temperature dependence could not be made. Because corrosion reaction rates are expected to increase with temperature, the Army should consider monitoring the temperature of a limited number of specific storage facilities. If temperature dependence is discovered, steps to mitigate this effect, such as temperature control, can be considered.

Autocatalytic Reaction Rate. Degradation may proceed by an autocatalytic reaction once the inhibitor in the munitions is exhausted. Currently, it is possible that the reaction rate is not changing very rapidly, but it might be approaching a rapidly increasing phase that is characteristic of autocatalytic reactions. The Army should maintain an aggressive program to identify any significant upward trend in the leaker rate that may result from a rapid rise in the reaction rate. Expedient disposal of those GB munitions could avoid serious problems. The existence of corrosion on some components of these munitions also argues for destroying the GB munitions and GB in containers as soon as possible.

VX Agent Leakers. Because of the toxic potential of VX agent, the Army's monitoring protocols should be reviewed to increase confidence that the frequency of leakers and mechanisms associated with VX degradation are accurately understood.

M55 Rocket Propellant. Currently, degradation of M55 rocket propellant is only a minor contributor to storage risk. Significant delays in destruction of these rockets, however, could require monitoring the condition and stability of the propellant more intensely because continuing agent degradation might result in leakage that could contribute to greater propellant instability from leakage. The M28 propellant in these rockets should be closely monitored if their destruction is significantly delayed.

Prioritizing Destruction Schedule. It might be possible to prioritize the destruction of M55 rockets by GB subtype to reduce the future likelihood of leaks. Consideration should be given to such prioritization as long as it does not adversely affect the overall M55 GB rocket destruction schedule.

Anomaly Monitoring. Current records do not allow a means to usefully link processing of anomalous munitions to downtimes in the destruction system. Early communication of anomaly detection is important. Lessons learned in taking corrective action to address anomalies should also be communicated to all disposal sites promptly and directly.

For Further Information

Copies of the complete report, *Effects of Degraded Agent and Munitions Anomalies on Chemical Stockpile Disposal Operations*, can be obtained on the National Academy Press Web <<http://books.nap.edu/catalog/10910.html>>.

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