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# EXECUTIVE SUMMARY

Karagozian and Case (K&C) was tasked to perform the Blast Effects Analysis (BEA) for a 2000 gallon rectangular aboveground storage tank (AST) designed and manufactured by Convault. The primary objective of the BEA was to determine the inherent blast resistance of Convault's design for the AST. A secondary objective was to provide recommendations on how to further improve the blast-resistant capabilities of the AST.

As such, the response of the Convault AST was analyzed for several blast threat scenarios, including: (1) a man-portable improvised explosive device (MPIED); (2) a vehicle-borne improvised explosive device (VBIED); (3) and loads representative of typical vapor cloud explosions (VCE). Various high-explosive (HE) weights and standoffs were considered for the improvised explosive devices, while the loads used to represent the effects of the VCE are applicable for an upper-bound and intense explosion.

Damage of AST was estimated based on the calculated results for: (1) the rigid body displacement of the AST, (2) the observed damage to the exterior concrete portion of the tank, and (3) the observed damage to the interior steel tank and interior steel frames.

For a majority of the analysis cases performed, the steel tank performed very well with little damage to its integrity. This is due, in large part, to the protection provided by the exterior concrete vault that encapsulates the steel tank. The damage incurred by the concrete vault essentially attenuates the load imparted to the steel tank.

Overall, the BEA indicates that the Convault AST is very resistant to the effects of the blast loads considered. The AST was found to resist with little damage to the primary steel tank, the effects of a 50-pound MPIED and 500-pound VBIED at the standoff distances of 5 feet and 20 feet, respectively. These results reflect the response of the AST when it is half-full of fluid. When subjected to loads representative of a typical VCE, the AST performed exceptionally well in the analysis with very minor damage to the exterior concrete and little to no damage to the primary steel tank. In all three scenarios any minor steel tank damage is not expected to cause primary tank leakage.

Based on the analysis results, recommendations were made if further enhancement to its blast-resistance of the AST were desired. These include: (1) ensuing that a minimum level of standoff distance is provided by deploying perimeter protection elements; (2) addition of concrete to the bottom of the AST to provide added mass, which will add to the AST's resistance to rigid body movements; (3) increase of the concrete thickness over the exterior of the vault and/or adding additional reinforcing. Further studies would be needed to determine the details for implementing these features.