

Managing Risk During the Consolidation of Operations

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During World War II, the United States constructed 84 new ammunition plants. Many of the plants were built before the United States officially entered the war. Because the government lacked sufficient management expertise to run all the plants, private industry was contracted to operate them, creating a new system of government owned, contractor operated (GOCO) ammunition plants. Many of the plants were closed after the war, never to reopen. Others were activated for the Korean conflict, Vietnam, or both, only to be laid away to be ready for some future conflict.

The end of the cold war and the absence of credible enemies has caused the United States to once again pare down its ammunition production capability. The production base is supporting a much smaller force than it did in the 1980s. Budget figures for 1996 indicate that active Army strength is down to 495,000 soldiers. The total planned strength for the entire Department of Defense is 1.45 million active duty personnel, down 33 percent from 1987 levels.¹ A smaller active force means less ammunition will be consumed in training and less is needed in the event of war, since ammunition needs are based on the number of weapons available.

To avoid a further drawdown in personnel, the Army is attempting to “..reorganize and streamline the institutional side of the Army.”² Maintaining production facilities is costly, so the Army is disposing of ammunition plants that are considered no longer required for future defense needs. Other plants, which were active up to the 1990s, are now laid away. There are currently nine active GOCO ammunition plants and three active government operated ammunition facilities. The active plants have reduced their activity to a trickle compared to the production levels of World War II and subsequent conflicts. The plants remaining active are expected to operate as efficiently as possible.

The Lake City Army Ammunition Plant, like most other GOCO plants, has experienced a decrease in production schedules in relation to the shrinking of the size and missions of the U. S. military. The plant construction began in 1940 with a ground breaking ceremony presided over by Senator Harry S. Truman in his home town of Independence, Missouri. The plant occupies 4000 acres on the east end of Independence. Production employment at the plant during World War II exceeded 13,000 employees, but the plant currently employs less than one tenth of that number. As a consequence of the reduced schedules, only 17 percent of the available production space at Lake City is currently being used.

Unlike many of the GOCO plants, which were intended for temporary production, Lake City was built of brick and concrete over heavy steel framework. It was built to last. Because small arms

¹ Hudson, Neff, "House Panel: Hold Army at 495,000/ Lawmakers Fear Second Drawdown", *Army Times*, June 12, 1995

² Tice, Jim, "Reimer: Proposed Drawdown Could Affect National Security", *Army Times*, May 6, 1996.

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production was not considered particularly hazardous at the time the plant was built, buildings are fairly close together. Also, extensive use was made of natural lighting. There are thousands of glass pane windows which provide light and ventilation in the production areas. Some of the propellant loading mezzanines, and even the hazard class 1.1 primer insertion wings, contain entire walls of glass. This construction is not common in ammunition facilities outside the small arms industry.



Load and Assemble Wing, Glass Pane Windows



Priming Wing, Glass Pane Windows

The plant has 531 individual facilities with total floor space of 3.25 million square feet. There are currently four major active production building complexes, each producing a single caliber of small arms ammunition. Because different calibers of ammunition are being produced in different facilities, fixed overhead remains at nearly the same levels as when production was higher.

To lower the cost of ammunition to the U. S. Government, Olin Corporation, Winchester Division, which manages the plant for the U. S. Army, has proposed to consolidate operations currently performed in three production buildings and a support facility into one building. The consolidation is expected to produce over \$3 million in savings every year through greater efficiency and reduced costs for utilities, maintenance and other overhead activities.

The challenges of fitting like manufacturing processes of different calibers of ammunition into existing space and minimizing risks to employees through reduction of exposures to energetic materials are the topics of this presentation.

When the plant engineer in that famous Widget Manufacturing Company is told to consolidate operations, he just has to worry about fitting all the people and equipment into the space available. When an ammunition manufacturing facility wants to consolidate, one has to consider the risks imposed by each of the operations on the others. Of particular concern at Lake City was the introduction of 20 mm high explosives rounds into a building that previously did not have high explosive projectiles. To further complicate matters, the building also houses non production activities, such as engineering and maintenance personnel.

Because the building which will receive the consolidated operations contains 466,000 square feet of space, adequate quantity-distance spacing for class 1.1 and 1.3 materials can be established among the various activities as if they were all located in separate buildings. That approach, plus the use of the existing building walls and a concrete ceiling to eliminate fragmentation hazards to

unrelated activities from class 1.2 ammunition, were instrumental in making the decision that the consolidation could be carried out safely.

With the background just mentioned, let's now discuss some of the particular challenges in performing a hazards analysis for this operation.

Explosives safety at the Army's GOCO plants is governed by DOD Directive 4246.26M, Contractor's Safety Manual, and Army Materiel Command Regulation 385-100. Both documents specify particular procedures and formulas for the determination of safe distances for the conduct of explosives operations. Since 1992, explosives operations have also been governed by 29 CFR 1910.119, Process Safety Management. While the military regulations contain specific and consistent rules, the Occupational Safety and Health Act (OSHA) uses hazards analyses of specific conditions as the methodology for determining the relative safety of conditions. The hazards analysis process, used extensively by civilian employers, has military roots in Mil Standard 882B. The objective of a hazards analysis is to identify and assess risks associated with particular processes and to decide whether the risk is acceptable or if changes are needed.

Consolidation will lower the exposure of the plant wide population to energetic materials, if for no other reason than the fact that there will be fewer people working in the new facility than are currently working in multiple facilities. This is particularly true of employees who perform maintenance, administrative and custodial duties. On the other hand, exposure of some specific individuals will increase as they become involved in an activity in which higher than present quantities of 1.1 materials and 1.2 materials will be used, when they previously had only a 1.3 or relatively low 1.1 exposure.

The main challenges to consolidation of operations are listed below.

- o Existence of glass pane windows
- o Fragmentation threat from 20 mm projectiles
- o Overpressure threat from explosives magazines
- o Insufficient magazine space
- o Presence of employees whose jobs are not directly related to explosives operations in explosives operating buildings.

Some of the glass windows will be bricked over where a direct fragmentation or overpressure threat will exist. Other windows, located where employees could be injured by flying glass, will be covered with a plastic film developed by the 3M Corporation, primarily to increase security for businesses and homes without degrading light or view. We have already used such film on some of the windows in building 3 as well as in the present 20mm production facility.

The explosives service magazine for the building presents a class 1.1 overpressure threat to the Building 3 machine shop and to the glass windows in the shop. The magazine is presently rated for 50 pounds of 1.1 material storage. The limit will be reduced to 23 pounds, and two additional "minimags", magazines designed specifically to confine any potential fragmentation will be built. Windows which would be exposed to over pressures of 0.5 psi or greater will be covered with safety film.

Personnel assigned to the building, but not related to the explosives operation, will be afforded inhabited building distance from the explosives operations within the building. Barricades will be erected to protect common areas of the building, such as the cafeteria, from the effects of an incident in manufacturing.

By using a hazards analysis approach to the explosives safety system, as opposed strictly to following quantity distance guidelines, it was demonstrated that the consolidation of operations was feasible and could be done safely without imposing new risks to the plant population.

Consolidation does present a risk that an incident involving one caliber of ammunition could affect other calibers as well. This type of added risk is faced daily by companies all over the nation which are consolidating operations for the sake of economy. Companies from Colgate-Palmolive to Hallmark Cards have faced the challenge of protecting operations in consolidated facilities.³ Greater emphasis must be placed on fire prevention, fire control, and damage control to prevent a minor incident from turning into a catastrophe.

Primer manufacturing for all calibers of ammunition has always been consolidated at Lake City, and the end product manufacturing buildings are already configured to minimize collateral damage, so major changes are not needed to achieve this goal. Damage control in the Lake City consolidated manufacturing center will be achieved by use of the fire and explosion resistivity of the existing walls and barricades, distance between operations, limiting explosives quantities, and the erection of additional barricades to limit incidents to their place of origin. In addition, ultra high speed deluge systems are being installed to control fires and to knock down any initiation of energetic material before it spreads. Sprinkler systems and a fire department capable of responding in less than three minutes are added damage control.

Through the application of hazards analyses, prudent modifications of facilities to minimize collateral damage, and administrative control of access to hazardous locations, it has been demonstrated that cost savings can be achieved by consolidating like manufacturing processes from multiple facilities into a single manufacturing center without decreasing the degree of safety afforded employees in the facility.

³ Aschensky, Janet "The Fire Next Time", Risk and Insurance, June 1996, p. 1.