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PACKAGING- AND TRANSPORTATION-RELATED OCCURRENCE REPORTS

FY–1996 Annual Report

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ACRONYMS

ALO	Albuquerque Operations
ANLE	Argonne National Laboratory—East
BNI	Bechtel National, Inc.
BNL	Brookhaven National Laboratory
BPOI	Bechtel Petroleum Operations, Inc.
CFR	Code of Federal Regulations
CH	Chicago Operations
CY	Calendar year
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DP	Defense Programs
DynCorp	DynCorp of Colorado
EE	Energy Efficiency and Renewable Energy
EG&G	EG&G Idaho, Inc.
EGGM	EG&G Mound Applied Technologies, Inc.
EGGR	EG&G Rocky Flats, Inc.
EH or ES&H	Office of Environment, Safety and Health
EM	Environmental Management
ER	Energy Research
FAA	Federal Aviation Administration
FE	Fossil Energy
FERM	Fernald Environmental Restoration Management Corp.
FMCSR	Federal Motor Carrier Safety Regulation
FY	Fiscal year
GE/KN	General Electric Knolls Atomic Power Laboratory
HEPA	High-efficiency particulate air (filter)
HP	Health physics
HQ	Headquarters
ID	Idaho Operations
INEEL	Idaho National Engineering and Environmental Laboratory
KCP	Kansas City Plant
KEH	Kaiser Engineers Hanford
KNOLLS	Knolls Electric Power Plant (MMES)
LANL	Los Alamos National Laboratory
LITC	Lockheed Idaho Technologies Corp. (operator of INEEL)
LL	Lessons learned
LLNL	Lawrence Livermore National Laboratory
LLW	Low-level waste
LMES	Lockheed Martin Energy Systems, Inc.

MHSM	Mason & Hanger, Silas-Mason Co., Inc.
MK-F	MK-Ferguson
NE	Nuclear Energy
NN	Nuclear Non-Proliferation
NOC	Nature of Occurrence
NRC	Nuclear Regulatory Commission
NVO	Nevada Operations
OAK	Oakland Operations
OEWS	Operating Experience Weekly Summary
OR	Occurrence report
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORPS	Occurrence Reporting and Processing System
PANX	Pantex Plant
PATS	Packaging and Transportation Safety
PCB	Polychlorinated Biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PNNL	Pacific Northwest National Laboratory
PORTS	Portsmouth Gaseous Diffusion Plant
PPPL	Princeton Plasma Physics Laboratory
QA	Quality assurance
REECO	Reynolds Electrical & Engineering Company
RFO	Rocky Flats Office
RLO	Richland Operations
RW	Radioactive Waste Management
SAIC	Science Applications International Corporation
SARP	Safety Analysis Report for Packaging
SMAC	Shipment/Mobility Accountability Collection
SNL/A	Sandia National Laboratory–Albuquerque
SNL/L	Sandia National Laboratory–Livermore
SRO	Savannah River Operations
SRS	Savannah River Site
UMTRA	Uranium Mill Tailings Remedial Actions Project
USEC	United States Enrichment Corporation
WHC	Westinghouse Hanford Company
WIPP	Waste Isolation Pilot Plant
WSRC	Westinghouse Savannah River Company
WVDP	West Valley Demonstration Project
WVNS	West Valley Nuclear Services, Inc.
Y-12	Oak Ridge Y-12 Plant

EXECUTIVE SUMMARY

The Oak Ridge National Laboratory (ORNL), through its support to the U.S. Department of Energy's (DOE's) Office of Transportation, Emergency Management, and Analytical Services (EM-76), retrieves reports and information pertaining to transportation and packaging occurrences from the centralized Occurrence Reporting and Processing System (ORPS) database. These selected reports are analyzed for trends, impact on packaging and transportation operations and safety concerns, and lessons learned (LL) in transportation and packaging safety. Some selected reports are reviewed to evaluate the corrective actions being conducted.

This report contains an analysis of 246 occurrences identified as packaging- or transportation-related during fiscal year (FY) 1996, with supporting data from calendar year (CY) 1991 through 1995 which provide the basis for trending. The overall number of packaging- and transportation-related occurrences remains a small percentage of the total occurrences in the DOE system, though it is relatively higher this year (~6%) than previous years when transportation occurrences were approximately 3% of the total. The decrease in the total number of occurrences may be the result of the "rollup" provisions of the new DOE Order 232.1, and the comparative increase in packaging- and transportation-related occurrence reports (ORs) is only a reflection of the decrease in the overall total. There does not appear to be a correlation between the total number of offsite hazardous materials shipments and the number of reported occurrences. The offsite occurrences, while few in number, are consistent for the major shippers and contractors.

In FY 1996, the major nature of occurrence offsite was vehicular and driver safety; this type of occurrence was followed closely by shipment preparation. The major nature of occurrence onsite was contamination caused by a packaging or transportation incident. Examination of the root cause assigned by the occurrence reporters showed consistency with causes of occurrences in previous years in that "personnel error" and "management problems" were the most common causes identified.

The effectiveness of the corrective actions proposed to address occurrences were examined for 20 of the total 246 reports. These included all occurrences categorized as unusual, since there were no emergency reports. Fifty-five percent of the ORs corrective actions described in the ORs were evaluated as satisfactory. Reviewing the summaries of corrective actions provides one a glimpse of the LL process and could lead transportation professionals to recognize potential problems and ways to apply preventive measures. Based on ORPS data, material from the *Federal Register*, and other publications, the Packaging and Transportation Safety (PATS) Program developed four LL during this FY.

1. INTRODUCTION

The U.S. Department of Energy (DOE) Occurrence Reporting and Processing System (ORPS) is an interactive computer system designed to support DOE-owned or operated facilities in the reporting and processing of information concerning occurrences related to facility operations. The requirements for reporting and the extent of the occurrences to be reported are defined in DOE Order 232.1, "Occurrence Reporting and Processing of Operations Information." The centralized database, managed through the Idaho National Engineering and Environmental Laboratory (INEEL), provides computerized support for the collection, distribution, updating, analysis, and sign-off of information in the occurrence reports (ORs).

The Oak Ridge National Laboratory (ORNL) Packaging and Transportation Safety Program (PATS) has been charged with the responsibility of retrieving reports and information pertaining to transportation and packaging incidents from the centralized ORPS database. These selected reports are analyzed for trends, impact on packaging and transportation operations and safety concerns, and lessons learned (LL). Moreover, the selected ORs are reviewed for compliance with the DOE Order 232.1 requirement to provide appropriate corrective actions. This task is designed (a) to keep the DOE Office of Transportation, Emergency Management, and Analytical Services (EM-76) aware of what is occurring on DOE sites and what potential transportation and packaging problems may need attention and (b) to develop and distribute LL to the Operations Offices.

This annual report details (1) the methodology that PATS uses to conduct searches of the ORPS for pertinent information and the form of reporting to EM-76, (2) major shippers of hazardous materials and major reporters of occurrences, (3) review and examination of trends observed in ORs analyzed by the nature of occurrence (NOC) codes of PATS, (4) a presentation and discussion of the root-cause codes of ORPS, and (5) evaluation of ORs that were categorized on the ORPS as emergency or unusual to determine whether the actions taken to close out the occurrences are sufficient to assure remediation of the incident and prevent recurrence.

Though this report presents an analysis of the ORs that occurred during fiscal year (FY) 1996 as reported to DOE-Headquarters (HQ), it also uses historical ORs to analyze for trends and patterns. The reports were retrieved from ORPS weekly; however, they were not submitted to DOE HQ in weekly reports because of budget constraints. The ORs selected per FY are based upon the report notification date. In FY 1996, 246 ORs were selected of the 3,943 total occurrences reported to the ORPS. One hundred and twenty-eight of the 246 packaging and transportation-related ORs have been finalized. Up to October 1, 1995, 943 ORs had been previously selected, some of which were not reported in the weekly reports and, hence, are designated as historical. Therefore, including the ORs reported last FY, 1,187 ORs (of which 771 are finals) are reviewed for this report, with emphasis on the occurrences of FY 1996. Figure 1 shows the number of packaging- or transportation-related ORs that have been selected from the ORPS by their FY notification date. The total number of occurrences reported during

previous FYs by ORPS are fewer than the amounts recorded previously in the annual reports because some ORs have been canceled or deleted from ORPS since the sites originally posted them. The total occurrences per FY represents the number of ORs that a query reveals is currently present in the ORPS.

The reduction in overall reporting of occurrences during FY 1996 may be due to the criteria qualification being redefined by issuance of DOE Order 232.1 and, to a lesser extent, the allowance for rollup reporting of related incidents.

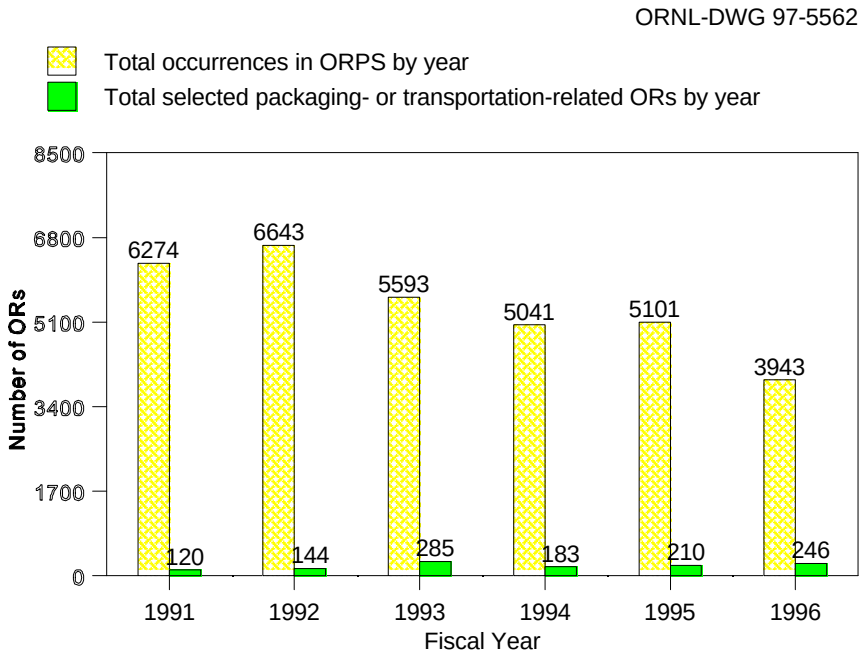


Fig. 1. Packaging- and transportation-related ORs selected by FY.

1.1 METHODOLOGY AND REPORTING

ORNL PATS staff conducted daily searches of ORPS to scan and retrieve summaries of ten-day reports (and updates to the ten-day reports) and reviewed each to identify those that have packaging and transportation significance. Final reports are also scanned to update previously selected occurrences.

Once the ORPS system has been scanned and the applicable ORs have been selected, these selected ORs are then independently checked by another transportation specialist to verify the selection. The selected ORs are drafted into a table that lists (1) report date, (2) discovery date

of the occurrence, (3) ORPS number, (4) occurrence type, (5) nature of the packaging and transportation safety concern, and (6) damage and injury resulting from the occurrence. This tabular listing of the selected ORs is usually compiled weekly. Key personnel of EM-76 are notified of any particularly threatening occurrences or patterns. However, a weekly report and electronic transmission are no longer routinely performed because of budget constraints. The selected ORs are officially reported semiannually and annually.

1.2 CATEGORIZATION OF OCCURRENCES

DOE Order 232.1 categorizes ORs into three types: *emergency*, *unusual*, and *off-normal*. For packaging and transportation concerns, the DOE Manual 232.1-1, *Occurrence Reporting and Processing of Operations Information*, defines these categories under Group 6 of Chapter 8, "Categorization of Reportable Occurrences," as:

"*Emergency*. A transportation event involving the release of a reportable quantity of hazardous substance (per 49 CFR Part 171.8) which is transported in support of departmental operations. Emergencies are further defined and classified in the DOE 5500 series of Orders.

Unusual.

(1) Any packaging or transportation activity (including loading, unloading, or temporary storage) involving the offsite release of radioactive material, etiologic agents, a reportable quantity of hazardous substance, or marine pollutants.

(2) Any shipment of radioactive material that arrives at its destination with radiation or contamination levels greater than DOT limits, or results in personnel radiation exposure higher than permitted in Federal permits, Federal regulations, or DOE standards.

(3) Any shipment or onsite transfer of radioactive material or hazardous waste that arrives at its destination with an unaccounted for package or an irreconcilable shipping paper, waste manifest, or onsite transfer authorization.

(4) A vehicle, vessel, rail or air incident or accident (without personal injury) that presents significant impact on ability of facility to conduct transportation operations and:

   (a) results in release of radioactive or hazardous materials above Federal permit, Federal regulatory, or DOE Standard limits;

   (b) involves significant degradation of safety equipment; or

   (c) is the result of failure or significant degradation of administrative controls required to ensure safety.

(5) Violations of the Federal Motor Carrier Safety Regulations or the Hazardous Materials Regulations if those violations are determined by DOT inspection and result in a fine (monetary penalty).

Off-normal.

(1) Any packaging or transportation activity involving:

(a) the offsite release of non-radioactive hazardous material, or any quantity of hazardous waste; or
(b) the onsite release of radioactive materials, etiologic agents, hazardous substances, hazardous waste, or marine pollutants.

(2) A vehicle, vessel, rail or air incident or accident (without personal injury) that affects the ability of a facility to conduct transportation operations and:

(a) results in release of radioactive or hazardous materials below limits established by Federal permits, Federal regulations, or DOE Standard limits but must be reported to State or local agencies; or
(b) is the result of operational procedural violations, including maintenance or administrative procedures.

(3) Noncompliances (potential violations) of the DOT Hazardous Materials Regulations or the transportation and packaging requirements of the Nuclear Regulatory Commission involving:

(a) errors made by the shipper in materials description, marking, labeling, or placarding;
(b) an unqualified person signing shipping papers;
(c) the highway routing selection requirements for highway route controlled shipments or the notification requirements for spent-fuel shipments not being observed;
(d) the separation and segregation tables for hazardous materials not strictly adhered to; or
(e) the applicable packaging requirements for the assembly, handling, or selection of a package not being in accordance with the applicable regulations.

(4) Noncompliances (potential violations) of the Federal Motor Carrier Safety Regulations involving:

(a) a contractor driver operating a DOE-owned motor vehicle after a positive drug test or failure of an alcohol test;
(b) an unqualified driver operating a vehicle (medical, driver's license, or training not in compliance);

(c) the carrier (contractor management) not having required insurance;
(d) a vehicle that failed inspection not being removed from service;
(e) a specification cargo tank with expired inspection being in service with hazardous materials;
(f) a driver's log book deliberately misrepresented; or
(g) the carrier (contractor management) failing to perform random or periodic drug or substance-abuse testing.

(5) Any violation of the Hazardous Material Regulations or Federal Motor Carrier Safety Regulations if that violation is determined by DOT inspection and does not result in a penalty."

Of the occurrences selected during FY 1996, there were no ORs listed as *emergency*. Twenty (20) ORs were listed as *unusual*; 11 of the unusual ORs have been finalized. A summary of these 20 ORs and an evaluation of the effectiveness of the reported respective corrective actions can be found in Chapter 5 and Appendix A of this report.

2. MAJOR SHIPPERS AND REPORTERS OF OCCURRENCES

The Shipment Mobility/Accountability Collection (SMAC) system is DOE's unclassified, computer-based historical transportation information system. SMAC provides centralized collection, analysis, and reporting of transportation data for shipments made by and on behalf of DOE. SMAC is operated for DOE by Science Applications International Corporation (SAIC). The SMAC system is funded by the DOE Office of Environmental Management (EM) through the DOE Oak Ridge Operations Office. The SMAC system contains data concerning shipments made on behalf of DOE, with the exception of parcel post and certain United Parcel Service shipments. Currently, SMAC contains information on about three million DOE shipments.

SMAC provides summaries for this project on hazardous materials shipments made by the DOE contractors during a specified time frame. SMAC data reveal Y-12 was the most active shipper in 1996 with 1,637 shipments having been made. However, this amount is only a little over the 1,240 shipments that Y-12 conducted last FY. The second largest shipper was Oak Ridge National Laboratory (ORNL) with 1,594 shipments, a total that is actually lower than the 1,977 that conducted last FY. What is noteworthy is that Lawrence Livermore National Laboratory (LLNL), which has consistently been the most active shipper of hazardous material and waste, conducted less than half of its typical volume of shipments, reporting only 1,267 shipments for the year. (An LLNL Traffic Shipping Office official stated that business has been down overall and some programs have been cutback, resulting in lessened shipments.) Figure 2 presents those contractors who reported more than 900 shipments to SMAC in FY 1996. The number of offsite packaging- and transportation-related ORs that the sites reported to ORPS is indicated in a line below the sites to offer a comparison with the number of offsite hazardous material and waste shipments conducted.

Figure 3 presents those contractors who reported more than 300 but fewer than 900 shipments to SMAC during FY 1996. (The acronym list in the front matter of this report contains the full names of the contractors indicated in these figures.) Table 1 lists the number of packaging- and transportation-related ORs of shippers who reported more than 300 hazardous materials shipments during FY 1996 to SMAC. The shippers are listed in alphabetical order for ease of reference. Occurrences are categorized in Figs. 4 and 5 into onsite, offsite, and others. Any occurrence that happens in an area which is within the boundaries of a DOE site or facility that is fenced or otherwise access-controlled is defined as an onsite occurrence. Offsite occurrences are those occurrences that happen in any area within or outside a DOE site to which the public has free and unlimited access. The category "others" is used by PATS to designate occurrences that were created by organizations other than the reporting group. This category ensures that an occurrence is not charged to a contractor simply because the contractor properly discovered and reported it. Because onsite shipments are not reported to SMAC, comparisons should be related to offsite occurrences only, not the total occurrences reported by the site.

Table 1 shows that some of the sites continue to report a relatively large number of occurrences, such as Westinghouse Hanford Company (WHC) and Westinghouse Savannah River Company (WSRC). The occurrences reported by Pantex for onsite shipments are almost 2.5 times greater

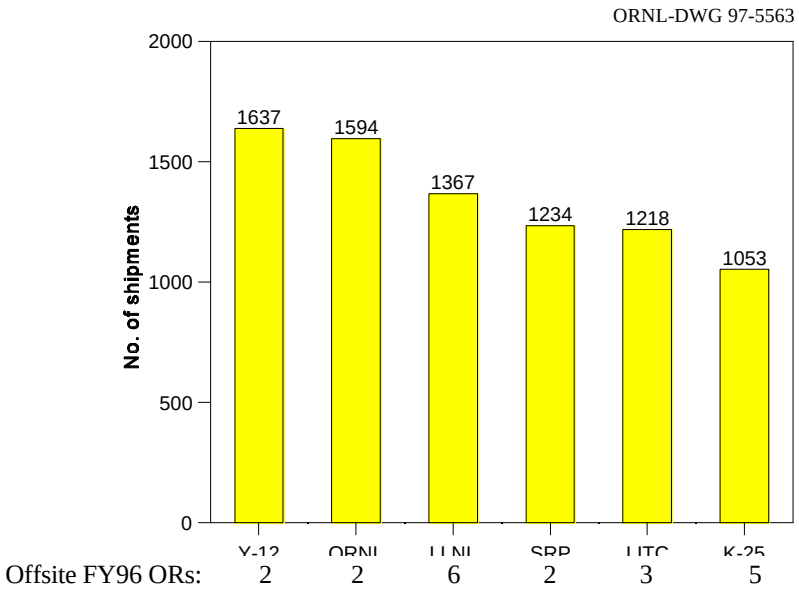


Fig. 2. Contractors conducting over 900 shipments during FY 1996 (SMAC data).

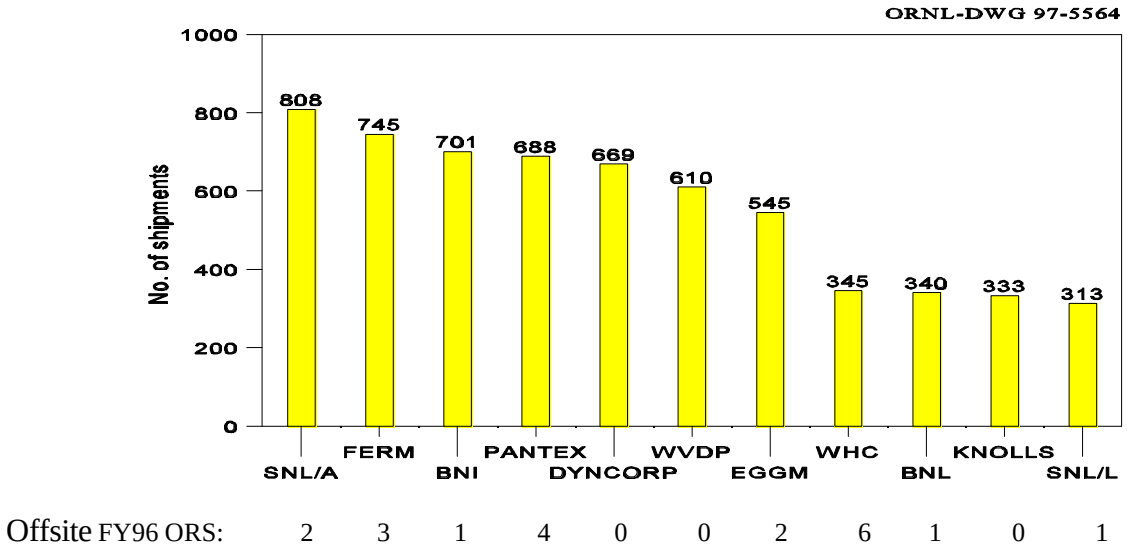


Fig. 3. Contractors with between 300 and 900 shipments during FY 1996 (SMAC data).

Table 1. ORs per year for contractors with >300 shipments during FY 1996

Contractor	Year	Onsite	Offsite	Others	Contractor	Year	Onsite	Offsite	Others
BNI	1992	0	1	0	**BNL**	1992	1	2	0
	1993	0	1	0		1993	3	3	1
	1994	0	0	0		1994	4	1	0
	1995	1	1	0		1995	5	3	2
	1996	0	1	0		1996	3	1	0
DYNCORP	1996	6	0	0	**EGGM**	1992	1	0	0
						1993	3	1	0
						1994	1	1	0
						1995	3	3	3
						1996	2	2	0
FERM	1992	0	1	0	**K-25 (LMES)**	1992	5	1	3
	1993	0	2	0		1993	0	0	0
	1994	1	2	9		1994	2	1	0
	1995	7	2	6		1995	0	0	0
	1996	2	3	2		1996	2	5	0
KNOLLS	1992	0	0	0	**LLNL**	1992	0	0	0
	1993	0	0	0		1993	3	3	0
	1994	0	0	0		1994	2	2	5
	1995	0	0	0		1995	5	6	0
	1996	0	0	0		1996	1	6	2
LITC	1992	0	0	0	**ORNL**	1992	1	2	0
	1993	0	0	0		1993	6	1	3
	1994	0	0	0		1994	2	3	1
	1995	5	3	1		1995	2	3	2
	1996	7	3	0		1996	4	2	1

Table 1. ORs per year for contractors with >300 shipments during FY 1996 (continued)

Contractor	Year	Onsite	Offsite	Others	Contractor	Year	Onsite	Offsite	Others
PANTEX	1992	3	3	0	**SNL/A**	1992	0	1	0
	1993	3	4	0		1993	1	1	1
	1994	2	3	1		1994	3	2	0
	1995	10	1	0		1995	6	1	0
	1996	24	4	0		1996	6	2	0
SNL/L	1992	0	0	0	**WVDP**	1992	0	0	0
	1993	0	1	0		1993	0	0	0
	1994	0	0	0		1994	0	0	0
	1995	1	0	0		1995	0	1	1
	1996	1	1	0		1996	0	0	0
WHC	1992	18	7	6	**WSRC**	1992	5	5	0
	1993	29	4	3		1993	23	3	2
	1994	20	1	5		1994	10	3	2
	1995	14	1	1		1995	14	7	2
	1996	13	6	2		1996	19	2	5
Y-12 (LMES)	1992	3	2	2					
	1993	6	3	2					
	1994	5	1	2					
	1995	0	1	2					
	1996	2	2	1					

than those listed last FY, rising from 10 to 24. Just as occurred last FY, 60% of the occurrences are related to shipment preparation. Because this was such a pronounced increase and it was unlikely that Pantex's quality assurance (QA) had decreased, the site was questioned for reasons that they thought might explain this increase. It was stated that a new report was issued during 1995 which identified explosives by part number and resulted in the reclassification of material which contained even small amounts of explosives as explosive materials. Hence, many routine movements of legacy material are being discovered to be non-compliant because the reclassified

material requires additional labeling, work orders, and safeguards. It is expected that Pantex's onsite occurrences will be relatively high during the next FY because all such material has not yet been identified and dispositioned.

A quick review of Figs. 2 and 3 show that there is little correlation between the number of shipments per year and the number of reported occurrences. Other than SMAC not receiving reports on onsite shipment activity, there may be several reasons for this lack of correlation (i.e., repeated numbers of similar shipments which reduces error by repetition, more diligence in reporting occurrences, and variations in interpretations of the reporting requirements). Therefore, it is not feasible to correlate the number of ORs reported to the volume of shipments made or equate the volume to number of shipments with a safety significance. For example, the number of ORs reported by WSRC may well reflect the quality of its investigative and reporting program rather than any lack of quality or compliance in its packaging and transportation operations.

Figures 4 and 5 present the shippers that reported over 900 ORs to SMAC during FY 1996. No trends are obvious from a comparison of the bar charts.

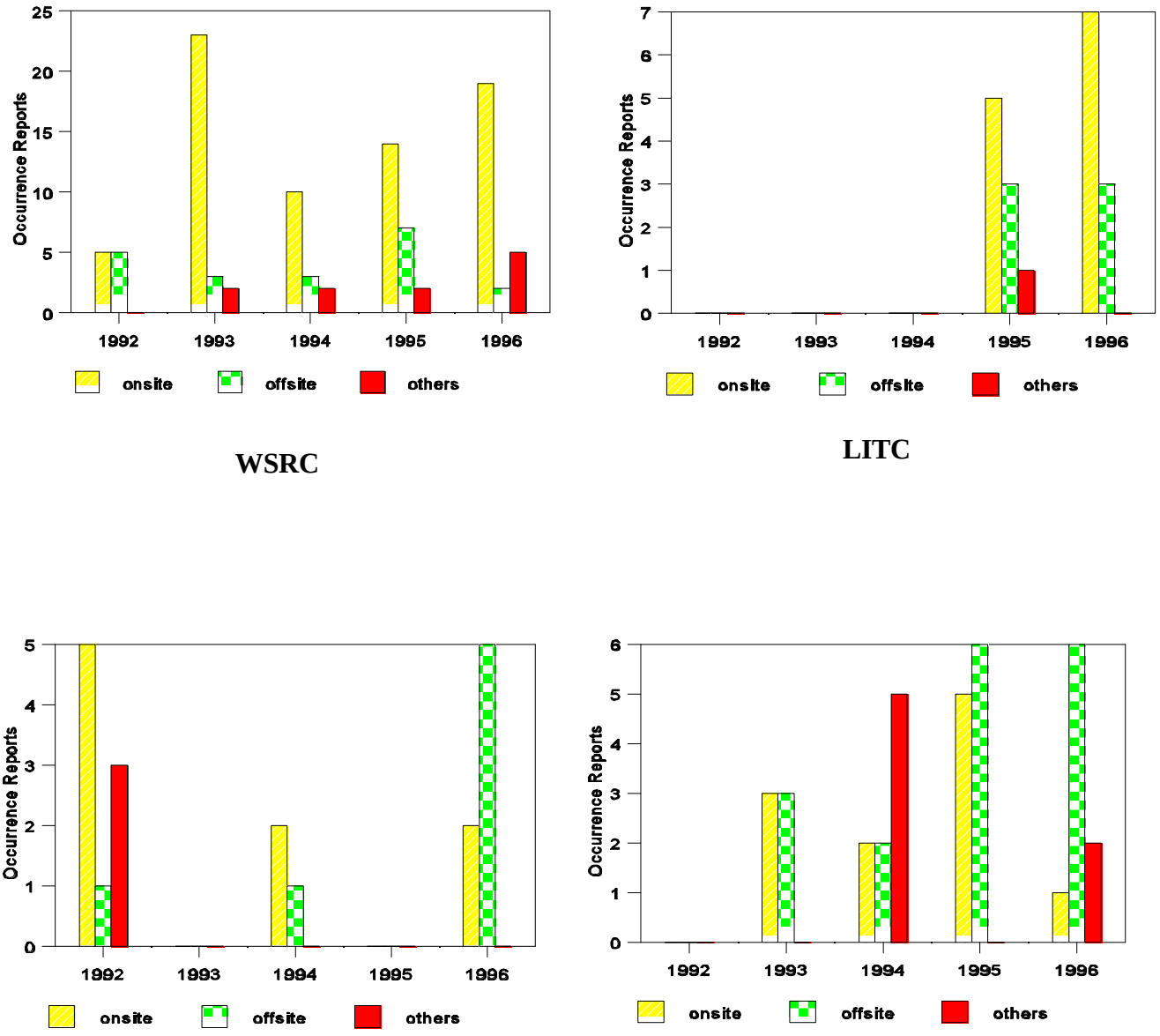
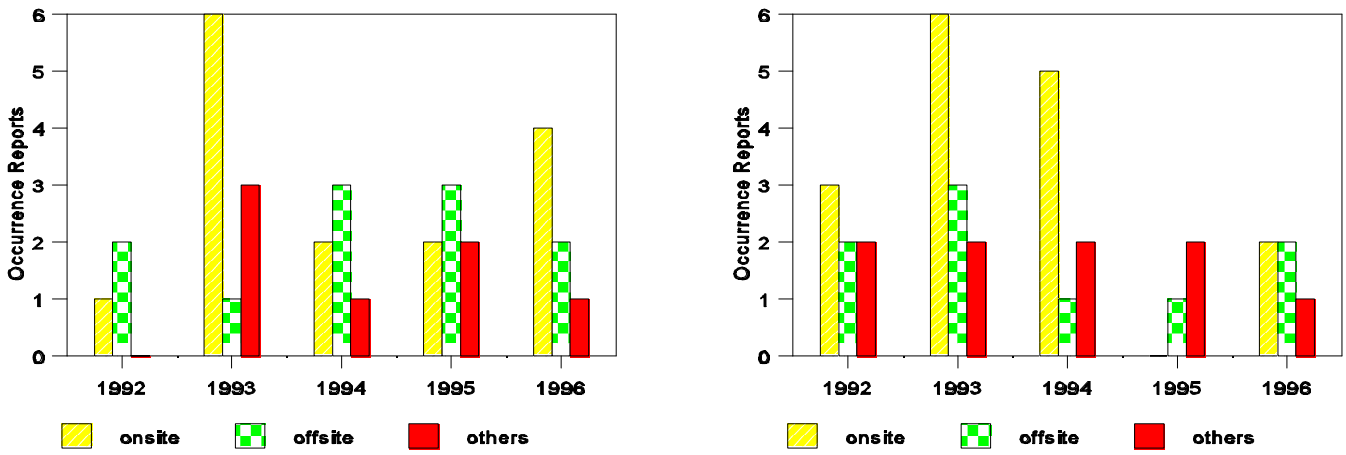


Fig. 4. ORs of shippers (WSRC, LITC, K-25, LLNL) with greater than 900 shipments



ORNL **Y-12 (LMES)**

Fig. 5. ORs of shippers (ORNL and Y-12) with greater than 900 shipments .

3. THE NATURE OF OCCURRENCE OF THE INCIDENT

The PATS-assigned NOC basically seeks to define what occurred and to classify the incident according to specific packaging- and transportation-related safety issues rather than to use the more general ORPS NOC assigned to the incident (see *ORPS User's Manual*, DOE/ID-10319). NOC coding categorizes ORs by unique packaging- and transportation-related criteria to focus on patterns and useful information for Headquarter's (HQ's) use and LL. (For a complete discussion of the selection criteria, please see the *PATS ORPS Manual*.) Table 2 presents a listing of the PATS-assigned NOC codes used.

The PATS_OR database was queried to obtain a grouping of the FY 1996 ORs by NOC classification and onsite or offsite designation. Again, any occurrence that happens in an area which is within the boundaries of a DOE site or facility that is fenced or otherwise access-controlled is defined as an onsite occurrence. Offsite occurrences are those incidents that happen in any area within or outside a DOE site to which the public has free and unlimited access. Table 3 lists the results of the query for ORs that were reported during FY 1996. Table 4 displays the NOC classification of all ORs currently in the database, covering package- or transportation-related ORs selected from October 1, 1990, through September 30, 1996, by report notification date.

Table 5 reveals that the most significant increase in ORs that were reported this FY is in improper hazardous material characterization, NOC 4. This category (13.8% of the packaging- and transportation-related ORs reported) is about twice the magnitude of any previous year. However, there has been a yearly increase in incidents involving improper hazardous material characterization since 1993, which could be the formation of a significant trend (see Table 5). See Figs. 6 and 7 for graphical representations of this discussion. Observation also reveals a decline in ORs created by others, NOC 8. Table 5 indicates an overall decline in occurrences attributable to others since 1994. Data for next FY will establish whether this is a trend or simply a random fluctuation.

The increase in incidents of improper hazardous material characterization may be attributed to a number of causes: (1) a change in the reporting criteria introduced by DOE Order 5000.3B being revised to DOE Order 232.1, (2) more shipments being performed of nonroutine items, (3) better QA and occurrence reporting procedures, (4) a neglect of training, (5) personnel turnover, or (6) inattention to detail and incautious work. Reviewing the descriptions of the 34 occurrences shows that the following violations were involved: mislabeling, inattention to detail, improper hazardous material characterization, improper hazardous material disposal, improper completion of manifests and shipping papers, procedures not in place or not being used, and a lack of training. Since none of these factors are unique to this reporting period and the mistakes were usually being made with commonly inventoried items, the first two postulated causes can be ruled out.

Table 2. PATS NOC categories

1. Contamination/release
   - 1A. Radioactive
     - 1A1. Environmental
     - 1A2. Personnel
     - 1A3. Equipment
   - 1B. Hazardous materials
     - 1B1. Environmental
     - 1B2. Personnel
     - 1B3. Equipment

2. Packaging
   - 2A. Damaged
   - 2B. Incorrect selection
   - 2C. Incorrect procedures

3. Storage Incident to Transport

4. Improper Hazardous Material Characterization

5. Shipment Preparation
   - 5A. Shipping papers
   - 5B. Marking
   - 5C. Labeling
   - 5D. Loading and tie-downs
   - 5E. Placards
   - 5F. Radiation survey

6. Modal Safety
   - 6A. Motor or driver safety
   - 6B. Aircraft safety
   - 6C. Rail safety
   - 6D. Barge safety
   - 6E. Pipeline safety

7. Reserved

8. Occurrence Created by Others (non-DOE or DOE/Contractor)
   - 8A. Shipping preparation
   - 8B. Packaging
   - 8C. Reserved
   - 8D. Vehicle or driver safety
   - 8E. Contamination
   - 8F. Not otherwise specified (NOS)

Table 3. FY 1996 ORs classified by PATS NOC

NOC category	No. of occurrences		
	Onsite	Offsite	Total
Contamination/Release	33	2	35
Packaging	16	7	23
Storage Incident to Transport	8	0	8
Improper Hazardous Material Characterization	13	21	34
Shipment Preparation	34	22	56
Vehicle or Driver Safety	50	18	68
Reserved	0	0	0
Occurrences Created by Others	1	21	22
Total ORs	155	91	246

Table 4. ORs of PATS_OR database classified by PATS NOC

NOC category	No. of occurrences		
	Onsite	Offsite	Total
Contamination/Release	206	36	242
Packaging	89	29	118
Storage Incident to Transport	23	2	25
Improper Hazardous Material Characterization	30	45	75
Shipment Preparation	133	124	257
Vehicle or Driver Safety	164	107	271
Reserved	0	0	0
Occurrences Created by Others	10	189	199
Total ORs	655	532	1187

Table 5. Percentage of ORs by FY

PATS NOC	Percent totals by FY					
	1991	1992	1993	1994	1995	1996
Contamination/Release	25.8	22.2	27.4	18.6	15.2	14.2
Packaging	6.7	10.4	7.4	10.9	14.7	9.4
Storage Incident to Transport	1.7	1.4	4.6	0.0	0.0	3.3
Improper Hazardous Material Characterization	3.3	4.2	2.1	4.4	8.1	13.8
Shipment Preparation	15.8	22.2	22.8	20.8	22.9	22.8
Vehicle or Driver Safety	25.8	18.1	20.7	18.6	25.2	27.6
Reserved	0.0	0.0	0.0	0.0	0.0	0.0
Occurrences Created by Others	20.8	21.5	15.1	26.8	13.8	8.9
Total ORs	120	144	285	183	210	246

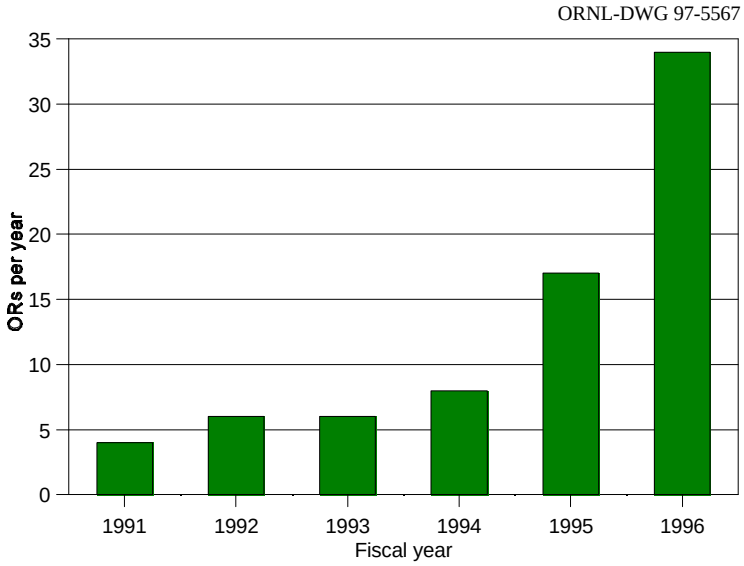


Fig. 6. Category 4 NOC by FY.

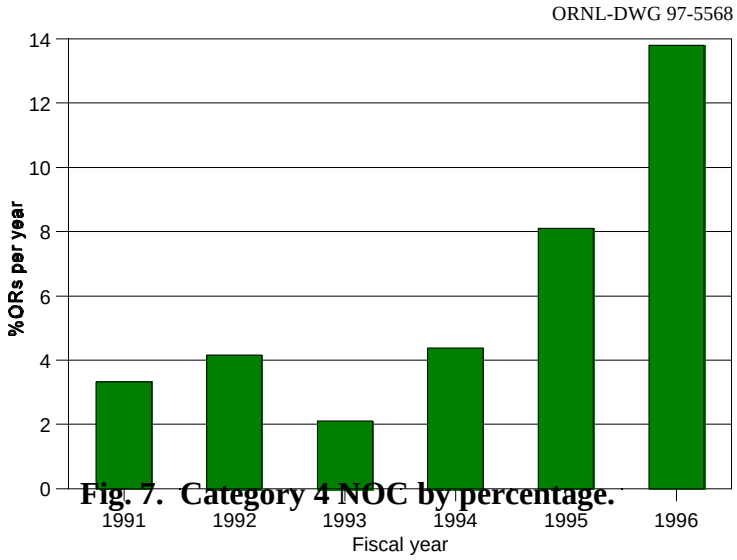


Fig. 7. Category 4 NOC by percentage.

Looking at the assigned root causes of incidents of mischaracterization reveals that 14 were attributable to management problems and another 14 were designated personnel error. (The other two events which were not assigned a root cause involved improper waste characterization and mislabelling of a packaging.) Over 50% of the 14 events related to personnel error were caused by inattention to detail. Inadequate controls and policy either not being defined or disseminated contributed to over 70% of those classified as management problems. Training deficiencies were designated the root cause of only two. The fact that 44% of the errors causing the improper hazardous material characterization are personnel errors compares consistently with other data that shows personnel error is present in over 38% of the overall incidents reported. (See Table 16.)

Because it is unlikely that downsizing affected the packaging and transportation organizations to the extent that their effectiveness was reduced (though it is hard to estimate the intangible effect of poor morale and a subsequent loss in effectiveness), one can only speculate that the real cause of the increase seen in the number of occurrences related to improper hazardous material characterization is either inattention to detail and careless work or better QA and occurrence reporting practices. This area should be carefully observed to determine the strength of this trend.

Tables 6–11 detail the occurrences by NOC for each category by quarters of each respective FY. Table 12 shows the number of ORs reported by contractors to their respective Program Offices during FY 1996. Table 13 shows this same number of ORs reported by the contractors to their respective Operations Offices during FY 1996. Figures 8 and 9 are graphical representations of these data. Consistent with previous years reporting, EM was the Program Office to which the most occurrences were reported, and the second largest receiver of ORs was Office of Defense Programs (DP). Unlike previous years, however, instead of being relatively close to the number of ORs reported by DP, EM programs received almost twice the amount reported than DP. In fact, EM programs account for almost half of the total ORs reported this period (46%). This finding is probably indicative of more transportation operations (including packagings) being performed for environmental restoration and fewer transportation functions being made for defense operations (possibly because of DOE operations on behalf of Defense programs being significantly decreased). Table 3 lends some support to this supposition, showing that onsite events (inclusive of cleanup operations and repackaging) had an effective 20% increase over the reporting of the last FY.

Consistent with the previous year's total of ~50 ORs, the Operations Office under DP which received the most ORs from its contractors was the Albuquerque Operations Office (ALO), which accounted for 45 of the 62 total ORs reported to DP. EM received most of its ORs from Richland Operations (RLO) with 29. Surprisingly, though, this total was almost matched by the the Savannah River Operations (SRO) which reported 26 (only 16 were reported to EM by SRO last year).

Table 6. Number of ORs during FY 1991, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	7	4	1	0	4	13	7	36
Second	13	2	0	1	5	8	9	38
Third	4	1	1	2	5	6	5	24
Fourth	7	1	0	1	5	4	4	22
NOC totals	31	8	2	4	19	31	25	120

Table 7. Number of ORs during FY 1992, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	9	4	0	1	8	6	7	35
Second	13	2	1	1	9	4	6	36
Third	9	6	1	2	10	7	7	42
Fourth	1	3	0	2	5	9	11	31
NOC totals	32	15	2	6	32	26	31	144

Table 8. Number of ORs during FY 1993, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	19	5	3	1	10	14	3	55
Second	20	5	8	3	20	12	14	82
Third	20	4	2	2	16	22	13	79
Fourth	19	7	0	0	19	11	13	69
NOC totals	78	21	13	6	65	59	43	285

Table 9. Number of ORs during FY 1994, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	6	3	0	0	7	7	18	41
Second	9	6	0	2	10	9	8	44
Third	7	7	0	1	12	5	12	44
Fourth	12	4	0	5	9	13	11	54
NOC totals	34	20	0	8	38	34	49	183

Table 10. Number of ORs during FY 1995, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	9	7	0	5	17	15	8	61
Second	5	8	0	3	10	14	7	47
Third	6	6	0	5	11	8	5	41
Fourth	12	10	0	4	10	16	9	61
NOC totals	32	31	0	17	48	53	29	210

Table 11. Number of ORs during FY 1996, as classified by NOC

	NOC category							
Quarter	1	2	3	4	5	6	8	Total
First	7	2	0	4	9	17	4	43
Second	6	9	0	10	9	13	6	53
Third	13	6	3	14	23	16	4	79
Fourth	9	6	5	6	15	22	8	71
NOC totals	35	23	8	34	56	68	22	246

Table 12. OR distribution by DOE Program Office for FY 1996

Code	Program Office	No. of ORs	
		Owner	Others
DP	Defense Programs	56	6
EM	Environmental Management	104	9
ER	Energy Research	21	6
FE	Fossil Energy	31	1
NE	Nuclear Energy	11	0
RW	Radioactive Waste Management	1	0
	Subtotal	224	22
	Grand total		246

Table 13. OR distribution by DOE Operations Office for FY 1996

Code	Operations Office	No. of ORs	
		Owner	Others
ALO	Albuquerque Operations	52	2
CH	Chicago Operations	8	2
HQ	DOE-HQ	32	1
ID	Idaho Operations	10	0
NVO	Nevada Operations	6	2
OH	Ohio	9	1
ORO	Oak Ridge Operations	22	2
RFO	Rocky Flats Operations	12	0
RL	Richland Operations	34	3
SAN	San Francisco Operations Office	11	4
SR	Savannah River Operations	22	5
USEC	United States Enrichment Corporation	6	0
	Subtotal	224	22
	Grand total		246

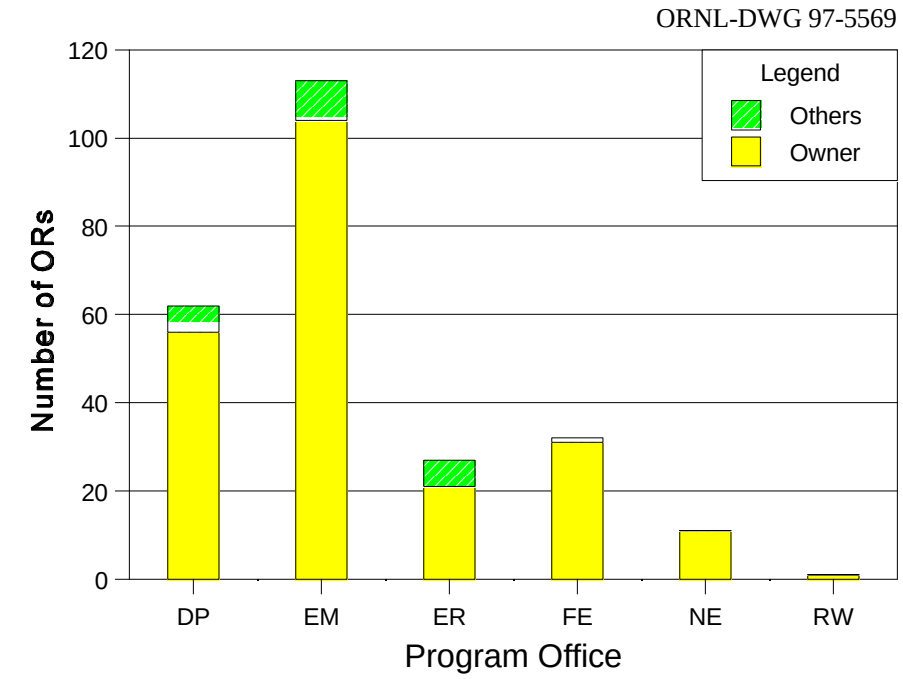


Fig. 8. OR distribution by DOE Program Office.

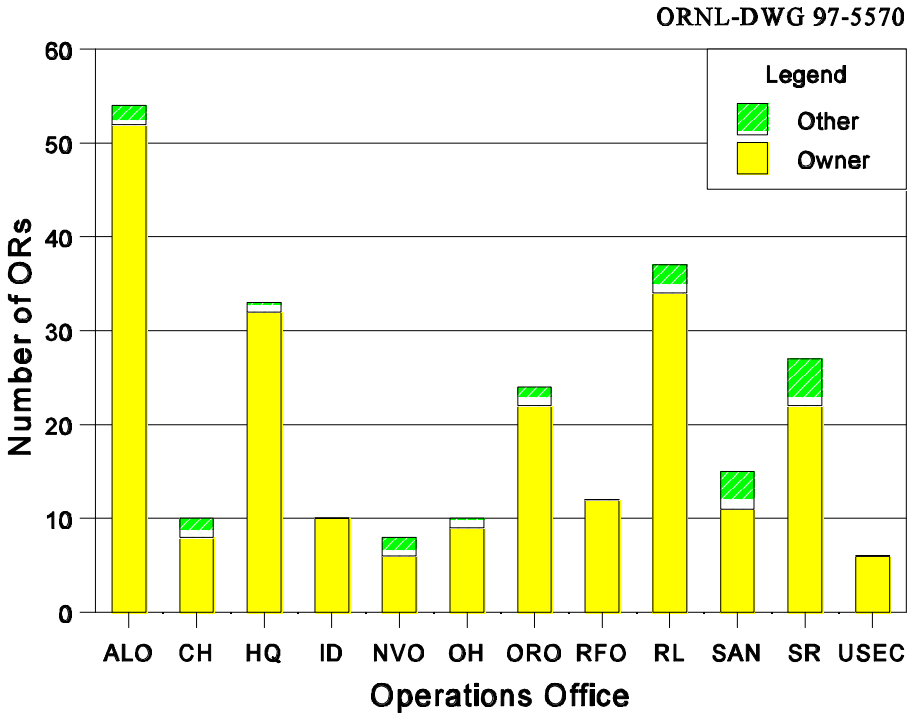


Fig. 9. OR distribution by DOE Operations Office.

4. ROOT-CAUSE ANALYSIS

Root cause is defined by DOE's *Root Cause Analysis Guidance Document* as

> ". . . the fundamental cause that, if corrected, will prevent recurrence of this or similar events. The root cause does not apply to this occurrence only, but has generic implications to a broad group of possible occurrences, and it is the most fundamental aspect of the cause that can logically be identified and corrected."

The root cause seeks to determine the "why" of an occurrence. Root cause is assigned by the facility and reported to ORPS; in this report this process is called "ORPS-assigned" root cause to distinguish it from PATS-assigned NOC coding. Table 14 presents the ORPS root-cause codes from DOE Manual 232.1-1.

ORs were examined for the determination by the facility of the root cause. No changes or interpretations were made to the ORPS-assigned root cause. Root-cause assignment for ORs of FY 1996 in the PATS_OR database is given in Table 15. Because root-cause codes are generally assigned only to final reports, the reports listed in the table are final ORs. Table 16 gives a matrix of the PATS NOC codes and the ORPS root-cause codes for ORs selected during FY 1996. [Note that because the previous total number of ORs in the database includes ten-day reports as well as finals, totals in earlier tables (such as Table 9) are more than for the reports in Tables 15 and 16, whose totals are limited to the finalized ORs.]

Table 16 shows that facilities have assigned personnel error and management problems, respectively, as the most frequent root cause. This finding is consistent with findings from past years. Table 16 shows the PATS NOC codes cross-referenced with the ORPS-assigned root causes. This very useful table gives the analyst a lead as to the relationship between the “what” and the “why.” Hence, more information is available on which to (1) assess the effectiveness of the root-cause assignment, (2) judge the appropriateness of corrective actions, and (3) possibly use this additional information to prevent recurrence. Considering the shaded cells of Table 16, it is revealed that personnel error was the root cause of 50% of the events involving improper hazardous material characterization, 39% of the shipment preparation incidents, and 53% of the modal safety incidents (down from last FY’s high of 66%). Of those ORs caused by management problems, 35% involved improper hazardous material characterization, 32% involved shipment preparation, and 23% involved modal safety issues. New this year is the Category 8 root-cause designation; and, interestingly, all problems associated with this root cause involved some contamination spread or release.

Of concern are the number of recurrent events that were previously publicized in LL bulletins. For example:

1. In April, PATS released a bulletin on properly disposing of hazardous waste (PATS LL:3720-96-02, *Respecting Your Waste*). Many incidents that are pertinent to that bulletin have occurred this year (ALO-AO-MHSM-PANTEX-1996-0109, ID--LITC-CFA-1996-0002, NVOO-BNOO-NLVO-1996-0002, OH-MB-EGGM-EGG-MAT04-1996-0005, etc.), some of which occurred after its issuance. Such was the case with an improperly classified and labeled package (SAN-LLNL-LLNL-1996-0028); improperly labeled shipment (ALO--GEO-GJO-1996-0005,); another improperly manifested shipment occurred during July (SAN-LLNL-LLNL-1996-0030); improper characterization and burial (ID--LITC-LANDFILL-1996-0001); and two improperly classified and manifested hazardous waste containers were shipped offsite for treatment and disposal (SAN-LLNL-LLNL-1996-0042).

2. In early 1995, PATS disseminated a bulletin concerning a carrier removing a trailer from Fernald without obtaining the proper shipping papers (PATS LL:3720-95-01, *Traffic Must Have Control Over Incoming and Outgoing Shipments*). Having a central point of contact for the status of trailers and having a release point to verify that all shipments are properly prepared before they are allowed on public roads were some of the suggestions offered to avoid repeat of this occurrence. On October 8, 1996, a gas vendor removed cylinders from a Fernald Environmental Restoration Management Corp. (FERM) facility without the required shipping papers (ORO-LMES-FEMP-1996-0056).

Moreover, the Nuclear and Facility Safety Operating Experience Weekly Summary (OEWS) has published many detailed lessons learned throughout the year, one of which concerned lids having been blown off over-pressurized drums. This event continues to occur even though the OEWS offered excellent advice on how to prevent this occurrence when removing the lid of a suspect, pressurized drum. The recurrence of events which have been addressed in LL publications points up the fact that the lessons are not being consistently applied by sites.

As in previous years, the major root cause for both onsite and offsite occurrences continues to be personnel error (Code 3) and management problems (Code 6). It is suggested that these areas be targeted by contractors' QA programs, assuring that procedures are on hand, training implemented and followed and LL disseminated at the operational level. Moreover, it is suggested that sites' LL programs increase their vigilance to assure that issued LL on operations and practices pertinent to their site are reviewed and assimilated, preventing recurrence.

Table 14. ORPS root-cause codes (DOE Manual 232.1-1, Sect. 9.2)

1. Equipment/material problem
   - 1A. Defective or failed part
   - 1B. Defective or failed material
   - 1C. Defective weld, braze, or soldered joint
   - 1D. Error by manufacturer in shipping or marking
   - 1E. Electrical or instrument noise
   - 1F. Contaminant
   - 1G. End-of-life failure
2. Procedure problem
   - 2A. Defective or inadequate procedure
   - 2B. Lack of procedure
3. Personnel error
   - 3A. Inattention to detail
   - 3B. Procedure not used or used incorrectly
   - 3C. Communication problem
   - 3D. Other human error
4. Design problem
   - 4A. Inadequate work environment
   - 4B. Inadequate or defective design
   - 4C. Error in equipment or material selection
   - 4D. Drawing, specification, or data errors
5. Training deficiency
   - 5A. No training provided
   - 5B. Insufficient practice or hands-on experience
   - 5C. Inadequate content
   - 5D. Insufficient refresher training
   - 5E. Inadequate presentation or materials
6. Management problem
   - 6A. Inadequate administrative control
   - 6B. Work organization/planning deficiency
   - 6C. Inadequate supervision
   - 6D. Improper resource allocation
   - 6E. Policy not adequately defined, disseminated, or enforced
   - 6F. Other management problem
7. External phenomenon
   - 7A. Weather or ambient condition
   - 7B. Power failure or transient
   - 7C. External fire or explosion
   - 7D. Theft, tampering, sabotage, or vandalism
8. Radiological/Hazardous Material Problem
   - 8A. Legacy Contamination
   - 8B. Source Unknown
9. Other

Table 15. FY 1996 ORs in database classified according to root cause

No.	ORPS root-cause code	Onsite	Offsite	Total
1	Equipment/Material Problem	6	3	9
2	Procedure Problem	8	4	12
3	Personnel Error	30	19	49
4	Design Problem	4	0	4
5	Training Deficiency	3	3	6
6	Management Problem	23	17	40
7	External Phenomenon	0	0	0
8	Radiological/Hazmat Problem	7	1	8

Table 16. FY 1996 PATS NOC codes and ORPS root-cause codes

	PATS NOC code								
	1	2	3	4	5	6	7	8	
Root cause									Total
1	2	0	0	0	2	3	0	2	9
2	0	2	0	1	4	4	0	1	12
3	4	3	1	10	11	16	0	4	49
4	3	0	1	0	0	0	0	0	4
5	1	0	0	2	2	0	0	1	6
6	5	5	0	7	9	7	0	7	40
7	0	0	0	0	0	0	0	0	0
8	8	0	0	0	0	0	0	0	8
Total	23	10	2	20	28	30	0	15	128

Notes: ORPS Root-Cause Codes
1. Equipment/Material Problem
2. Procedure Problem
3. Personnel Error
4. Design Problem
5. Training Deficiency
6. Management Problem
7. External Phenomenon
8. Radiological/Hazmat Problem

PATS NOC Codes
1. Contamination/Release
2. Packaging
3. Storage Incident to Transport
4. Improper Hazardous Material Characterization
5. Shipment Preparation
6. Modal Safety
7. Reserved
8. Occurrences Created by Others

5. EVALUATION OF THE EFFECTIVENESS OF CORRECTIVE ACTIONS

To determine the appropriateness of reported corrective actions to remedy an occurrence and prevent recurrence, all corrective action of occurrences categorized in the ORPS as unusual or emergency were reviewed. It should be emphasized that one needs to do more than review a site's suggested corrective actions to determine whether an action is suitable to close out an OR and prevent recurrence. More details surrounding the closeout, an understanding of site procedure, and the occurrence history need to be known. Therefore, the evaluations made on the effectiveness of closeout should be considered as technical judgments based on a limited presentation of facts and information contained in the OR itself.

5.1 EVALUATION CRITERIA

The effectiveness of proposed corrective actions are evaluated using the following evaluation criteria:

1. *Satisfactory*. The implementation of the corrective actions should correct the deficiency and significantly reduce the likelihood of recurrence;

2. *Conditional*. The implementation of the corrective actions should correct the deficiency but may not significantly reduce the likelihood of recurrence; or the actions may be sufficient, but more details and assurances are needed to positively make the determination; and

3. *Unknown*. The corrective actions do not appear to adequately resolve the deficiency and/or address recurrence; or more information is needed on the details of the corrective actions and their implementation plan.

The selection of a criterion is the technical judgment of the evaluator. Stating that effects of corrective actions are "unknown" does not imply that the contractor has failed to propose adequate steps to address the inadequacy; rather, it says that the contractor has not presented enough information or details to evaluate the incident based on the limited input of the OR. It is ultimately up to the contractor's Operation Office to make the determination of adequacy.

5.2 EFFECTIVENESS OF CORRECTIVE ACTION FOR ORs CATEGORIZED AS EMERGENCY OR UNUSUAL

In the following table, the report number is followed by a very brief description of the incident and an evaluation of the proposed corrective actions based on the criteria described in Sect. 5.1. A more detailed description of the OR and its associated corrective actions can be found in Appendix A.

Of the 20 reports selected to be examined, 11 were judged satisfactory, 7 were considered to be unknown, and 2 were judged to have been conditionally satisfied based on the detail presented in the proposed corrective actions. The effectiveness of the corrective actions of three of the events considered unknown are ORs originating from the Bechtel Petroleum Operations, Inc. (BPOI) Naval Petroleum Reserve (NPR). Until the corrosion problem of the oil pipelines is addressed by a replacement or periodic examination program, it is unlikely that the NPR's actions to "correct" spills will prevent recurrence. Hence, BPOI's corrective actions for such events will never truly be satisfactory. Actions were taken to correct the manifest deficiency in all the unknown cases; however, no actions were proposed or implemented to prevent recurrence. It must be noted, though, that only 7 of the 20 reports have been finalized; consequently, complete action plans have not been developed for the less-than-satisfactory cases.

Table 17. Evaluation of effectiveness of corrective action for ORs categorized as unusual during FY 1996

Report No.	Description	Effectiveness
ALO--ROSS-TSS-1995-0003	Because of a static oil leak, a LearJet had to return to the airport of departure.	Satisfactory
ALO-KC-AS-KCP-1995-0006	An open-ended, 55-gal drum of F001 (halogenated solvent) waste soil slipped from a lift during emptying for shipment.	Satisfactory
CH--AMES-AMES-1996-0001	Three personnel and a private employee suffered exposure to fumes from a gas cylinder which contained aqueous KOH.	Conditional
HQ--BPOI-NPRC-1995-0035	Corrosion caused an 8-in. shipping pipeline to leak and spill 64.4 bbl of crude oil.	Unknown
HQ--BPOI-NPRC-1995-0036	Corrosion caused an 8-in. shipping pipeline to leak and spill 161 bbl of crude oil.	Unknown
HQ--BPOI-NPRC-1996-0023	Corrosion caused a 10-in. gravity line to leak ~850 bbl of crude oil.	Unknown
HQ--BPOI-NPRC-1996-0034	A power failure caused a drain tank to overflow and spill 140 bbl of crude oil.	Unknown
ID--LITC-LANDLORD-1996-0004	An intraplant storage and transfer drum was found to be missing an inner metal container.	Satisfactory
OH-MB-EGGM-EGGMAT04-1996-0003	Low-level radionuclide scintillation fluids had been disposed of at an unauthorized hazardous waste incineration facility.	Satisfactory
ORO--ORNL-X10FINMAT-1996-0001	A radioactive container (containing six ^{252}Cf sources) from a non-DOE shipper had excessive surface radiation readings.	Unknown
RL--WHC-KBASINS-1996-0013	An investigation revealed that Operations' personnel were not consistently verifying the status of railroad switch derailleurs.	Satisfactory
SAN--LBL-EHS-1996-0001	Three shipments made in 1989, 1990, and 1995 for disposal as low-level waste (LLW) should have been treated as mixed waste.	Unknown
SR--WSRC-HWFAC-1996-0008	Low-level tritium waste, which contained resin and filters from the Heavy Water Facility, was improperly characterized.	Satisfactory
SR--WSRC-SLDHZD-1996-0013	Cadmium-coated high-efficiency particulatre air (HEPA) filter housings were found to have been improperly disposed of at the Savannah River landfill.	Conditional
SR--WSRC-WVIT-1996-0003	About 135 gal of fuel oil were spilled by a vendor during filtering oil from a storage tank.	Unknown
USEC--MMUS-PADGENPLT-1996-0014	A shipping container on a truck transporting LLW was found to be leaking an oily substance.	Satisfactory
USEC--MMUS-PADGENPLT-1996-0019	The internal volume of a drum liner for a 6 D-type drum exceeded the nuclear criticality safety limit of 5.5-gallon capacity.	Satisfactory
USEC--MMUS-PADGENPLT-1996-0028	An operation safety requirement was violated when the fissile material storage container tag was incompletely filled out.	Satisfactory
USEC--MMUS-PTSGENPLT-1996-0035	An arrival survey conducted by Paducah Health Physics (HP) personnel of a subcontractor's equipment trailer identified radioactive contamination.	Satisfactory
USEC--MMUS-PTSGENPLT-1996-0065	A procedural violation occurred when three empty cylinders were improperly moved with a cylinder stacker to a station for filling.	Satisfactory

6. CONCLUSIONS

The PATS Program selectively identifies ORs for their respective transportation or packaging impacts. During FY 1996, of the 3,943 total occurrences listed on the ORPS, 246 were identified as having packaging or transportation impact. Although a small percentage of the total occurrences, 6.4%, the percentages of the previous years for FY 1992 – FY 1995 for packaging- and transportation-related occurrence were even smaller: 2.5, 3.4, 3.1, and 3.2, respectively. There is not an increase in the number of packaging- and transportation-related occurrences, and the number of such ORs have remained relatively constant over the years. The larger percentage for FY 1996 results from fewer occurrences being reported overall (which reflects the DOE Order 5000.3B being revised to DOE Order 232.1 and the more generous rollup provisions).

To provide background data to enable program managers to reduce the number of occurrences further, this review has examined the major shippers and their occurrence rates, the specific nature of the occurrence in transportation terms, the root causes and their relationship to the nature of the occurrence, the corrective actions, and the lessons learned. Through this examination and evaluation, the major causes of problems and the corrective actions to prevent recurrence are being identified. These "safety concerns" and "solutions" are reported to the packaging and transportation community through LL bulletins and this *Annual Report*.

As a baseline for evaluation of the number of occurrences, the only data available are found in DOE SMAC system, which contains records on the total number of shipments performed by DOE contractors. Data for hazardous materials shipments conducted offsite may be selected. No similar data are available for onsite transfers. From the SMAC data, the major shippers of hazardous materials were determined, and the numbers of occurrences reported by the major shippers are tabulated by the onsite, offsite, or "others" occurrences. The SMAC data identified 17 contractor shippers who each had greater than 300 hazardous material shipments in FY 1996. The number of offsite occurrences per major shipper are consistently low. Y-12 and ORNL (the two shippers which SMAC identified as having the most offsite shipments this FY) had two offsite occurrences each, while the other major shippers ranged from zero to six offsite occurrences attributed solely to their operations. The historical data from 1991 to 1995 indicate similarly low occurrences by the major shippers.

Those shippers with the greatest total number of shipments are also the more experienced and may avoid occurrences because of this expertise. Also, some shippers tend to have repetitive types of material being shipped. Others, such as ORNL, have a great variety of hazardous materials and, consequently, require considerable training and expertise to package and ship this array of material correctly.

For more effective evaluation of the problems related to the transportation and packaging operations of DOE contractors, as reported on the ORPS incident reports, the PATS Program developed a coding system for the identification of the transportation-oriented nature of

occurrence. Through this coding system, it was determined that vehicle and driver safety accounted for 30% of the total occurrences not caused by other non-DOE operations. This was also the grouping that most onsite events fell within, totaling 50 of the 155 onsite occurrences not attributable to others. Similar to last FY almost a third (22 of 70) of the offsite occurrences not caused by others were related to shipping preparation. The shipping preparation NOC includes regulatory noncompliances of shipping papers, marking, labeling, placarding, loading, and tie-downs. It was noted that Pantex's onsite occurrences (60% of which related to shipping preparation) showed an increase because of a new report being implemented which resulted in the reclassification of many items as explosive material.

The NOC which showed the most increase this year was improper hazardous material characterization, up from a low of 2.1% in FY 1993 to 13.8% (34 of 246 ORs). Various reasons were postulated for this increase. Since it was uncertain that the minor revisions which occurred when DOE Order 5000.3B was upgraded to DOE Order 232.1 was a factor, it was concluded that this increase was due to either inattention to detail and careless work or better QA and occurrence reporting practices.

DOE Order 232.1 requires that the occurrence-reporting facility assign a root cause to the occurrence as part of the finalization and closure of the reporting process. Analyses of these data provide more insights into the problems associated with transportation occurrences. As in previous years, during FY 1996, the major root causes for onsite or offsite occurrences are personnel error and management problems, which outweigh all other causes of occurrences. Personnel error is the root cause assigned to 38% (49 of 128) of the finalized ORs overall. Further, personnel error was the root cause of 50% of the events involving improper hazardous material characterization, 39% of the shipment preparation incidents, and 53% of the modal safety incidents (down from last FY's high of 66%).

The effectiveness of the corrective actions proposed to address occurrences were examined for the 20 ORs classified as unusual. Based upon the criteria developed for evaluating the acceptability of the proposed actions, 11 of the 20 reports were seen as having been satisfactorily addressed. The evaluation was based primarily on information obtainable directly from ORPS. Updates to some of the occurrences designated "conditional" or "unknown" may have been posted to the ORPS after this evaluation was completed, which could raise the total percentage of satisfactory closures. Because this *Annual Report* is being published a month earlier than during previous years, more of the ORs remain unfinalized; consequently, corrective action plans have not been fully developed for some of the reports. In fact, only 7 of the 20 reports have been finalized, and only one of these (which are not attributable to other non-DOE entities) was not evaluated as satisfactory, being designated conditional.

Reviewing the summaries of corrective actions provides a glimpse of the LL process and could lead transportation professionals to recognize potential problems and how they may apply preventive measures (such as routinely upgrading aging pipelines rather than waiting for corrosion failure to signal the need for a replacement).

The purpose of the PATS program is to provide technical assistance and support to the DOE hazardous materials packaging and transportation programs. In fulfillment of that mission, PATS provides the DOE community and associated users with a compendium of information pertinent to packaging and transportation concerns through an electronic bulletin board on the World Wide Web and LL bulletins based upon ORPS data and other sources. The PATS program developed four LL bulletins during this FY: (1) PATS LL:3720-96-01, *Emergency? Whom are you going to call?*; (2), PATS LL:3720-96-02, *Respecting your waste*; (3) PATS LL:3720-96-01, *DOT Compliance review*; and (4) PATS LL:3720-96-04, *DOT revises retraining regulations*. These bulletins were distributed to the DOE community and have been posted to the PATS bulletin board on the World Wide Web (http://www.ornl.gov/pats/pats.htm).

Because of continued cutbacks and partial funding, this program continues to operate under the cloud of budget restriction. However, the fact that DOE HQ is willing to partially fund this program attests to its usefulness and value to the DOE community. A semiannual report was published last year and is expected to be produced in the future.

Appendix A

EVALUATION OF THE EFFECTIVENESS OF CORRECTIVE ACTIONS FOR UNUSUAL OCCURRENCES

ALO--ROSS-TSS-1995-0003

Shortly after departing Albuquerque, New Mexico, an emergency was declared aboard a LearJet Model 35, resulting in the plane returning to the airport. It was later determined that a static oil leak in the right engine had allowed oil to collect. The oil burned after take-off and produced smoke in the cabin.

Corrective Actions: The aircraft has been returned to the contractor for reinstallation of the original engine. The oil leakage appears to be a result of inadequate oil scavenging in a seal cavity. The engine manufacturer (Garrett) issued a *Service Bulletin* for the modification of the TFE 331 engine's oil-scavenging capabilities. With the issuance of this *Service Bulletin* and modification in the engine, the scavenge pump will increase scavenging of the oil and preclude this from recurring. Moreover, use of "third generation oils," which are blended to provide higher thermal resistance to coke formation, should also help prevent a recurrence of this event.

Evaluation of Proposed Action: Satisfactory

ALO-KC-AS-KCP-1995-0006

An open-ended 55-gal drum of F001 waste (halogenated solvent) soil was dropped onto a concrete pad, releasing approximately 650 lb of waste soil contaminated with 22 parts per million (ppm) of trichloroethylene onto a concrete pad. The drum slipped from a lift as it was being raised to empty the soil contents of the drum into a gondola for shipment to a certified offsite disposal facility. It was later determined that worn pads on the hydraulic barrel lift caused the barrel to slip.

Corrective Actions: AlliedSignal Chemical material handlers immediately cleaned up the F001 waste soil and loaded it into the gondola. The area was decontaminated and resulted in no offsite release. Proper notification was made to the appropriate regulatory agencies. The two existing sets of barrel pads for the hydraulic lift were repaired. The AlliedSignal chemical material handlers were trained to become more aware of the condition of the barrel lift pads.

Evaluation of Proposed Action: Satisfactory

CH--AMES-AMES-1996-0001

Three employees and a Department of Public Safety employee suffered exposure to fumes from a leak from around the regulator area of a gas cylinder containing hydrogen sulfide gas. The first employee to be exposed was trying to shut off the leak; the others became exposed when they were trying to assist the previously exposed persons. The direct cause of the exposure to the employees of toxic gas fumes was the use of a defective, pressure regulator of unknown history in the experimental setup (which allowed fumes to escape). A contributing cause was an inadequate preoperational safety review of this experiment.

Corrective Actions: A readiness review was completed for the experiment in question before work was allowed to start again. The formal accident investigation has identified the following "Judgement of Needs": (1) a need exists to provide adequate formal guidance to users of gas pressure regulators regarding use, maintenance and testing procedures, and (2) a need to assure that appropriate and adequate preoperational reviews of hazardous work processes are conducted by supervisors before the work begins.

Evaluation of Proposed Action: Conditional (Actions proposed will be sufficient if the identified needs result in establishment of procedures.)

HQ--BPOI-NPRC-1995-0035

Corrosion caused an 8-in. shipping line to leak and spill 64.4 barrels of crude oil.

Corrective Actions: The leak was clamped and cleanup operations commenced. Approximately 46 barrels of crude oil were recovered. Plans were made to replace the leaking section of pipe.

Evaluation of Proposed Action: Unknown (It is likely that similar occurrences will continue to happen because the root issue of corrosion has not been addressed. Pipelines need to be periodically replaced before corrosion degradation causes their unfitness.)

HQ--BPOI-NPRC-1995-0036

Corrosion caused an 8-in. gravity line to leak and spill 161 barrels of crude oil.

Corrective Actions: The leak was stopped and cleanup operations commenced. Approximately 152 barrels of oil were recovered.

Evaluation of Proposed Action: Unknown (It is likely that similar occurrences will continue to happen because the root issue of corrosion has not been addressed.)

HQ--BPOI-NPRC-1996-0023

A shutdown of electrical power to a drain tank allowed about 140 barrels of crude oil to spill. The power failure was caused by the transformer breaker tripping when wildlife came into contact with the tank’s overhead power lines.

Corrective Actions: The transformer breaker was reset, and about 131 barrels of crude oil were recovered.

Evaluation of Proposed Action: Unknown.

HQ--BPOI-NPRC-1996-0034

Corrosion caused a 10-in. gravity line to leak and spill 850 barrels of crude oil.

Corrective Actions: The leak was stopped by installing an external line clamp, and cleanup operations resulted in about 810 barrels of oil being recovered.

Evaluation of Proposed Action: Unknown (It is likely that similar occurrences will continue to happen because the root cause of the corrosion has not been addressed.)

ID--LITC-LANDLORD-1996-0004

During fuel inventory activities it was discovered that there was a discrepancy between the inventory paper work and the fuel identification numbers in an intraplant storage drum. It was also discovered that the same drum was missing the metal inner container. Two technical standard violations necessitate that these discoveries be treated as a safety limit violation.

Corrective Actions: Fuel inventory activities were stopped to determine if safety consequence and appropriate notifications were made to management. After completing the safety evaluation, the inventory on the drum was completed, and the affected drum was isolated and given approved interim storage status. No corrective action is associated with receiving material because procedures are currently in place which require incoming radioactive material shipments to be inspected upon receipt. In addition, the drum contents have been repackaged so that they meet technical requirements.

Evaluation of Proposed Action: Satisfactory

OH-MB-EGGM-EGGMAT04-1996-0003

An assessment of the Counting Laboratory's activities revealed that low-level-radionuclide scintillation fluids had been disposed of at a hazardous waste incineration facility which was not authorized to handle radioactive material . Further investigations revealed that from April 1991 through September 1995, 199 drums of liquid scintillation fluids had been disposed of and incinerated as nonhazardous, nonradioactive wastes. This waste was known to contain no hazardous constituents and was believed to contain levels of radioactivity that were below applicable regulatory thresholds. However, during an ongoing self-assessment of the environmental and waste management practices, it was determined that the radioactivity in the liquid scintillation fluids may not have qualified for disposal as nonradioactive wastes.

Corrective Actions: Pertinent procedures will be updated and modified. All collection of such wastes by waste management personnel has been suspended. All plant personnel participated in a operational review to identify all waste, radiological and nonradiological, generated by their organizations. Further, any liquid scintillation vials generated by laboratories during ongoing

operations will be segregated based on the levels of tritium and alpha emitters present. As an interim measure, any vial with detectable concentrations of radionuclides other than tritium will be managed as low-level waste (LLW). In addition, a root cause analysis is being performed to identify areas of concern not previously identified. Mound plant personnel will work with all affected vendors to ensure that they have adequate technical support and up-to-date information.

Evaluation of Proposed Action: Satisfactory

ORO--ORNL-X10FINMAT-1996-0001

ORNL received a radioactive container (box) from a non-DOE shipper which contained six ^{252}Cf sources totaling 3,000 microcuries. The container's surface radiation reading was 278 mrem/h. The DOT limit is 200 mrem/h.

Corrective Actions: The occurrence was determined to be an error by the shipper; the manufacturer estimated the radiation level rather than performing the proper calculations or measuring the surface radiation. Corrective actions will be the responsibility of the shipper. ORNL performed the following actions: (1) verified the accuracy of the ORNL HP instrument, (2) contacted the shipper and informed that company of the results, and (3) placed the container in a shielded cabinet to reduce personnel exposure.

Evaluation of Proposed Action: Unknown (Errors committed by others are not directly controllable.)

RL--WHC-KBASINS-1996-0013

During the surveillance of a procedure pertaining to inspecting the position of a railroad switch, it was determined that the derailleur could not be verified as being in the locked position without entering a contamination area and, further, that operations personnel were not consistently entering the contamination area to verify the status of the locks.

Corrective Actions: Walkdowns and observation will be performed of pertinent procedures. Meetings will be conducted with all shift operations employees detailing expectations for procedure compliance and specifically verification of locks. Lock-verification training will be included in the Systems/Routines module and on-the-job training. Meetings will be conducted with employees as a refresher on procedure compliance and verification requirements. The four locks of the derailleurs will be painted with high-visibility paint.

Evaluation of Proposed Action: Satisfactory

SAN--LBL-EHS-1996-0001

After evaluation of waste processes, it became apparent that mixed waste was being captured in processes focused on capturing and preventing the release of tritium. This waste had been shipped to another DOE site and disposed of as LLW.

Corrective Actions: Waste in inventory was properly characterized and moved to ensure compliance management. No other action to date.

Evaluation of Proposed Action: Unknown (Procedures should be established to ensure that waste is properly characterized before transport and disposal.)

SR--WSRC-HWFAC-1996-0008

Low-level tritium waste, which contained resin and filters from the Heavy Water Facility, was improperly characterized. The curie count had been estimated rather than measured. Consequently, a self-assessment was performed on the waste certification program which revealed several other serious deficiencies in the program.

Corrective Actions: It was recommended to (1) revise the *Waste Characterization Plan* to include requirements for development of new or revised characterization methodologies; 2) conduct and document sensitivity analysis for existing waste streams; (3) identify all routine waste generation in facilities and establish segregation needs for each waste streams; (4) revise the Waste Generator Training Program to clarify the role of the *Waste Certification Plan, Waste Characterization Plan,* and the Waste Stream Characterization Form; (5) transfer responsibility for control of waste containers to Reactor Waste Management until retraining occurs; (6) establish a program to sample waste containers to ensure compliance with segregation requirements; and (7) revise procedures to reflect locking details.

Evaluation of Proposed Action: Satisfactory

SR--WSRC-SLDHZD-1996-0013

The Solid Waste Disposal Facility was notified by offsite waste generators that cadmium-coated high-efficiency particulate air-filter housings have been disposed of at the Savannah River Site (SRS).

Corrective Actions: Notifications were made, and all naval reactor waste shipments have been suspended until this issue is resolved. Naval reactor facilities are not under the control of the SRS; therefore, a formal root cause was not performed.

Evaluation of Proposed Action: Conditional (SRS cannot be held responsible for deficient practices of others.)

SR--WSRC-WVIT-1996-0003

Approximately 135 gal of fuel oil spilled to the ground while a vendor was in the process of filtering a fuel oil storage tank.

Corrective Actions: Fuel oil which had not migrated into the soil was pumped to a 55 gal container. The area was secured while the event was evaluated and a path-forward remediation plan was developed.

Evaluation of Proposed Action: Unknown

USEC--MMUS-PADGENPLT-1996-0014

The Paducah Gaseous Diffusion Plant's plant shift superintendent's office was notified by the driver of a truck transporting LLW (paper, wood, plastic, and absorbent pads) that an oily substance was leaking from a shipping container onto the parking lot at a truck stop in Laramie, Wyoming. (According to the report, a cup of the nonradioactive material had actually leaked.)

Corrective Actions: Revise existing procedures to reflect the new changes in generator management of oily-wet absorbents and rags in generator staging areas and revise pertinent procedures to include offsite shipment certification requirements in accordance with 10 CFR Parts 20, 61, and 71 and with treatment, storage, and disposal facilities' waste acceptance criteria. Evaluate processes within production support and environmental safety and health related to packaging and handling of regulated liquids and materials with absorbed liquids which will be shipped offsite to ensure adequate controls are in place to prevent an offsite spill. Conduct a surveillance of functional organization processes related to packaging and handling of regulated liquids and materials with absorbed liquids which will be shipped offsite. Surveillance will check compliance with procedural controls to prevent offsite spills. Packaging and Transportation will review transportation procedures for improvement in the characterization information prior to packaging selection.

Evaluation of Proposed Action: Satisfactory

USEC--MMUS-PADGENPLT-1996-0019

Acting on notification of a potential discrepancy from a vendor, field measurements of a drum liner for a 5.5 gal 6D-type drum indicated an internal volume which exceeded the nuclear criticality safety limit of 5.5-gal capacity.

Corrective Actions: The 6D drums which were already in use for potentially fissile waste were posted with advisory signs. Existing stored waste was characterized and assured to meet proper exempt criteria. To assure that the 6D drums are adequately controlled, Waste Management will

issue a notice to all functional organizations to recall unused 6D drums and properly mark them with the warning not to use the container without the inner plastic jug and a designation to use "for nonfissile waste only." Procedures will be revised (1) to include the requirement of volume verification when using 6D drums and (2) to document the volume verification process. The use of the 6D drums for potentially fissile waste is planned to be phased out once a suitable container can be identified and procured.

Evaluation of Proposed Action: Satisfactory

USEC--MMUS-PADGENPLT-1996-0028

While moving one of four drums of potentially fissile waste from a temporary staging area, it was found to have an incompletely filled out fissile material storage container tag attached. The waste location, trap number, and sample number were left blank.

Corrective Actions: Ensure that all affected employees receive training with the pertinent modules. Documentation will include a listing from functional organization managers which defines the affected personnel and lists the date that training is completed. Issue a fact sheet on potentially- fissile-waste tagging for review by employees who package or handle such waste. Develop and issue a conduct-of-maintenance procedure which addresses the guidance and requirements of job performance monitoring. Conduct an end-point assessment of effectiveness of corrective actions for potentially fissile-waste tagging completion.

Evaluation of Proposed Action: Satisfactory

USEC--MMUS-PTSGENPLT-1996-0035

An arrival survey conducted by Paducah health physics personnel of a subcontractor's tool and equipment trailer identified radioactive contamination on a mechanic's creeper and three full-body safety harnesses. The trailer had been transported and stored temporarily at the subcontractor's storage lot at which the subcontractor had failed to control access to the trailer following the Portsmouth Gaseous Diffusion Plant (PORTS) exit survey.

Corrective Actions: The root cause of this event is the failure to control access to the subcontractor's trailer following the survey to release the trailer from the site. The survey of the trailer appears to have been comprehensive at the time it was conducted. However, the fact that the trailer remained in service negated the earlier (PORTS) survey. A system was lacking to either prevent the continued use of the trailer or to identify that the trailer had been opened and used following the completion of the exit survey. Consequently, PORTS health physics shall develop a method to provide assurance that containers such as trailers are not used following the exit survey. Health physics shall survey all trailers currently in the subcontractor storage lot for contaminated items.

Evaluation of Proposed Action: Satisfactory

USEC--MMUS-PTSGENPLT-1996-0065

A procedural violation occurred when three empty cylinders were improperly moved with a cylinder stacker to a station for filling.

Corrective Actions: The use of a cylinder stacker instead of an overhead crane (which was out of order) was outside the design basis of the *Final Safety Analysis Report*. Cylinder movement was suspended until the crane was repaired. A critique of the event was held, and a training program was initiated to ensure that appropriate personnel are aware of the Unreviewed Safety Question process.

Evaluation of Proposed Action: Satisfactory

Appendix B:

LIST OF OCCURRENCE REPORTS FOR FY 1996

Table B.1 ORs included in annual report for FY 1996

Report No.	Status	Category	NOC	Report date
ALO--GEO-GJO-1996-0004	F	O	6A	05/03/1996
ALO--GEO-GJO-1996-0005	F	O	4	05/14/1996
ALO--GOAL-TSS-1996-0001	U	O	6A	03/29/1996
ALO--MCTC-GJPOTAR-1996-0001	F	O	6A	09/19/1996
ALO--ROSS-TSS-1995-0003	U	U	6B	10/24/1995
ALO--UMTR-UMTRA-1995-0020	F	O	6A	11/16/1995
ALO--UMTR-UMTRA-1995-0021	F	O	6A	11/22/1995
ALO--UMTR-UMTRA-1996-0003	F	O	1B1	09/13/1996
ALO--WWID-WIPP-1996-0001	F	O	6A	01/25/1996
ALO-AO-MHSM-PANTEX-1995-0178	U	O	5	10/27/1995
ALO-AO-MHSM-PANTEX-1995-0191	F	O	8E	11/13/1995
ALO-AO-MHSM-PANTEX-1995-0210	U	O	5	12/05/1995
ALO-AO-MHSM-PANTEX-1995-0229	F	O	5D	12/26/1995
ALO-AO-MHSM-PANTEX-1996-0008	F	O	1A3	01/11/1996
ALO-AO-MHSM-PANTEX-1996-0045	F	O	5A	02/21/1996
ALO-AO-MHSM-PANTEX-1996-0059	U	O	5A	03/14/1996
ALO-AO-MHSM-PANTEX-1996-0072	U	O	5	04/01/1996
ALO-AO-MHSM-PANTEX-1996-0079	F	O	5A	04/18/1996
ALO-AO-MHSM-PANTEX-1996-0080	F	O	4	04/23/1996
ALO-AO-MHSM-PANTEX-1996-0084	U	O	5D	04/29/1996
ALO-AO-MHSM-PANTEX-1996-0086	U	O	5	05/02/1996
ALO-AO-MHSM-PANTEX-1996-0092	U	O	5	05/07/1996
ALO-AO-MHSM-PANTEX-1996-0109	F	O	4	05/22/1996
ALO-AO-MHSM-PANTEX-1996-0110	U	O	4	05/22/1996
ALO-AO-MHSM-PANTEX-1996-0128	U	O	2C	06/20/1996
ALO-AO-MHSM-PANTEX-1996-0129	U	O	3	06/20/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
ALO-AO-MHSM-PANTEX-1996-0134	U	O	5C	07/02/1996
ALO-AO-MHSM-PANTEX-1996-0153	F	O	5D	07/19/1996
ALO-AO-MHSM-PANTEX-1996-0160	U	O	5	07/29/1996
ALO-AO-MHSM-PANTEX-1996-0166	F	O	2C	08/02/1996
ALO-AO-MHSM-PANTEX-1996-0171	U	O	3	08/06/1996
ALO-AO-MHSM-PANTEX-1996-0172	U	O	3	08/06/1996
ALO-AO-MHSM-PANTEX-1996-0183	U	O	5C	08/20/1996
ALO-AO-MHSM-PANTEX-1996-0184	U	O	2C	08/22/1996
ALO-AO-MHSM-PANTEX-1996-0187	U	O	5	08/29/1996
ALO-AO-MHSM-PANTEX-1996-0188	U	O	5	09/04/1996
ALO-AO-MHSM-PANTEX-1996-0189	U	O	5	09/05/1996
ALO-KC-AS-KCP-1995-0006	F	U	1B1	11/03/1995
ALO-KO-SNL-12000-1996-0001	F	O	5C	05/03/1996
ALO-KO-SNL-6000-1996-0001	F	O	5F	02/15/1996
ALO-KO-SNL-7000-1996-0003	F	O	5F	06/19/1996
ALO-KO-SNL-7000-1996-0006	F	O	3	07/24/1996
ALO-KO-SNL-7000-1996-0009	U	O	4	08/22/1996
ALO-KO-SNL-7000-1996-0010	U	O	2B	09/12/1996
ALO-KO-SNL-CASITE-1996-0003	F	O	5F	04/25/1996
ALO-KO-SNL-CASITE-1996-0005	F	O	6A	06/13/1996
ALO-LA-LANL-MATWAREHS-1996-0001	F	O	8A	01/23/1996
ALO-LA-LANL-PHYSTECH-1996-0005	U	O	6B	06/21/1996
ALO-LA-LANL-SIGMA-1996-0002	U	O	5	06/04/1996
ALO-LA-LANL-TA55-1996-0005	F	O	4	02/06/1996
ALO-LA-LANL-TA55-1996-0046	F	O	5	08/02/1996
ALO-LA-LANL-WASTEMGT-1996-0001	U	O	4	03/11/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
CH--AMES-AMES-1996-0001	F	U	2A	03/13/1996
CH-AA-ANLE-ANLEPFS-1996-0006	F	O	1B1	06/04/1996
CH-AA-ANLW-HFEF-1996-0001	F	O	2C	02/07/1996
CH-BA-FNAL-FERMILAB-1996-0002	F	O	8A	06/19/1996
CH-BA-FNAL-FERMILAB-1996-0003	F	O	5D	07/03/1996
CH-BH-BNL-BNL-1996-0003	F	O	5A	04/17/1996
CH-BH-BNL-BNL-1996-0010	F	O	6A	07/10/1996
CH-BH-BNL-PE-1995-0018	U	O	1A3	10/10/1995
CH-BH-BNL-PE-1996-0008	F	O	1B1	04/23/1996
CH-PA-PPPL-PPPL-1996-0003	U	O	8	09/09/1996
HQ--BPOI-NPRC-1995-0029	U	O	6E	10/06/1995
HQ--BPOI-NPRC-1995-0030	U	O	6E	10/06/1995
HQ--BPOI-NPRC-1995-0034	U	O	6E	11/21/1995
HQ--BPOI-NPRC-1995-0035	U	U	6E	11/21/1995
HQ--BPOI-NPRC-1995-0036	U	U	6E	11/21/1995
HQ--BPOI-NPRC-1996-0003	U	O	6E	01/08/1996
HQ--BPOI-NPRC-1996-0004	U	O	6E	01/12/1996
HQ--BPOI-NPRC-1996-0005	U	O	6E	01/25/1996
HQ--BPOI-NPRC-1996-0006	U	O	1B	02/08/1996
HQ--BPOI-NPRC-1996-0011	U	O	6E	05/01/1996
HQ--BPOI-NPRC-1996-0012	U	O	6E	05/02/1996
HQ--BPOI-NPRC-1996-0013	U	O	6E	05/06/1996
HQ--BPOI-NPRC-1996-0014	U	O	6E	05/30/1996
HQ--BPOI-NPRC-1996-0015	U	O	6E	06/03/1996
HQ--BPOI-NPRC-1996-0017	U	O	6E	06/11/1996
HQ--BPOI-NPRC-1996-0021	U	O	6E	07/15/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
HQ--BPOI-NPRC-1996-0022	U	O	6E	07/23/1996
HQ--BPOI-NPRC-1996-0023	U	U	1B1	07/29/1996
HQ--BPOI-NPRC-1996-0024	U	O	6E	08/12/1996
HQ--BPOI-NPRC-1996-0025	U	O	6E	08/19/1996
HQ--BPOI-NPRC-1996-0029	U	O	6E	09/09/1996
HQ--BPOI-NPRC-1996-0030	U	O	6E	09/11/1996
HQ--BPOI-NPRC-1996-0033	U	O	6E	09/23/1996
HQ--BPOI-NPRC-1996-0034	U	U	6E	09/26/1996
HQ--BPOI-NPRC-1996-0035	U	O	6E	09/30/1996
HQ--GOPE-NIPER-1996-0008	U	O	2A	06/05/1996
HQ--GOPE-NIPER-1996-0009	U	O	8A	09/17/1996
HQ--SAYM-YMSGD-1996-0004	F	O	1B1	05/22/1996
HQ--SPR-BH-1996-0002	F	O	1B1	04/30/1996
HQ--SPR-BM-1996-0001	F	O	6E	02/08/1996
HQ--SPR-BM-1996-0004	F	O	6E	06/03/1996
HQ--SPR-WI-1995-0005	F	O	6E	11/09/1995
ID--LITC-ATR-1996-0015	F	O	1A2	07/10/1996
ID--LITC-ATR-1996-0018	F	O	6A	08/19/1996
ID--LITC-CFA-1996-0002	U	O	4	04/25/1996
ID--LITC-DESERT-1996-0003	U	O	6A	07/19/1996
ID--LITC-LANDFILL-1996-0001	U	O	4	05/16/1996
ID--LITC-LANDLORD-1996-0003	F	O	2A	02/06/1996
ID--LITC-LANDLORD-1996-0004	F	U	2C	02/14/1996
ID--LITC-TOWN-1996-0006	U	O	2A	02/28/1996
ID--LITC-TRAHC-1996-0001	U	O	4	05/30/1996
ID--LITC-WASTEMNGT-1995-0033	F	O	1A3	10/12/1995

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
NVOO--BNOO-NLVO-1996-0001	F	O	6B	02/21/1996
NVOO--BNOO-NLVO-1996-0002	U	O	5A	03/08/1996
NVOO--BNOO-NTS-1996-0006	F	O	8A	04/25/1996
NVOO--BNOO-NTS-1996-0008	F	O	8B	06/11/1996
NVOO--BNOO-NTS-1996-0009	U	O	1B1	06/12/1996
NVOO--REEC-EHDO-1995-0003	F	O	6A	12/14/1995
NVOO--SDNL-TTRO-1996-0002	F	O	6A	07/31/1996
NVOO--SDNL-TTRO-1996-0003	U	O	1B1	09/04/1996
OH-AB-RMI-RMIDP-1996-0001	F	O	5	01/15/1996
OH-FN-FERM-FEMP-1995-0126	F	O	5	11/09/1995
OH-FN-FERM-FEMP-1995-0131	F	O	8A	12/05/1995
OH-FN-FERM-FEMP-1996-0030	U	O	5C	05/31/1996
OH-FN-FERM-FEMP-1996-0031	F	O	5	06/11/1996
OH-FN-FERM-FEMP-1996-0034	F	O	5A	06/21/1996
OH-MB-EGGM-EGGMAT01-1996-0016	U	O	2C	09/04/1996
OH-MB-EGGM-EGGMAT04-1995-0019	F	O	5	11/02/1995
OH-MB-EGGM-EGGMAT04-1996-0003	F	U	4	02/07/1996
OH-MB-EGGM-EGGMAT04-1996-0004	F	O	5	02/09/1996
ORO--BNI-FUSRAPCISS-1995-0003	F	O	2B	10/02/1995
ORO--LMES-K25ENVRES-1996-0002	F	O	5	05/12/1996
ORO--LMES-K25GENLAN-1995-0006	F	O	6A	12/13/1995
ORO--LMES-K25GENLAN-1996-0006	U	O	5C	02/21/1996
ORO--LMES-K25GENLAN-1996-0010	U	O	5A	04/29/1996
ORO--LMES-K25GENLAN-1996-0013	U	O	5	05/13/1996
ORO--LMES-K25GENLAN-1996-0015	F	O	6A	05/23/1996
ORO--LMES-K25WASTMAN-1996-0001	U	O	6A	07/25/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
ORO--LMES-PORTENVRES-1996-0002	U	O	1A3	04/11/1996
ORO--LMES-X10CHEMTEC-1995-0001	F	O	4	10/11/1995
ORO--LMES-X10CM-1996-0001	F	O	6A	01/23/1996
ORO--LMES-X10METCER-1995-0001	F	O	1A3	10/26/1995
ORO--LMES-X10WSTEMRA-1996-0002	F	O	1B3	08/26/1996
ORO--LMES-Y12CM-1996-0004	F	O	6A	03/17/1996
ORO--LMES-Y12CM-1996-0006	F	O	1A3	06/11/1996
ORO--LMES-Y12SITE-1995-0002	F	O	6A	10/20/1995
ORO--LMES-Y12SITE-1996-0024	F	O	2A	05/23/1996
ORO--LMES-Y12SITE-1996-0028	F	O	8A	07/10/1996
ORO--MK-WSSRAP-1995-0023	F	O	5A	10/27/1995
ORO--MK-WSSRAP-1995-0026	F	O	2A	12/04/1995
ORO--MK-WSSRAP-1996-0018	U	O	4	10/01/1996
ORO--MKFO-SSCCONSTRM-1996-0001	F	O	6A	05/01/1996
ORO--ORNL-X10FINMAT-1996-0001	F	U	8A	02/20/1996
ORO--ORNL-X10PLEQUIP-1996-0006	F	O	5D	04/30/1996
ORO--ORNL-X10PLEQUIP-1996-0008	F	O	6A	06/14/1996
RFO--KHLL-371OPS-1995-0050	F	O	4	10/12/1995
RFO--KHLL-371OPS-1996-0119	U	O	3	09/19/1996
RFO--KHLL-771OPS-1996-0137	F	O	2C	08/20/1996
RFO--KHLL-ENVOPS-1996-0006	F	O	5D	06/21/1996
RFO--KHLL-PUFAB-1995-0038	F	O	5A	10/16/1995
RFO--KHLL-SITEWIDE-1996-0003	U	O	1A3	06/13/1996
RFO--KHLL-SOLIDWST-1996-0063	U	O	5	05/23/1996
RFO--KHLL-SOLIDWST-1996-0120	U	O	2C	08/14/1996
RFO--KHLL-SUPPORT-1995-0005	F	O	5	10/16/1995

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
RFO--KHLL-SUPPORT-1996-0012	U	O	2A	03/05/1996
RFO--KHLL-SUPPORT-1996-0018	U	O	5D	04/12/1996
RFO--KHLL-UTILITIES-1996-0021	F	O	3	04/15/1996
RL--BHI-DND-1996-0007	F	O	4	03/28/1996
RL--HEHF-HEHF-1996-0003	U	O	6A	03/13/1996
RL--PNNL-PNNLBOPEM-1995-0019	U	O	6A	12/29/1995
RL--PNNL-PNNLBOPEM-1996-0003	U	O	4	01/09/1996
RL--PNNL-PNNLBOPER-1996-0004	F	O	1A	01/19/1996
RL--PNNL-PNNLBOPER-1996-0011	F	O	5A	02/22/1996
RL--PNNL-PNNLBOPER-1996-0022	U	O	5	07/09/1996
RL--PNNL-PNNLBOPER-1996-0024	U	O	5B	07/18/1996
RL--PNNL-PNNLBOPER-1996-0025	U	O	8A	07/24/1996
RL--PNNL-PNNLBOPER-1996-0029	U	O	4	08/26/1996
RL--PNNL-PNNLNUCL-1996-0007	F	O	5	02/09/1996
RL--PNNL-PNNLNUCL-1996-0008	F	O	2C	02/09/1996
RL--PNNL-PNNLNUCL-1996-0019	F	O	1A3	04/10/1996
RL--PNNL-PNNLNUCL-1996-0024	F	O	4	06/17/1996
RL--PNNL-PNNLNUCL-1996-0025	F	O	5	06/17/1996
RL--PNNL-PNNLNUCL-1996-0034	U	O	5	08/02/1996
RL--WHC-200LWP-1996-0001	F	O	4	01/29/1996
RL--WHC-ANALLAB-1996-0002	F	O	1A3	01/17/1996
RL--WHC-ANALLAB-1996-0032	U	O	3	08/28/1996
RL--WHC-FFTF-1996-0003	U	O	2C	04/01/1996
RL--WHC-GENERAL-1996-0008	U	O	5D	05/09/1996
RL--WHC-GENERAL-1996-0011	F	O	1A3	07/26/1996
RL--WHC-KBASINS-1996-0012	F	O	1A2	07/18/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
RL--WHC-KBASINS-1996-0013	F	U	6C	07/24/1996
RL--WHC-KBASINS-1996-0018	F	O	1A3	09/19/1996
RL--WHC-KHFSS-1996-0005	U	O	4	03/04/1996
RL--WHC-KHFSS-1996-0007	U	O	6A	04/19/1996
RL--WHC-PATROL-1995-0001	F	O	6A	12/18/1995
RL--WHC-PFP-1996-0023	F	O	4	05/21/1996
RL--WHC-TANKFARM-1996-0019	F	O	6C	02/26/1996
RL--WHC-TANKFARM-1996-0039	F	O	1A3	06/12/1996
RL--WHC-TPLANT-1996-0017	U	O	1A3	09/16/1996
RL--WHC-TRANS&PKG-1995-0002	U	O	8B	11/30/1995
RL--WHC-TRANS&PKG-1996-0001	U	O	2B	01/11/1996
RL--WHC-TRANS&PKG-1996-0002	U	O	8A	03/01/1996
RL--WHC-TRANS&PKG-1996-0003	U	O	2B	05/23/1996
RL--WHC-TRANS&PKG-1996-0004	F	O	6C	09/13/1996
SAN--ETEC-RMDF-1995-0001	U	O	5A	10/25/1995
SAN--GOSF-HCF-1996-0001	F	O	8A	07/01/1996
SAN--LBL-EHS-1995-0006	F	O	6A	10/12/1995
SAN--LBL-EHS-1996-0001	U	U	4	03/07/1996
SAN--LBL-ENG-1996-0001	U	O	6A	08/27/1996
SAN--LLNL-LLNL-1995-0062	U	O	4	11/02/1995
SAN--LLNL-LLNL-1995-0066	F	O	4	12/08/1995
SAN--LLNL-LLNL-1996-0002	F	O	8A	01/23/1996
SAN--LLNL-LLNL-1996-0013	U	O	6A	03/14/1996
SAN--LLNL-LLNL-1996-0028	F	O	4	06/26/1996
SAN--LLNL-LLNL-1996-0030	U	O	4	07/10/1996
SAN--LLNL-LLNL-1996-0041	F	O	8B	08/22/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
SAN--LLNL-LLNL-1996-0042	U	O	4	08/22/1996
SAN--LLNL-LLNL-1996-0046	U	O	6A	09/12/1996
SAN--SU-SLAC-1996-0006	F	O	8A	04/01/1996
SR--WSIS-SECFOR-1996-0002	F	O	4	05/21/1996
SR--WSRC-CMD-1996-0005	U	O	6A	05/08/1996
SR--WSRC-CSWE-1996-0007	U	O	8	07/26/1996
SR--WSRC-ERF-1996-0009	U	O	8E	08/08/1996
SR--WSRC-FCAN-1996-0026	U	O	6C	09/27/1996
SR--WSRC-FTANK-1995-0086	F	O	1A3	11/21/1995
SR--WSRC-HCAN-1996-0013	F	O	1A2	05/15/1996
SR--WSRC-HTANK-1996-0001	F	O	4	01/18/1996
SR--WSRC-HTANK-1996-0008	F	O	6A	04/08/1996
SR--WSRC-HTANK-1996-0014	F	O	4	06/04/1996
SR--WSRC-HWFAC-1996-0008	F	U	4	05/07/1996
SR--WSRC-HWFAC-1996-0012	U	O	5	09/19/1996
SR--WSRC-ITP-1996-0016	F	O	4	07/29/1996
SR--WSRC-LTA-1996-0003	F	O	6A	02/08/1996
SR--WSRC-LTA-1996-0010	F	O	4	05/15/1996
SR--WSRC-LTA-1996-0020	F	O	4	07/12/1996
SR--WSRC-LTA-1996-0028	F	O	5F	08/20/1996
SR--WSRC-RBOF-1995-0034	F	O	8E	11/02/1995
SR--WSRC-RBOF-1996-0006	F	O	8D	03/27/1996
SR--WSRC-REACC-1996-0003	F	O	1A3	03/21/1996
SR--WSRC-REACK-1996-0007	F	O	1A3	04/17/1996
SR--WSRC-SLDHZD-1996-0013	U	U	4	03/22/1996
SR--WSRC-SLDHZD-1996-0016	F	O	5	05/29/1996

Table B.1 ORs included in annual report for FY 1996 (continued)

Report No.	Status	Category	NOC	Report date
SR--WSRC-SLDHZD-1996-0023	F	O	6A	08/07/1996
SR--WSRC-TD-1996-0001	F	O	6A	07/11/1996
SR--WSRC-TRIT-1996-0005	F	O	8	02/21/1996
SR--WSRC-WVIT-1996-0003	U	U	1B1	02/08/1996
USEC--MMUS-PADGENPLT-1995-0076	U	O	1B1	10/09/1995
USEC--MMUS-PADGENPLT-1996-0014	U	U	2A	03/31/1996
USEC--MMUS-PADGENPLT-1996-0019	U	U	2C	05/03/1996
USEC--MMUS-PADGENPLT-1996-0028	U	U	3	06/30/1996
USEC--MMUS-PTSGENPLT-1996-0035	U	U	1A3	04/04/1996
USEC--MMUS-PTSGENPLT-1996-0065	U	U	5D	09/26/1996

Notes:
1. Status: The report's notification status: notification (N), ten-day (T), ten-day update (U), or final (F).
2. Category: DOE Order 232.1 categories: emergency (E), unusual (U), or off-normal (O).
3. NOC: PATS Nature of Occurrence.
4. Report Date: The date that initial notification was made of the incident.