Environment, Safety and Health Bulletin

Update – Battery Booster Explosions

DOE/EH-0697 2005-15 (Update) January 2006

***Special Operations Reports** are issued to initiate management actions in response to events whose subject matter represents significant Departmental safety concerns.*

***Environment, Safety and Health Alerts** are issued to initiate immediate action on potentially significant safety issues.*

***Environment, Safety and Health Bulletins** are issued to share information and recommend actions on potential safety issues.*

***Safety Advisories** are issued to provide information to the DOE Complex on potentially significant safety or health issues.*

PURPOSE

This Safety Bulletin is being issued to alert readers to recent explosions involving Solar Truck Pac® model ES1224 battery boosters manufactured by Clore Automotive. Specifically, the Office of River Protection at Hanford reported an explosion (Figure 1) following an attempt to jump-start a crane using a model ES1224 booster. Two other reports of similar events in commercial facilities were reported in November 2005. This update is being issued to clarify the details of the Hanford event and add summaries of the other two reported incidents.

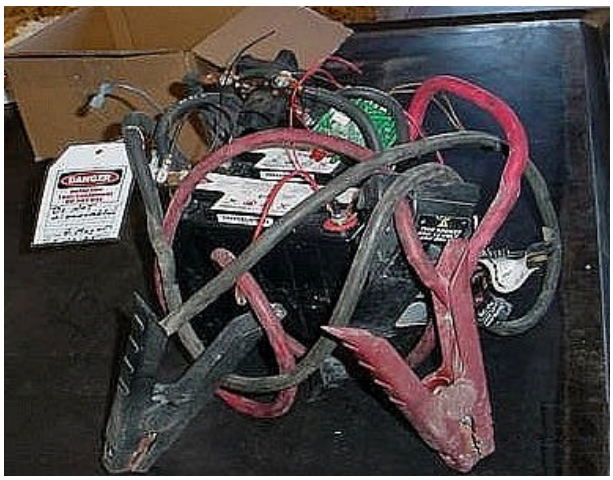

Figure 1. The damaged battery booster after the explosion

BACKGROUND

On August 30, 2005, at the River Protection Waste Treatment Plant construction project, a maintenance mechanic connected the battery booster unit to a crane and attempted to jump-start it. When he turned the selector switch from 24v to OFF, the booster exploded, propelling pieces of the plastic case as far as 25 feet. No one was injured, but three workers, including the maintenance mechanic, reported to the project medical facility with hearing impairments. [ORPS Report EM-RP--BNRP-RPPWTP-2005-0021]

The mechanic and his superintendent examined the remains of the battery booster unit and found that the rubber caps that covered the battery cells had not been properly seated on the cells, and two of the caps were visibly deformed (see Figure 2 below). Also, the case itself did not appear to have been adequately ventilated, and the switch contacts were exposed. Investigators believe that built-up hydrogen gas inside the case was ignited by a spark generated by the exposed contacts.

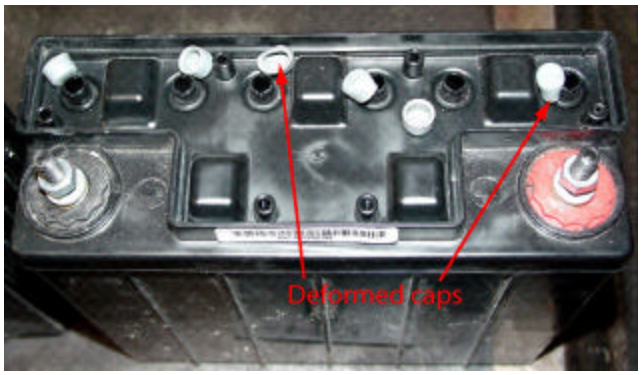

Figure 2. The uncapped battery cells

A similar incident involving an ES1224 was reported at an Australian mining operation in November 2005. A mechanic was using the battery booster to jump-start a mining machine and noticed smoke coming from the unit and an audible alarm. Subsequently, the booster exploded as the mechanic attempted to switch it off. One person sustained minor injuries to the forearm.

Another incident was reported at an Australian construction site in November 2005 when employees were using an ES1224 to jump-start an 18-ton crane. Several employees experienced ringing in their ears from the explosion. Investigators concluded that seal leakage around the internal battery caps and insufficient case ventilation were direct causes of the explosion.

The manufacturer has indicated that cell caps are designed to relieve pressure if the sealed battery pressure exceeds design limits for hydrogen recombination, typically between 3 and 7 psi. Such overpressures can result from overcharging the battery or charging the battery at too high a voltage, such as charging a 12-volt battery with a 24-volt charger or battery.

IMPLICATIONS

An exploding battery charger can cause personnel injury from flying debris or burns from contact with the sulfuric acid inside the cells.

Normal operation and charging of lead-acid batteries produces hydrogen. In a sealed gel-type battery, this hydrogen is reabsorbed and recombined. If the battery seal is compromised, whether through manufacturing defect or abuse in service, hydrogen will be continuously vented from the battery cells. Any condition such as inadequate ventilation or confined space that allows the hydrogen to accumulate presents a potential explosion hazard. For this reason, ignition sources including sparks, smoking materials, and flames must be kept away from batteries.

ACTIONS

The Office of Environment, Safety and Health recommends that sites examine their inventory of battery charging equipment, removing any Solar Truck Pac model ES1224 units from service to check for any indication that the battery seal has been lost. The actual cell caps are covered with a vanity cover; any displacement or distortion in this vanity cover may indicate loss of battery cell seal (Figure 3). Removal and replacement of the vanity cover is not recommended as careful alignment is needed to avoid damaging the battery cell seals. If these indications are found, contact the manufacturer and report this finding in the Occurrence Reporting and Processing System (ORPS).

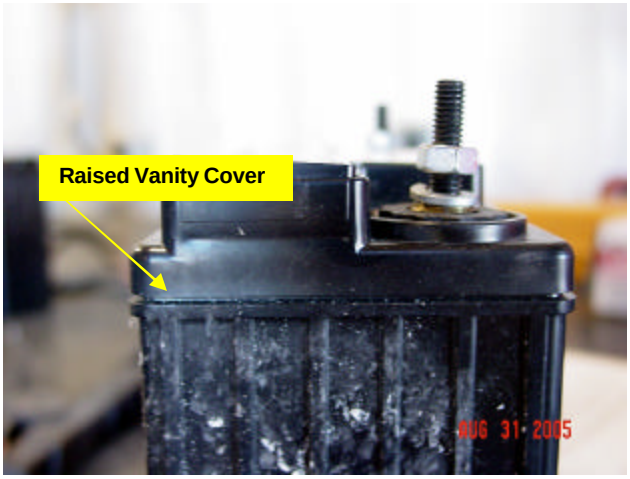

Figure 3. Battery with raised vanity cover

Questions concerning this Environment, Safety and Health Safety Bulletin should be directed to Tom Williams at (301) 903-4859 or e-mail Thomas.E.Williams@eh.doe.gov.

Safety Bulletin 2005-15 December 2005

PREVENT EVENTS
Learning from Industry Experience

PREVENT EVENTS is intended for use by personnel during morning meetings, pre-job briefings, and work unit meetings to communicate key industry experience.

Management

1. Have we implemented a process for identifying defective batteries or chargers, removing them from service, and contacting the manufacturer?
2. Does our preventive maintenance program address batteries and chargers? Does our program consider useful life?
3. Do we keep records of our inventory of these units?
4. Who monitors manufacturers' safety notices or product recalls?
5. How are safety notices and recalls communicated to on-site users?

Individual Worker

1. Do I know how to inspect battery-charging equipment before using it?
2. What PPE do I need (safety goggles, face shield) when recharging a battery?
3. Do I know that connecting a 24-volt battery to a battery booster that is switched to the 12-volt setting may overcharge the battery and lead to an explosion? (A "dead" 24-volt battery may have sufficient energy to rapidly overcharge a 12-volt battery and break the cell seals.)
4. Do I know how to connect the jumper cables in the correct sequence?
   - Do I know that my last connection should be connecting the negative jumper cable to a ground (such as the bare-metal frame of the equipment being started) on the discharged battery instead of directly to the battery terminal?
   - Do I know that when removing jumper cables, I should disconnect the ground to the bare metal frame first?
5. Do I know never to overcharge a battery?
6. Do I know that I must keep sparks and flames away when recharging a battery?
7. Do I know the right ambient temperature conditions for recharging a battery?
8. Do I know who to go to for help if I am unsure of how to proceed?

Training

1. Do we provide training on the proper use of batteries and chargers?
2. Do we have a process to update staff on lessons learned and manufacturers' safety notices?