Date: Thu, 02 Apr 1998 11:01:23 -0600
Subject: Red Alert: Workers Burned When Fumes Ignite

TITLE: **Electricians Received Burns from Fireball Caused by Aerosol Cleaner**

IDENTIFIER: 1998-LA-LANL-ESH7-0003
DATE: April 2, 1998

LESSONS LEARNED: Some organic solvent cleaners generate dense, flammable vapors that can migrate through a work area, creating a path for fire or an explosion. Ignition sources such as portable electric heaters should not be used in poorly ventilated spaces if the work involves combustible chemicals. Additionally, workers need to be provided with portable communication equipment when they work in areas without existing communications systems.

DESCRIPTION: On March 27, 1998, two electricians received first-and second-degree burns to their hands and faces when a flammable gas cloud ignited while they were performing preventive maintenance on two transformers. The fireball ignited when the fumes from the aerosol cleaner they were using contacted an electric space heater. The cleaner, QD Contact Cleaner, is manufactured by CRC Industries, Inc. The cleaner contains hexane, which is heavier than air, and its vapors collect in low areas. The Material Safety Data Sheet (MSDS) specifies a <0 flash point (the lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air), and it notes that the vapors are extremely flammable. Although the electricians were aware that the MSDS was located on the back of the cleaner can labels, they were not familiar with the information.

Before the maintenance work began, the main power supply to the building was deenergized, locked, and tagged out. The day was cold and windy with occasional snow showers. The electricians, who began working at 1700, wore long pants, jackets, leather gloves, and safety glasses.

To take advantage of the remaining daylight hours, the electricians first cleaned two electrical disconnect boxes on the exterior of the building. The electricians used 4 cans of QD Contact Cleaner to remove dirt from the equipment. One of the electricians subsequently stated that it is common practice to use aerosol cleaners for this purpose. The electricians then set up a portable generator to provide power for lights and heat inside the building, which is a small, windowless, metal structure that houses shielded detectors for the Los Alamos Neutron Science Center. The building has two doors, a roll-up door and a personnel door. The electricians ran an extension cord out the roll-up door to the generator and then closed the roll-up door. They left the personnel door open a few inches to provide ventilation.

The shielding blocks for the detectors form a small L-shaped space around the transformers, located immediately inside the personnel door. The blocks are stacked 8 feet high, leaving a 4-foot gap between the blocks and the ceiling. The electricians set up portable lights near the roll-up door, and then they placed an electric space heater in front of the lights. The electricians decided to use the heater because of the weather conditions; however, use of a heater was not

specified in any of the job planning documentation. Therefore, reviewers were not able to evaluate the heater as a potential ignition hazard.

After removing their gloves so they could perform the maintenance work, the electricians knelt in front of the transformers and began spraying them with cleaner. The electricians had been working for about 5 minutes when one electrician saw an orange fireball coming toward them as he turned to speak to the other electrician. They ran out of the building, checked themselves for injuries, returned to the building to check for fire, and then went to an adjacent building for help. A custodian paged their foreman, who took the electricians to the Los Alamos Medical Center, where they were treated and released.

The electricians did not have radios or cellular phones to contact their foreman or call for assistance in case of an emergency. Instead, the foreman periodically checked in with them at the job site. The foreman had checked on the electricians shortly before the incident occurred, and had then left the site.

ANALYSIS: Investigators believe that fumes from the aerosol cleaner flowed along the floor to the heater as the electricians were spraying down the transformers. The fumes ignited and flames travelled toward the electricians through a narrow space between the transformers and the area where the heater and lights had been set up. The cold weather conditions are also believed to have contributed to this incident by inhibiting dispersal of the cleaner fumes.

RECOMMENDATIONS: Use of combination ventilation-heater units similar to those used for manhole work should be considered in place of portable electric heaters for work in enclosed spaces that involves any type of combustible chemical fumes. Because the units are placed outside the work area, no ignition source is introduced that could result in a fire or explosion. Alternative cleaners that do not generate volatile vapors or that generate vapors that rapidly disperse should also be considered. Additionally, workers in areas without existing communications systems should be provided with radios or cellular phones so they can obtain help in a timely manner if necessary.

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FOLLOW-UP ACTIONS: Information in this report is accurate to the best of our knowledge. As a means of measuring the effectiveness of this report, please contact the originator of any action taken as a result of this report or of any technical inaccuracies you find. Your feedback is appreciated.