12.05-01/01/92-00144

An explosives expert prepares a cylinder for puncturing by making a shaped-charge explosion.

1000 abandoned cylinders pose special problem at Lakehurst

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How does one dispose of old compressed gas cylinders which may still contain compressed gases, some of them possibly dangerous?

This question confronted the Environmental/Utilities Branch of the Public Works Department, Naval Air Engineering Center (NAEC), Lakehurst, N.J. The solution that was developed could be useful to other Navy units that encounter the same problem.

A wide variety of compressed gases is used in industrial processes in the military. These gases range from the relatively inert, such as nitrogen, to the highly flammable and explosive, such as hydrogen. Apart from the nature of the contained gas, the method of storage poses a hazard: the gas is under pressure. A rupture of the container may result in an explosive fragmentation of the cylinder, propelling heavy pieces of metal in all directions, or even propelling the cylinder itself through the air like an unguided missile.

Because of this hazard, special storage and handling procedures are used for gas cylinders.

In the normal cycle of use, full cylinders are purchased, the gas is used, the empty cylinders are exchanged for full cylinders, and the cycle repeats. Sometimes the cycle breaks down and cylinders are abandoned. Contractors working aboard a base may leave cylinders behind. Military organizations undergo reorganizations, transfers of personnel, changes of mission, and reassignment of units. People can forget who is responsible for gas cylinders.

So it is that some cylinders are abandoned or turned to other uses. Lakehurst and the Navy are not unique in this respect; a general cleanup at the NAEC turned up nearly 1,000 abandoned and rusting cylinders.

The majority of the cylinders were obviously empty — the valves had been removed. Others could be tested simply by cracking open the valve. Empty cylinders posed no problem; they could be disposed of as scrap through the Defense Property Disposal Office.

Many of the cylinders, however, could not be checked so easily. Valves or valve guards were frozen in place. To compound the problem, there was no way to determine the content through markings or cylinder size or valve threading; these cylinders dated from before modern safety systems were set up for gas cylinders.

What markings there may have been were no longer readable. Lakehurst began as a Navy installation in 1920, and its long history includes the manufacture of gas by the Navy. Many of the old cylinders were probably manufactured by the Navy. It was not known, therefore, what might be in these cylinders.

State and federal regulations define such cylinders as hazardous items, and there is no question they can be dangerous. This fact was driven home during the NAEC cleanup when three such cylinders were inadvertently placed in a trash dumpster, possibly by an overly enthusiastic cleanup crew, and ended up at a nearby landfill. During trash compacting operations, one of them broke open and shot into the air, smashing the safety glass window of the trash compacting machine before arcing to the ground many yards away.

The cylinders were retrieved and returned to the NAEC. On further examination, one was found to contain hydrogen gas.

Not only had cylinders been discarded and abandoned at Lakehurst over the years, some had been set in concrete bases as traffic bumpers or barriers. The cleanup included the removal of these as well as those that had simply been abandoned. In all, more than 200 cylinders of dubious

safety — corroded, unopenable, markings unreadable — were gathered.

It is possible to set mechanics to work with wrenches and rust solvents on the rusted valves and valve guards, but this procedure is potentially dangerous. Valves could break off, releasing gas and causing injury or illness to workmen. Weakened metal could crack, releasing the contained gas with violent force. Sparks from the metal-to-metal contact of tools with container could set off fires or explosions in escaping gas. Drilling through the cylinder posed the same problem. Rupture of the container could throw shrapnel throughout the workplace.

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A safer means of opening the cylinders had to be found. As collection of the cylinders proceeded, it was considered to use explosive charges to blow holes in them, and this possibility was explored with experts from nearby demolition units. The Navy Explosive Ordnance Disposal Detachment (EOD) at Earle, N.J., agreed that the idea seemed feasible. NAEC personnel suggested an old gravel pit on the NAEC that met the required safety conditions set by the EOD: no combustible material within 500 feet and no personnel or installations within 1,800 feet.

Before proceeding, approval was obtained from the U.S. Environmental Protection Agency, the New Jersey Department of Environmental Protection, and the Northern Division of the Naval Facilities Engineering Command.

In May 1982, EOD experts rigged shaped charges to five cylinders chosen at random to test the method. Because of concern that the cylinders might fragment into shrapnel, they were buried neck down, and the charges were rigged around the cylinder bottoms. When the charges were fired, at 10-second intervals, all five blew holes in the cylinders to which they were attached.

Even from 2,000 feet away, the hiss of escaping gas could be heard following four of the five explosions. Later, when it was safe to approach the cylinders, it could be seen that the rushing gas had blown small craters in the sand. Four of the five cylinders showed this evidence that they had vented gas.

The test proved the safety of the procedure, so plans were made to detonate the remainder of the cylinders in batches of about 100 at intervals of a week between batches. Public Works Department crews dug a long trench in the gravel pit and installed the cylinders for the first large-scale firings, which took place in June. The crews also prepared a safety trench at a short distance away in case something went wrong while the EOD experts were setting the charges.

The operation of such a disposal process requires notification of the state and federal regulatory agencies and all affected base operations and personnel to avoid disruption of other necessary activities and harm to personnel. The Plan of the Day publication was used as well as phone calls and personal meetings to advise all concerned of the program.

Finally, all preparations were complete. Selected representatives of the Environmental/Utilities Branch, the U.S. Environmental Protection Agency, and the base Fire Department waited in a sheltered location under the supervision of the EOD experts as the charges were fired. The explosions punctured 97 cylinders and 11 of these showed evidence they had vented gas. (The remaining three were successfully punctured in the next set of firings.)

Cylinders are buried neck down in a trench in an abandoned gravel pit in preparation for puncturing with shaped charges.

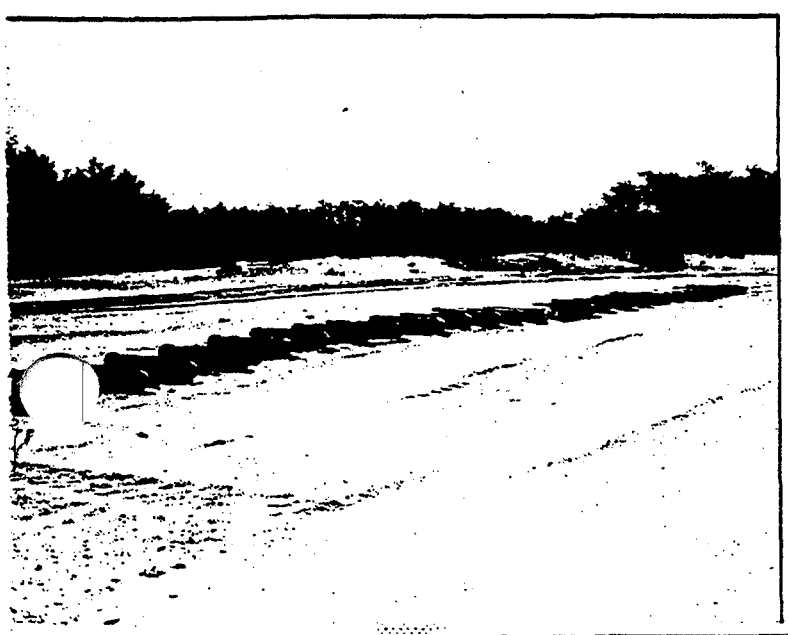
A week later, 90 more cylinders were rigged and detonated. A number of these cylinders also showed evidence they had vented gas, including two which may have contained acetylene. One of these produced a huge fireball and then burned for a few minutes; the other vented gas for an hour. Additional firings that day punctured the remaining cylinders.

In summary, more than 200 cylinders were successfully punctured by shaped-charge explosions. Many cylinders showed signs they had vented gas immediately after the explosions. This was proof that these cylinders, at least, would have been dangerous to send to a landfill or to sell as scrap.

Because valve guards and valves were rusted shut and markings were nonexistent, there was no way of knowing beforehand which cylinders were dangerous and which were benign. The demolition program removed the doubts and the dangers. The hazard to base personnel was removed without endangering trash haulers or landfill workers. In addition, the method proved the thoroughness and expertise of the members of EOD Earle.

Continued vigilance at the NAEC should ensure that no more cylinders are abandoned. However, it is a large and mostly wooded base with a long history, and more cylinders could be found.

As of this writing, 12 more cylinders have turned up and are awaiting disposal. There is now a safe, effective procedure to render them harmless. □



Some of the old gas cylinders gathered during a cleanup campaign at the Naval Air Engineering Center, Lakehurst, New Jersey, in storage awaiting disposal.