Operating Experience Summary

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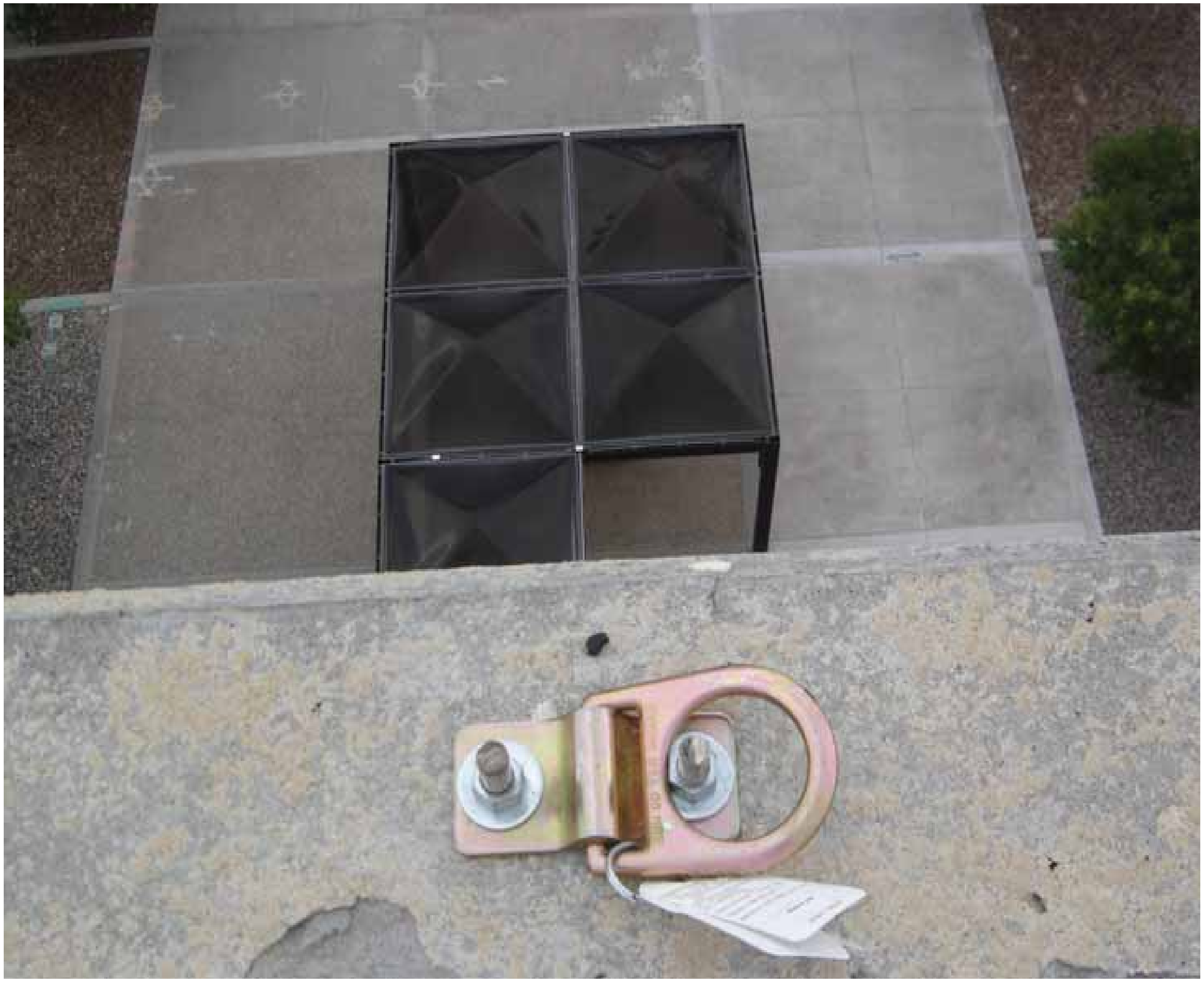

Inside This Issue

Damaged Powered Air Purifying Respirator Hoses

1

On August 2, 2007, at the Hanford K-Basins, a cut in a breathing air tube for a powered air purifying respirator (PAPR) was identified at a mask issuing station. The air supply tube on the PAPR, manufactured by Bullard, was damaged by the sharp edges of the tube connector. (Lesson Learned 2007-RL-HNF-0029)

The Bullard PAPR hood uses a breathing air tube (PN# PA1BT) that connects to a plastic fitting that has a sharp outer edge. This can cause small holes to develop in the composite plastic breathing air tube that supplies air to the hood. The holes can be difficult to see and may be partially covered by a black outer wrap around the hose (Figure 1-1).

Figure 1-1. Small holes in white plastic breathing air tube (red circle)

The outer edge of the plastic fitting, which inserts into the hose, can score the composite plastic hose and cause a line of small cuts penetrating the hose around it's perimeter near where the hose contacts the top of the fitting. After cutting apart one of the hoses, investigators observed that the outer edge of the fitting against the hose was sharp and rough in some spots (Figure 1-2). The normal action of assembling the hose to the blower unit and normal movement could score the hose and then exacerbate the cutting effect. These cuts can be single or multiple. The observed multiple cuts appear to lie in a straight line around the perimeter where they contact the inner fitting.

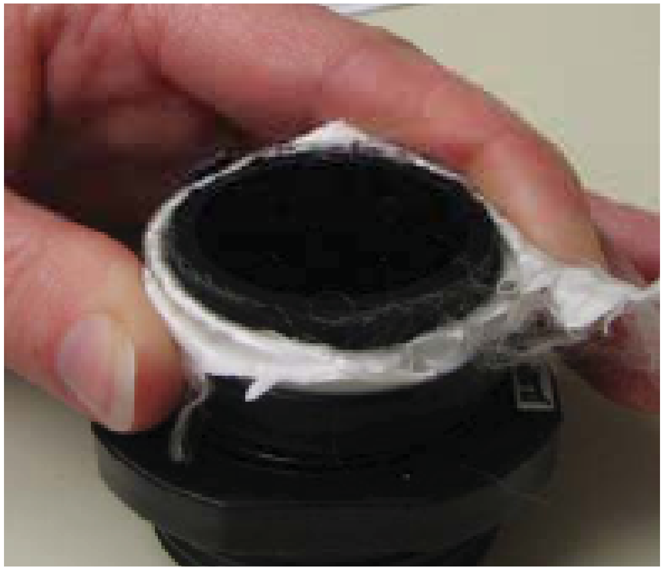

Figure 1-2. The rough and sharp edge can be seen around the edge of the black tube (fitting)

Once the problem of the damaged air hose was identified, respiratory protection personnel inspected a sample of 50 hoses of which 12 were found to have the same problem. Most of these hoses had been used daily for more than a month. They also inspected 100 new hoses and found no holes. The manufacturer has been contacted and is working with the Hanford Respiratory Protection Program to eliminate the occurrence of this type of damage.

Past problems with Bullard PAPR's include the loss of power to an in-use PAPR when the charging port plug dislodged because it lacked a positive locking mechanism (ORPS Report EM-ID--BBWI-TAN-2003-0002) and the ability of lateral forces to detach the hose to the hood if the clamp is not sufficiently engaged and to separate the threaded coupling at the blower housing (ORPS Report EM-RL--PHMC-SNF-2005-0021).

The identification of the damaged air purifying respirator hoses underscores the importance of inspecting respirator equipment and verifying its integrity before it is issued to the user. It is also extremely important to ensure that personnel who wear respirators understand and implement the correct methods for checking, wearing, and operating their respirators.

KEYWORDS: *Respirator, PAPR, air hose, respiratory protection, damaged, defective, hole*

ISM CORE FUNCTIONS: *Provide Feedback and Continuous Improvement*

Safe Use And Installation of Fall Protection Anchors

2

On June 9, 2007, at Sandia National Laboratory, two members of a roofing crew for a roofing contractor attached their fall protection lanyards to anchor points that were not completely installed. They did not notice that the anchor points were not fastened to bolts epoxied into a parapet wall. After scraping gravel from the roof, the roofers took a morning break. While disconnecting their fall protection lanyards from the anchor points, one of the roofers noticed that the anchor point was not bolted down. When the hook was removed from the D-ring, the anchor point came off the bolts and fell four stories to the ground. This event is significant because the roofers believed their fall protection system was adequate. (ORPS Report NA--SS-SNL-NMFAC-2007-0006; Final filed 07/29/2007)

On May 30, 2007, a craftsperson for the construction contractor installed the tie-off points along the roof edge of Building 891. The bolts that would be used to attach the fall protection anchors to the parapet wall were epoxied in place and the anchors were placed over the bolts. However, the craftsperson did not have the nuts necessary to complete the task and planned to finish the job the following day but was reassigned to another work location and the nuts were not installed. Figure 2-1 shows the anchor correctly bolted in place.

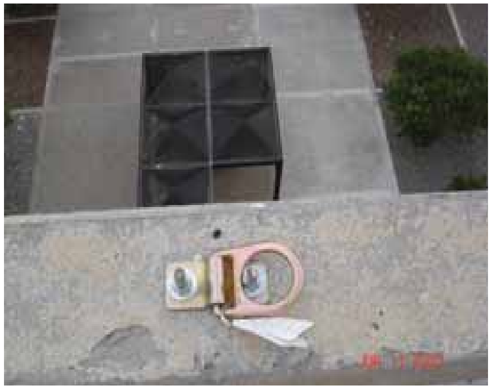

Figure 2-1. Fall protection anchor bolted in position. Note: The canopies are 45 - 50 feet below.

Investigators determined that the roofing contractor's superintendent failed to ensure that the anchor points were properly bolted down before he directed the roofing crew to use them for their fall protection equipment. Also the construction contractor's superintendent failed to ensure the task of installing the anchor points had been completed before reassigning his craftsperson. Investigators also determined that the anchors purchased by the roofing contractor and provided to the construction contractor for installation were not engineered to be installed on the top of the parapet wall. Neither contractor superintendent contacted the project manager or construction manager to obtain approval before using the anchor points; consequently no structural or safety engineer reviewed the installation.

It is not only important that engineered fall protection anchor systems are properly installed, but also that the installation is performed safely. The following event involves contact with hidden hazards while penetrating a roof structure.

On September 26, 2006, at the National Renewable Energy Laboratory, a subcontractor using 2-inch and 3-inch-long decking screws to install a roof-mounted fall protection anchor plate, struck and penetrated two sections of 277-volt electrical conduit, an electrical junction box, a fire detection and alarm system conduit and a facilities system data acquisition conduit. The damaged conduit and boxes were located inside the building, just below the roof deck. (ORPS Report: EE-GO--NREL-NREL-2006-0008)

A work package, including a Safe Work Permit, was developed to repair the membrane roofing system. The scope was modified to include the installation of roof anchors for fall protection. The anchors would be secured to the roof deck by a series of nuts and bolts. To prevent damage to systems underneath the roof, the drilling of holes and installation of the bolts would be coordinated by workers on the roof and inside the building.

Prior to the start of work, a change was made to install larger base plates for the roof anchors such that they would withstand an imposed force of 5,000-pounds. The larger base plates (16 ft^2) would require more screws (roof penetrations) to adequately secure them to the roof deck.

Investigators learned that the project manager decided to abandon the use of nuts and bolts to secure the anchor plates in favor of using 2-inch deck screws applied from the roof surface. The project manager apparently believed that 2-inch deck screws would not damage any of the utilities systems below the roof deck. The project manager proceeded with the installation before completing a thorough hazard assessment of the change and without involving the general contractor or the Environment, Safety, Health & Quality Office point of contact.

Proper placement and installation of fall protection anchors is important to worker safety. OSHA states that fall protection lifelines shall be securely attached to substantial members of the structure, or to securely rigged lines, which will safely suspend the worker in case of a fall. Anchors are a minimum requirement on all roofs not equipped with a 42-inch high parapet or guardrail to protect workers performing maintenance at roof level.

Many buildings are not equipped with suitable anchorages or safety anchors to secure fall protection equipment. Instead, workers often attach to any convenient member to which a rope can be tied. Objects such as vent pipes, air conditioning units, service piping, and metal ladders are not suitable for supporting a worker in the event of a fall. OSHA requirements state that anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 pounds or shall be designed, installed, and used as a part of a complete personal fall arrest system which maintains a safety factor of at least two.

The installation of fall protection anchors should be well planned and engineered. It is important to carefully calculate the amount of load the anchor needs to support during normal operation and in the event of an accidental fall. Any installation should be reviewed by a safety professional and approved before allowing workers to attach their fall protection system to the anchor point. Don't make the anchor point the weak link in your fall protection system.

KEYWORDS: *Fall protection, anchor, lifelines, near miss, roof*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls, Perform Work within Controls*

NRC Identifies Recurring Operability Issues with Emergency Diesel Generators

3

On August 6, 2007, the Nuclear Regulatory Commission (NRC) issued Information Notice 2007-27, *Recurring Events Involving Emergency Diesel Generator Operability*, to inform operating license holders of the results from a staff evaluation of recent operating experience that identified recurring events involving the operability of emergency diesel generators (EDG). Just as at many DOE facilities, nuclear power plant operators rely on EDGs to provide a source of emergency electrical power during a loss of normal offsite power. These EDGs are required to be operable as specified in power plant technical specifications. (NRC Information Notice 2007-27)

The Office of Nuclear Reactor Regulation (NRR) reviewed operating experience related to EDG failures that had occurred since the beginning of 2004. The NRR staff identified the following recurring events and overall tendencies:

- Vibration-induced failures of EDG piping and tubing (recurring);
- Failure to take prompt corrective action, especially to repair EDG fluid leaks;
- Inadequate EDG post-maintenance testing; and
- Failure to follow procedures.

The following are representative examples of EDG-related events from five different nuclear power plants.

1. During an EDG test run at the Kewaunee Power Station, an operator identified a minor fuel oil leak at a fitting on a diesel fuel oil line. No repair was performed and the degraded condition was not entered into the corrective action program. Fifty-one days later, operators stopped the EDG surveillance when the fuel oil leak increased to a pencil-sized stream at the original leak location. Approximately three EDG run hours had elapsed between the time the initial leak was identified and when the leak became more significant. The licensee could not prove that the EDG was operable for the 51-day period.

2. During EDG testing at River Bend Station Unit 1, a minor leak was identified at a compression fitting in the jacket water cooling system. A mechanic performed a tightness check on the fitting, but the leakage rate did not change. During a subsequent EDG run, the jacket water tubing separated at the same fitting, causing a significant leak. The results of an event analysis determined that the EDG was inoperable for approximately 23 days. The most probable cause of the failure was a combination of normal engine vibration and damage caused by over-tightening during past maintenance.

3. An EDG output breaker failed to close during a surveillance test at Crystal River Unit 3. Investigators found the breaker closing spring not charged and the charging motor control power switch in the “OFF” position. They determined that the charging motor control power switch was not verified to be in the “ON” position following circuit breaker maintenance, causing the EDG to be inoperable for approximately 28 days.

4. During an extent of condition review for post-maintenance test concerns at Indian Point Nuclear Generating Unit 2, the licensee determined that one EDG had not been run at its full load rating following a governor replacement that took place about six months earlier. During a subsequent full load test, the EDG could not achieve its rated load of 2,300 kW. The licensee determined that the fuel rack linkage was improperly set after the EDG governor replacement. Inadequate post-maintenance was the cause.

5. During a loss of offsite power at Brunswick Steam Electric

Plant Unit 1, an EDG experienced a high lubricating oil strainer differential pressure alarm and tripped on a momentary drop in lube oil header pressure. The alarm condition was caused by fibrous lint material in a lube oil duplex strainer – remnants of a cleaning towel that was inadvertently left in the EDG lube oil sump during previous maintenance. The licensee had failed to take effective corrective action after similar high differential pressure alarms were received during two prior post-maintenance testing runs. During the event follow-up it was discovered that a crankshaft bearing had lost effective lubrication and the surface of the bearing was wiped.

One recurrent event that continues to stand out involves vibration-induced failure of EDG piping and tubing. In many cases, major piping failures occurred after minor leaks were identified and not immediately or properly repaired. One licensee noted that employee training did not cover common industry-known tubing failure mechanisms and their managers and supervisors lacked knowledge of industry operating experience relating to this type of failure. It is important that EDG small-bore piping and tubing be properly routed, supported and maintained to prevent this type of failure. This topic was previously addressed by NRC Information Notice 89-07, *Failures of Small-Diameter Tubing in Control Air, Fuel Oil, and Lube Oil Systems Which Render Emergency Diesel Generators Inoperable.*

The NRC archive of information notices can be obtained at http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/.

A review of recent and past emergency diesel generator events at DOE sites reveals similar issues of concern identified in the NRC information notice. The following are examples of these problems:

- Damaged electrical wiring caused by vibration-induced chaffing;
- Failure to perform surveillance on diesel starting batteries;
- Failure to sample diesel fuel as required;
- Diesel batteries in service beyond warranty period;
- Failure to follow manufacturer's recommended preventive maintenance for lubrication of automatic transfer switch;
- Failed transfer of electrical power because of a mispositioned transfer switch;
- Failure to recognize decreasing specific gravity resulting in dead diesel starting batteries; and
- Failure to enter an out-of-tolerance condition, terminate operations, or perform an equipment return-to-service following replacement of a radiator hose that failed during a diesel generator surveillance.

These diesel generator problems and the events identified in the NRC information notice highlight the importance of conducting periodic diesel generator startup/load tests and the need to perform required preventive maintenance in accordance with manufacturer's recommendations. Adherence to EDG operating procedures and the performance of routine surveillance testing are important for verifying operability of emergency diesel generators. A strong preventive and corrective maintenance program, which can identify and quickly resolve problems, will help ensure emergency diesel generators are available to provide reliable backup electrical power.

KEYWORDS: *Emergency diesel generator, EDG, testing, surveillance*

ISM CORE FUNCTIONS: *Provide Feedback and Continuous Improvement*

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Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CPSC	Consumer Product Safety Commission
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
INPO	Institute for Nuclear Power Operations
NIOSH	National Institute for Occupational Safety and Health
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
SELLS	Society for Effective Lessons Learned Sharing

Units of Measure	
AC	alternating current
DC	direct current
mg	milligram (1/1000th of a gram)
kg	kilogram (1000 grams)
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
TWA	Time Weighted Average
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
JSA	Job Safety Analysis
NOV	Notice of Violation
SAR	Safety Analysis Report
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

Regulations/Acts	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act

Miscellaneous	
ALARA	As low as reasonably achievable
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
MSDS	Material Safety Data Sheet
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
SME	Subject Matter Expert