The Office of Environment, Safety and Health and its Office of Nuclear and Facility Safety (NFS) publishes the Operating Experience Weekly Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging feedback of operating experience and encouraging the exchange of information among DOE nuclear facilities.

The Weekly Summary should be processed as an external source of lessons-learned information as described in DOE-STD-7501-96, *Development of DOE Lessons Learned Programs*.

To issue the Weekly Summary in a timely manner, the Office of Operating Experience Analysis and Feedback (OEAF) relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the summary, please bring this to the attention of Dick Trevillian, 301-903-3074, or Internet address dick.trevillian@hq.doe.gov, so we may issue a correction.

Internet addresses provided in the Weekly Summary will be formatted as lower-case alphabetical characters. Numerical characters will be specifically defined when used in Internet addresses. The Internet Uniform Resource Locator (URL) for the Weekly Summary is http://www.tis.eh.doe.gov/web/oeaf/oe_weekly/oe_weekly.html. The Weekly Summary, with word search capability, is also available on the OEAF home page at http://tis.eh.doe.gov/web/oeaf. If you experience difficulties accessing the Weekly Summary at these URLs, please contact Mark Mortensen at 208-525-3753 for assistance.

Readers are cautioned that review of the Weekly Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Weekly Summary 97-04

January 17 through January 23, 1997

Table of Contents

EVENTS 1

1. DISCOVERY OF IMPROPERLY STORED LITHIUM METAL..... 1

2. UNPLANNED EXPOSURES AT THE NEW WASTE CALCINING FACILITY 2

3. INADEQUATE PROCEDURE CAUSES SAMPLER UNIT CONTAMINATION..... 5

4. ELECTRICIAN SUFFERS ELECTRIC FLASH BURNS 7

5. NONCOMPLIANCE WITH FEDERAL MOTOR CARRIER SAFETY REGULATIONS 10

NOTICES UNDER DEVELOPMENT 11

EVENTS

1. DISCOVERY OF IMPROPERLY STORED LITHIUM METAL

On January 17, 1997, at the Oak Ridge Y-12 Site, Special Materials Organization personnel discovered two containers in which lithium metal was not submerged in mineral oil or inerted. They found the metal while looking for old sample bottles and containers in preparation for lithium-hydride processing. Operators repackaged the metal in mineral oil and verified the remainder of the inventory was properly stored. Lithium metal constitutes a safety hazard and is highly reactive when exposed to moisture or air. (ORPS Report ORO--LMES-Y12SITE-1997-0003)

The approved facility basis for interim operations for lithium operation assumes that metal will be stored submerged in mineral oil or inerted to prevent self-ignition in moist air. Because the as-found condition could increase the probability of a fire scenario, as evaluated in the basis for interim operations, operations personnel initiated an unreviewed safety question determination.

Investigators determined the lithium metal was the result of a legacy condition and had been stored in its present condition for several years. The metal was in chucks and chips and stored in plastic bags. Although operators took the correct action in repackaging the lithium metal, they handled the material bare-handed, in an area not approved for metal operations, and without wearing protective equipment.

NFS reported lithium fires in Weekly Summaries 95-24 and 92-36. Fires associated with other pyrophoric materials and improper handling and storage of pyrophoric materials were reported in Weekly Summaries 96-30, 96-23, 96-22, and 96-05.

- On May 30, 1996, at the Rocky Flats Environmental Technology Site, during an inventory to locate excess chemicals, a building manager discovered that metallic potassium stored in a petroleum base was in an unsafe condition. Some of the oil evaporated, exposing 3/4 to 1 inch of potassium to air. The potassium metal oxidized and created a peroxide that was shock sensitive. An ordinance disposal team removed and disposed of the material. (Weekly Summary 96-23; ORPS Report RFO--KHLL-779OPS-1996-0045)

- On May 23, 1996, at the Oak Ridge Y-12 Site, Special Materials Organization personnel found 4 leaking canisters of lithium metal during a surveillance of 179 canisters. Holes formed in the cylindrical portion of the small, pressure-extruded, aluminum canisters, each of which contained 50 grams of material. Corrective actions included submerging the canisters in mineral oil, then removing the lithium from the canisters and placing it in storage. (Weekly Summary 96-22; ORPS Report ORO--LMES-Y12SITE-1996-0024)

Lithium ignites and burns vigorously at a temperature of 180°C (356°F), which is near its melting point. Unlike sodium and potassium, it will burn in nitrogen. Lithium should be stored in argon or helium atmospheres. When stored on work benches, it should be placed in kerosene or in a closed container of mineral oil.

DOE HDBK-1081-94, *Primer on Spontaneous Heating and Pyrophoricity*, contains valuable information on pyrophoric hazards. The section on lithium storage and handling warns that, because lithium (an alkali metal) reacts with water, it requires special precautions to prevent contact with moisture. Drums and cases containing alkali metals should be stored in a dry, fire-resistive room or building used exclusively for alkali metal storage. Sprinkler protection is undesirable, and combustible materials should not be stored in the same area with lithium. Managers at DOE facilities who use and store lithium materials should review the information in DOE HDBK-1081-94.

KEYWORDS: lithium, pyrophoric, unreviewed-safety-question determination

FUNCTIONAL AREA: materials handling/storage

2. UNPLANNED EXPOSURES AT THE NEW WASTE CALCINING FACILITY

On January 13, 1997, at the Idaho New Waste Calcining Facility, a radiation control technician and a facility operator received an unplanned whole body radiation dose of 749 mrem and 535 mrem, respectively. They received the dose while conducting a contamination and radiation survey for input to a recovery work package to inspect a remote manipulator power cable. When they left the room, the technician discovered that her direct-reading dosimeter was off-scale high. Investigators determined that the technician failed to recognize trigger levels that required an As Low As Reasonably Achievable (ALARA) review and failed to have an ALARA review conducted before entry. Failure to recognize ALARA trigger levels resulted in unplanned exposures. (ORPS Report ID--LITC-WASTEMNGT-1997-0001)

The radiation control technician generated a Radiation Work Permit (RWP) to enter the cell to conduct the survey. Since no information regarding the current radiation levels in the filter cell existed, the technician set a projected dose of 1.9 rem for the total work described on the RWP. The radiation control technician then entered the cell to complete the survey. An operator, acting as a backup, also entered the cell. Both the technician and the operator wore thermoluminescent dosimeters; low-range, direct-reading dosimeters; and electronic dosimeters set to alarm at 400 mrem total dose. After 13 minutes they exited the cell. While exiting, the operator's electronic dosimeter audible alarm sounded. Investigators later found that the technician's electronic dosimeter malfunctioned.

Investigators found both the technician and operator exceeded the limiting conditions of the RWP while they were in the cell and did not exit the cell area immediately. Investigators also determined the technician did not receive the required approvals for changes she made to the RWP. The technician did not recognize that trigger levels requiring an ALARA review were exceeded; however, the RWP did not require an ALARA review. Investigators found that an air sample taken during entry showed that the respiratory protection device prescribed by the technician would not provide the degree of protection required for the anticipated airborne radioactivity levels. Whole body counts on both the technician and the operator showed no uptake.

The Management and Operations manager directed the following corrective actions.

- Any single entry into a radiological area projected to result in an individual receiving a dose greater than or equal to 100 mrem must be authorized by

the individual's direct supervisor and the next level of supervision. The radiological control manager will modify the RWP procedure to include this requirement.

- Only radiological control personnel will be allowed to participate in initial entries to determine radiological conditions. The radiological control manager will modify the RWP procedure to include this requirement.

- All personnel (including radiological control personnel) working on a RWP are subject to the limiting conditions stated on the permit. If the conditions found are outside the conditions stated on the permit, work is to be stopped immediately, and the job is to be re-evaluated.

NFS recently reported radiological violations in Weekly Summaries 97-01 and 96-30.

- Weekly Summary 97-01 reported that on December 18, 1997, the DOE Office of Enforcement and Investigation issued a Preliminary Notice of Violation under the Price-Anderson Amendments Act to Petsco and Son, Inc., a general contractor to Brookhaven National Laboratory (BNL), for potential radiological non-compliance. The office also issued an Enforcement Letter to BNL. These potential non-compliances involved a number of instances of contractor or subcontractor failure to: (1) comply with area radiological warning signs; (2) use protective clothing and equipment; (3) maintain radiation exposures ALARA; and (4) complete radiological worker training. The maximum exposures from the non-compliances were 40 mrem each for two individuals; however, the exposures were unplanned and preventable.

- Weekly Summary 96-30 reported that on July 19, 1996, at the Pantex Plant, four technicians and a supervisor working in the contamination area of a compactor room did not comply with a RWP requirement that personnel entering the area must be in the tritium bioassay program. The technicians and the supervisor had received a memorandum from the Radiation Safety Department in March 1996 that removed them from the program. They continued to work in the compactor room from February 1996 to July 19, 1996, because they believed that the memoranda exempted them from the requirement. They did not provide monthly bioassay samples. Pantex Plant Standard 3209 for RWPs specifies that personnel must comply with the RWPs and supervisors must ensure compliance.

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for exposures and found 126 events. Figure 2-1 shows the distribution of root causes for these events.

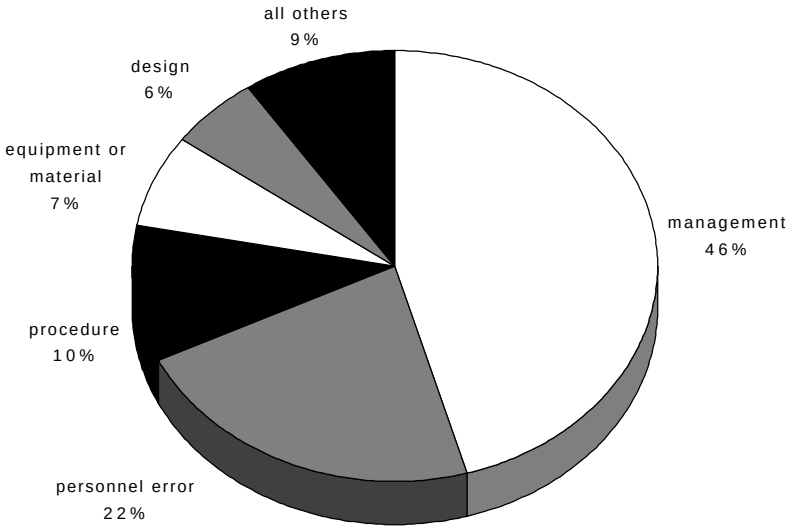

Figure 2-1. Distribution of Root Causes for Personnel Exposures[1]

Management problems contributed to 46 percent of root causes for personnel exposures. Table 2-1 shows a breakdown of the causal codes by percentage.

TABLE 2-1. CONTRIBUTION TO MANAGEMENT PROBLEMS BY CAUSAL CODES

Cause Codes	Percent
Inadequate administrative control	42
Policy not defined, disseminated, or enforced	24
Other management problem	18
Work organization/Planning deficiency	12
Inadequate supervision	4

When workers violate RWP requirements, they increase the risk of contamination and radiation exposure because they may be unaware of the radiological conditions. The purpose of the permit is to clearly inform workers of controlled area conditions and entry requirements. Workers must guard against complacency in the performance of routine work. Workers must also read and understand permits before signing them.

[1] OEAF engineers reviewed the ORPS database for all narrative, using exposure@, dose+rating@, and high+rad@ +area; and subtracted nature of occurrence, 04B (personnel contamination) for final reports 01/01/95 through 01/01/97; and found 126 occurrences. Based on a random sample of 50 reports, OEAF engineers determined that each slice is accurate within ± 3.3 percent.

DOE/EH-0256T, *DOE Radiological Control Manual,* states that radiation exposure of the work force and public shall be controlled such that there is no radiation exposure without commensurate benefit. Section 312, "Planning for Maintenance, Operations, and Modifications," specifies trigger levels that require formal radiological review. DOE managers should review these sections to ensure that they are doing everything reasonable to control radiation exposure of the work force and the public and that there is no radiation exposure without commensurate benefit.

KEYWORDS: radiation protection, ALARA, radiation work permit

FUNCTIONAL AREAS: radiation protection

3. INADEQUATE PROCEDURE CAUSES SAMPLER UNIT CONTAMINATION

On January 18, 1997, at the Savannah River Site F-Canyon, a sample-aisle operator backflushed a sampler unit with 4.1 percent nitric acid instead of domestic water after sampling a vessel containing a sodium carbonate solution. The acid and carbonate mixture reacted in the sampler lines. This reaction caused a foam solution to run out of an air bleed line, spreading contamination onto the floor of the sampler box. The next day another operator and a radiological control operations inspector were exposed to airborne contamination while attempting to clean up the foam residue on the sampler box floor. The sample procedure they used did not specify the correct flushing solution or warn of possible chemical reactions. This procedure inadequacy resulted in the spread of contamination and possible personnel contamination. (ORPS Report SR--WSRC-FCAN-1997-0003)

On January 19, 1997, a sample-aisle operator and a radiological control operations inspector went to the sample unit to re-sample the sodium carbonate solution. When they opened the sampler box door, they saw dried foam solution on the floor of the sampler. The inspector performed a routine survey of the box, and the operator obtained the sodium carbonate solution sample. After drawing the sample, the operator decontaminated the sampler unit. He flushed the contamination to the sampler drain using 4.1 percent nitric acid. At that time, the contamination became airborne, and constant air monitors alarmed. The operator and inspector shut the sampler box door, evacuated the sample aisle, monitored themselves, and immediately notified their supervisor. Surveys of the inspector's and operator's respirator filters found alpha contamination. Nasal and saliva smears indicated that both individuals should begin a 24-hour bioassay program for further evaluation.

Investigators determined that, although the sample procedure required a backflush, it did not specify whether water or acid should be used. Operators are permitted to use an acid flush if blockage occurs in the piping. Investigators believe the 4.1 percent acid solution used for decontamination of the foam on the sampler box floor may have reacted, causing an airborne contamination problem.

The facility manager requested that sample procedures be changed to indicate that domestic water is required for backflushes and decontamination when sampling solutions contain sodium carbonate. He also directed posting placards at the sample units to reinforce these requirements.

NFS reported inadequate procedure events in Weekly Summaries 96-48, 96-39, 96-34, 96-24, 96-19, 96-17, 96-14, 96-11, 96-08, and 96-04. These events involved procedures that (1) lacked instructions for correct equipment line-ups (2) did not include important safety warnings (3) provided incorrect setpoints and calculations, and (4) did not adequately address operational safety requirements.

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for final reports between December 1995 and December 1996 with violation or inadequate procedures as the nature of occurrence and found 451 occurrences DOE-wide. Distribution of root causes for these occurrences is shown in Figure 3-1.

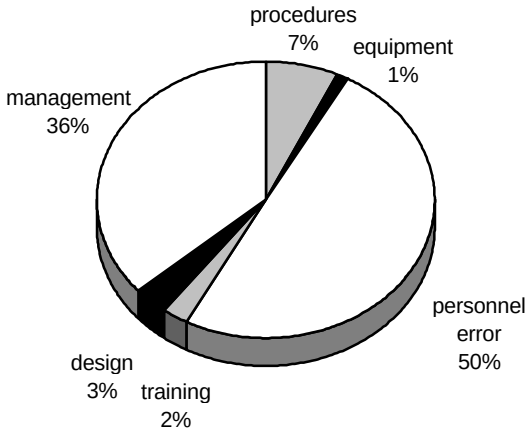

Figure 3-1. Distribution of Root Causes for Violation or Inadequate Procedures[1]

Personnel errors accounted for 50 percent of the events, and management problems contributed to 36 percent. A breakdown, showing the percentage of these cause codes, is shown in Table 3-1.

[1] OEAF engineers screened the ORPS database for final reports from 12/01/95 through 12/31/96 with the nature of occurrence 01F@ (violation or inadequate procedures) and found 451 occurrences.

TABLE 3-1. BREAKDOWN OF PERSONNEL ERROR AND MANAGEMENT PROBLEM CAUSE CODES DOE-WIDE

Personnel Errors	**Percent**
Inattention to detail	43
Procedure not used or used incorrectly	41
Communication problems	8
Other human errors	8
Management Problems	
Inadequate administrative control	34
Policy not adequately defined, disseminated, or enforced	28
Work organization or planning deficiency	23
Other management problems	9
Inadequate supervision	4
Improper resource allocation	2

DOE 5480.19, *Conduct Of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," states that operations procedures provide direction to ensure that the facility is operated within its design basis, and they should be used effectively to support safe operation of the facility. Attention should be given to writing, reviewing, and monitoring operations procedures to ensure the content is technically correct and the wording and format are clear. DOE-STD 1029-92, *Writers Guide For Technical Procedures*, provides guidance to assist procedure writers across the DOE complex in producing accurate, complete, and usable procedures that promote safe and efficient operations. Section 4.10, "Action Steps with Warnings, Cautions, and Notes," states that caution statements alert users to potential hazards of products or equipment. Both new and revised procedures should be reviewed by subject matter experts before issuance to ensure that the information, instructions, and cautions are technically accurate and the human-factor considerations have been included.

KEYWORDS: procedures, sampling, contamination, bioassay

FUNCTIONAL AREAS: procedures, chemistry, radiation protection

4. ELECTRICIAN SUFFERS ELECTRIC FLASH BURNS

On January 11, 1997, at Hanford, an electrician received minor flash burns when he reconnected energized, 480-volt power leads to a motor control center main breaker. The electrician did not receive an electrical shock. The electrician and a co-worker believed the circuit was de-energized based on their interpretation of electrical system drawings and an earlier zero energy verification. The electrician received only minor burns because he was wearing the required protective clothing. The shift manager stopped all work in the area and directed electricians to de-energize the electrical power. Emergency medical response team members transported the electrician to the hospital, where he was treated and released. Investigators determined there was an inconsistency between the electrical

system configuration and the system drawings. The use of inadequate system drawings for a lockout/tagout resulted in an injury to the electrician. (ORPS Report RL--PHMC-S&W-1997-0001)

The area manager convened a critique to investigate the event. Critique members determined the drawings the work planner used were inadequate because they showed the wrong power supply for the main breaker. They also determined the actual location and labeling of a 600-amp switch and an 800-amp breaker were inconsistent with the drawings. Critique members found that another group of electricians performed electrical switching operations approximately 1 minute before the electrician started handling the cables. The switching operations energized the cables being connected. After a break in the performance of work, the electrician did not perform a second zero energy verification. The electrician connected four of six cables without a problem. When he tried to connect the fifth cable, a phase-to-phase short-circuit resulted. The contractor is conducting an investigation to determine the root and contributing causes of this event and plans to develop effective corrective actions when the investigation is completed.

NFS recently reported on configuration management issues in Weekly Summaries 96-26 and 96-28.

- Weekly Summary 96-26 reported that on June 10, 1996, at Hanford, a near-miss occurred when two Tank Farm electricians were performing preventive maintenance on four glycol cooling fans. The electricians installed a personal locking device on a disconnect to de-energize four cooling fans in a bank of eight. They also performed a zero energy check at the disconnect. As they were preparing to work on two of the fans, four of the glycol-cooling fans started automatically from a thermostat. The technicians thought that two of the fans that started had been tagged out and de-energized. Mislabeled equipment and operating the system without field-verified drawings created the potential for injury or equipment damage. (ORPS Report RL--WHC-TANKFARM-1996-0041)

- Weekly Summary 96-28 reported two events at Savannah River Site caused by inaccurate drawings. On July 2, 1996, at the In Tank Precipitation Facility, electricians observed arcing when they cut electrical cable they believed to be de-energized. No injuries resulted, and electricians stopped work to isolate the electrical services. The electricians used inaccurate drawings when de-energizing the cables. On June 26, at F-Canyon, operators detected contamination in the FB-line process water system after the valve to an incorrect water supply was opened. Operators were following a sketch included in the procedure. Operators shut the process water valve when the error was detected. Inaccurate drawings can jeopardize safety and cause actions that may lead to contamination, injuries, or death. (ORPS Reports SR--WSRC-ITP-1996-0013 and SR--WSRC-FCAN-1996-0004)

DOE/EH-0411, *Type A Accident Investigation Board Report on the June 17, 1994, Electrical Arc Blast at Building 9725 Resulting in an Injury at the Department of Energy Oak Ridge Reservation,* describes an event where an electrician was seriously burned from an arc blast while preparing to reconnect a 480-volt distribution panel. Corrective actions for that event included strengthening work planning to ensure electrical safety requirements are clearly defined in work packages and enforced by supervisors. This includes the use of hold points to ensure safety requirements are adequate based on work conditions. (ORPS Report ORO--MMES-Y12SITE-1994-0025)

Operating Experience Analysis and Feedback (OEAF) engineers reviewed the Occurrence Reporting and Processing System (ORPS) database and found 81 events reported DOE-wide where electrical shocks or near-misses were attributed to drawing, specification, or data errors. Figure 4-1 shows the distribution of root causes for these events and shows that the root cause of 36 percent of these events was reported as a management problem.

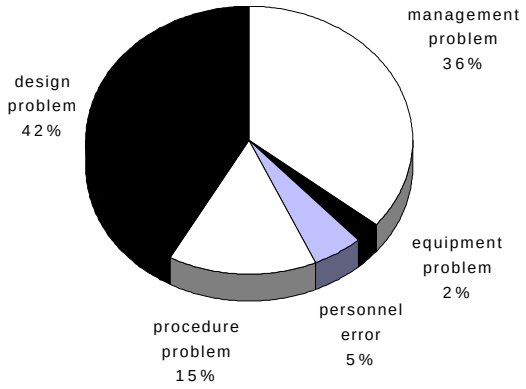

Figure 4-1. Root Causes for Electrical Shock or Near-Misses Attributed To Drawing, Specification, or Data Errors[1]

The causal code for design problems (drawing, specification, or data errors) contributed 88 percent of the overall design-related causes. Management problems contributed to 36 percent of the root causes for electric shock or near-misses attributed to drawing, specification, or data errors. Table 4-1 shows the breakdown of the causal codes by percentage.

TABLE 4-1. CONTRIBUTION TO MANAGEMENT PROBLEMS BY CAUSAL CODES

Cause Codes	Percent
Inadequate administrative control	35
Policy problem	24
Work planning deficiency	21
Other management problem	14
Inadequate supervision	3
Improper resource allocation	3

This event underscores the importance of correct drawings and a disciplined configuration management program. When facility managers become aware that their facility drawings

[1] OEAF engineers screened the ORPS database for all narrative using “elec@ + shock@ +arc@ +flash@” for direct cause “4d” (drawing, specification, or data errors) and found 81 events. Based on a random sampling of 25 events, accuracy of each slice is within ± 4.3 percent.

may be incomplete or inaccurate, additional safety steps should be incorporated into work controls and maintenance activities. The coincident switching of electric power to this building changed the work conditions for the electrician between the time he conducted a zero energy check and started to perform the cable termination.

DOE/ID-10600, *Electrical Safety Guidelines*, prescribes safety standards for DOE field offices and facilities involved in the use of electrical energy. Included in the guidelines is information on training and qualifications, work practices, protective equipment, insulated tools, and recognition of electrical hazards.

DOE-STD-1073-Pt.1 and -Pt.2, *Guide for Operational Configuration Management Program*, states that physical configuration assessments or walk-downs should be performed for representative sample structures, systems, and components within the facility to determine the degree of agreement between the physical configuration and the configuration on the facility documentation. Physical walk-downs should be included as part of the programmatic assessments conducted during initial assessments, post-implementation assessments, and periodic effectiveness assessments. Facility managers should verify that these assessments include electrical drawings and system configuration as well as mechanical system drawings.

KEYWORDS: electrical hazard, configuration control, work planning

FUNCTIONAL AREAS: electrical maintenance, work planning

5. NONCOMPLIANCE WITH FEDERAL MOTOR CARRIER SAFETY REGULATIONS

On January 8, 1997, at the Oak Ridge National Laboratory, a researcher, who was not qualified to operate a commercial motor vehicle in accordance with Federal Motor Carrier safety regulations, rented a small truck from a national rental company in Knoxville, Tennessee, and drove it back to the Laboratory. He rented the truck to transport a control system to Arnold Air Force Base in Tullahoma, Tennessee. Oak Ridge Transportation Department personnel discovered the driver was not qualified to operate the vehicle and assigned a qualified driver to deliver the shipment. The operation of commercial vehicles by unqualified drivers in the performance of official company or government business can result in civil or criminal penalties. (ORPS Report ORO--ORNL-X10IANDC-1997-0001)

Investigators determined the researcher who drove the truck to Oak Ridge was not a qualified driver as defined in 49CFR391.11, "Qualifications of Drivers." The truck, a small box-bed with van cab, had an empty weight of 14,000 pounds gross weight.

On Monday, January 13, 1997, the Oak Ridge Transportation Safety Compliance Office issued a bulletin to remind Oak Ridge National Laboratory personnel of the requirements that classify a commercial motor vehicle, as regulated by the U.S. Department of Transportation, Federal Highway Administration. The bulletin listed the following requirements.

- any vehicle with a gross weight rating or gross combination weight rating of 10,001 or more pounds
- any vehicle designed to transport more than 15 passengers, including the driver

- any vehicle used in the transportation of hazardous materials requiring placarding

The bulletin also reminded Laboratory employees that operation of commercial motor vehicles by company employees in pursuit of their employment is restricted to qualified drivers only. This includes the use of rental vehicles. Any unqualified driver who rents a commercial motor vehicle and operates it to conduct company business runs the risk of incurring civil or criminal penalty. Should an accident occur, the company and the employee could be liable, regardless of fault.

NFS reported an event in Weekly Summary 96-25 concerning a shipment of explosives where one of the two truck drivers did not meet Federal Motor Carrier driver-qualification requirements. Investigators determined that the comprehensive checklist used to verify proper packaging, shipping papers, manifest, and vehicle checks did not include a verification or check of driver qualifications. Corrective actions included requiring drivers to complete Federal Motor Carrier qualifications and incorporating verification of the driver's qualification into procedures and checklists. (ORPS Report ALO-KO-SNL-CASITE-1996-0005)

This event illustrates the need for transportation managers and facility managers to ensure that personnel who operate owned or rented commercial motor vehicles are qualified drivers as defined by Federal Motor Carrier safety regulations.

KEYWORDS: transportation, truck, training and qualifications, vehicle

FUNCTIONAL AREAS: training and qualification

NOTICES UNDER DEVELOPMENT

The Office of Nuclear and Facility Safety encourages input related to the development of Notices. If you have any questions, comments, or information concerning events or issues similar to the following, please contact Mr. Dick Trevillian, Office of Nuclear and Facility Safety at (301) 903-3074 or at Internet address dick.trevillian@hq.doe.gov.

OEAF is currently developing Safety Notices on the following issues:

1. Water Hammer