ORNL/PATS-94-001

PACKAGING- AND TRANSPORTATION-RELATED OCCURRENCE REPORTS

1993 ANNUAL REPORT

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ACRONYMS

ALO	Albuquerque Operations Office
AS	Allied-Signal, Inc., Kansas City Division
ANL-E	Argonne National Laboratory - East
BNL	Brookhaven National Laboratory
BPOI	Bechtel Petroleum Operations, Inc.
CE	Conservation and Renewable Energy (now EE)
CH	Chicago Operations Office
DOE	Department of Energy
DOT	Department of Transportation
DP	Defense Programs
EG&G	EG&G Idaho, Inc.
EGGM	EG&G Mound Applied Technologies, Inc.
EGGR	EG&G Rocky Flats, Inc.
EH	Office of Environment, Safety and Health
EM	Environmental Restoration and Waste Management
ER	Energy Research
ES&H	Environment, Safety and Health
FAA	Federal Aviation Administration
FE	Fossil Energy
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corp. of Ohio
GE/KNOLL	General Electric KNOLLS Atomic Power Laboratory
HQ	DOE Headquarters
HP	health physics
ID	Idaho Operations Office
INEL	Idaho National Engineering Laboratory
K-25	Oak Ridge K-25 Plant
KCP	Kansas City Plant
KEH	Kaiser Engineers Hanford
KWOC	Key-Word-Out-Of-Context
LANL	Los Alamos National Laboratory
LBL	Lawrence Berkeley Laboratory
LLNL	Lawrence Livermore National Laboratory
LSA	low specific activity
MHSM	Mason & Hanger-Silas Mason Company, Inc.
MKFO	MK-Ferguson
MMES	Martin Marietta Energy Systems, Inc.
MSE	Mountian State Energy
NE	Nuclear Energy
NOC	nature of occurrence
NRC	Nuclear Regulatory Commission
NVO	Nevada Operations Office

OR	occurrence report
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations Office
ORPS	Occurrence Reporting and Processing System
PANTEX	Pantex Plant
PATS	Packaging and Transportation Safety
PCB	polychlorinated biphenyl
PGDP	Paducah Gaseous Diffusion Plant
PINELLAS	Pinellas Plant-Largo
PNL	Pacific Northwest Laboratory
PPPL	Princeton University Plasma Physics Lab
REECO	Reynolds Electrical & Engineering Company, Inc.
RFO	Rocky Flats Operations Office
RL	Richland Operations Office
RW	Radioactive Waste Management
SAN	San Francisco Operations Office (now Oakland)
SMAC	Shipment/Mobility Accountability Collection
SNL	Sandia National Laboratory
SNL-L	Sandia National Laboratory, Livermore
SPR	Strategic Petroleum Reserves
SR	Savannah River Operations Office
UMTR	Uranium Mill Tailings Project Office
WHC	Westinghouse Hanford Company
WSRC	Westinghouse Savannah River Company
WVNS	West Valley Nuclear Services, Inc.
WIPP	Waste Isolation Pilot Plant
WSSRAP	Weldon Spring Site Remedial Action
X-10	Oak Ridge X-10 Plant
Y-12	Oak Ridge Y-12 Plant

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 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 5000.3B, *Occurrence Reporting and Processing of Operations Informati*on (hereafter referred to as DOE 5000.3B). The centralized data base, which is managed by the Idaho National Engineering Laboratory (INEL), 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 (PATS) Program has been made responsible for retrieving reports and information pertaining to transportation and packaging incidents/accidents from the centralized ORPS database. These selected reports are analyzed for (a) trends, (b) impact on packaging and transportation operations and safety, and (c) "lessons learned" in transportation and packaging safety. Moreover, the selected ORs are reviewed to see if the DOE Order 5000.3B requirement to provide for appropriate corrective actions is being followed. This task is designed not only to keep the DOE Transportation and Packaging Safety Division, EH-332, aware of what is occurring on DOE sites and of potential transportation and packaging problems that may need attention, but also it is intended to allow dissemination of lessons learned to the Operations Offices, from which the information can be communicated to contractors.

This annual report details (1) the methodology that PATS uses to conduct searches of the ORPS for pertinent information, (2) the form of reporting to EH-332, (3) review and examination of trends observed in ORs related to transportation and packaging safety, (4) a presentation and discussion of the root-cause codes of ORPS and the nature of occurrence codes of PATS, (5) timely processing of notification reports to final stage, and (6) analysis of 10% of the reported ORs that were finalized to determine whether the actions taken to close out the occurrences were sufficient to ensure remediation of the incident to prevent a recurrence. Data in the report are presented by calendar years.

Though this report will present an analysis of the 1993 ORs, as reported to DOE Headquarters (HQ) in the Weekly Reports, it will also use historical ORs to analyze for trends and patterns. Of the 5,361 total occurrences reported to the ORPS for 1993, 266 ORs were selected. Of the 266 packaging and transportation-related ORs, 208 have been finalized in accord with the procedures of DOE 5000.3b. Historical ORs occurring from 1990 to 1992 comprise another 275. Hence, these 541 ORs (of which 470 are finals) will be reviewed for this report, with emphases on the occurrences during 1993.

The Key-Word-Out-Of-Context (KWOC) Index is an alphabetical list of the key words in the titles of the occurrence reports in the PATS-OR database, covering the 1993 calendar year. This index is, in effect, a comprehensive subject cross index; each title is listed as many times, by keyword, as there are major terms (i.e., key words) in its title. *Because this multiple listing is lengthy, it was not included in this Internet-accessible version of the annual report.*

1.1 METHODOLOGY AND REPORTING

ORNL PATS staff conduct daily searches of ORPS to scan and retrieve summaries of ten-day reports (and updates to the ten-day reports), and review 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 pertinent ORs have been selected by a searcher, the selected ORs are then independently verified by another transportation specialist. The selected ORs are compiled into a table that lists the (1) report date, (2) discovery date of the occurrence, (3) occurrence report number, (4) occurrence type, (5) nature of the packaging and transportation safety concern, (6) damage and injury resulting from the occurrence, and (7) follow-up action taken. This tabular listing of the selected ORs is compiled weekly and transmitted electronically to key personnel of EH-332 for review and distribution at HQ as well as for further direction to PATS for follow-up. Also, a quarterly summary of the submitted weeklies is compiled, detailed for any unusual or emergency occurrences, analyzed for trends, and submitted to EH-332 for distribution. This report if the first annual report of this program.

1.2 CATEGORIZATION OF OCCURRENCES

DOE 5000.3B categorizes ORs into three types: emergency, off-normal, and unusual. For packaging and transportation concerns, DOE 5000.3B defines these categories (under Group 6 of Appendix 1) as the following

(1) Emergency is an offsite transportation event involving the release of a reportable quantity of hazardous substance (per 49 CFR 171.8).

(2) Unusual is an offsite transportation event involving the release of hazardous material in a quantity greater than limited quantities (or any release of radioactive material) or any shipment of radioactive material or hazardous waste that arrives at its destination with a nonreconcilable shipping paper discrepancy or unaccounted for package related to material quantity, or with radiation or contamination levels in excess of Department of Transportation (DOT) allowable limits. Violation of Federal Motor Carrier Safety Regulations or Federal Aviation Administration regulations involving a release of hazardous material is also included. Onsite "unusual occurrences" are defined similarly for releases.

(3) Off-Normal is defined as an offsite event in involving a release of hazardous material, other than radioactive, not exceeding a limited quantity. Violations of marking, labeling, placarding, routing, or separation/segregation of material are included in its definition, as well as any transportation event involving departmental property resulting in vehicular/aircraft damage of more than $5000 (or total losses). Onsite "off-normal" events are defined substantially the same.

Of the occurrences reported during 1993, only two are still listed as "emergencies" and 17 are listed as "unusual." One of the emergency-categorized ORs has been finalized, and nine of the unusual ORs have been finalized.

2. MAJOR SHIPPERS AND REPORTERS OF OCCURRENCES

The Shipment Mobility/Accountability Collection (SMAC) 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. The SMAC system is funded by Environmental Restoration and Waste Management (EM), Transportation Management Division, through the DOE Oak Ridge Operations Office (ORO). 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 more than two-million DOE shipments.

SMAC provides quarterly and annual summaries to ORNL for this project on hazardous materials shipments made by the DOE contractors during the specified time frame. SMAC data reveals that in 1993 Lawrence Livermore National Laboratory (LLNL) was the most active shipper: LLNL made 3,546 of the total 22,718 hazardous material shipments. Second was the Paducah Gaseous Diffusion Plant, which made 1,944 shipments. Figure 1 presents those contractors who reported more than 800 shipments to SMAC during 1993. Figure 2 presents those contractors who reported more than 300 but fewer than 800 shipments to SMAC during 1993. (The acronym list at the beginning of this report contains the full names of the contractors indicated on these figures.)

No correlation exists between the volume of shipments made and the number of packaging and transportation ORs reported. LLNL reported only 5 ORs during 1993; while the Westinghouse Hanford Co. (WHC), which reported a total 469 shipments to SMAC (443 from WHC Defense Operations) and had 39 ORs, of which 8 were caused by others. Los Alamos National Laboratory (LANL), which made 995 shipments during 1993, reported a close second—with 38 ORs, although 17 of these were the result of others' errors. The site which reported the greatest percentage of ORs to shipments was Brookhaven National Laboratory (BNL). It conducted only 122 shipments in 1993, but it reported seven ORs (one was the result of other's error) for about 5% ratio of occurrence reporting to shipments. Table 1 lists those contractors reporting more than 300

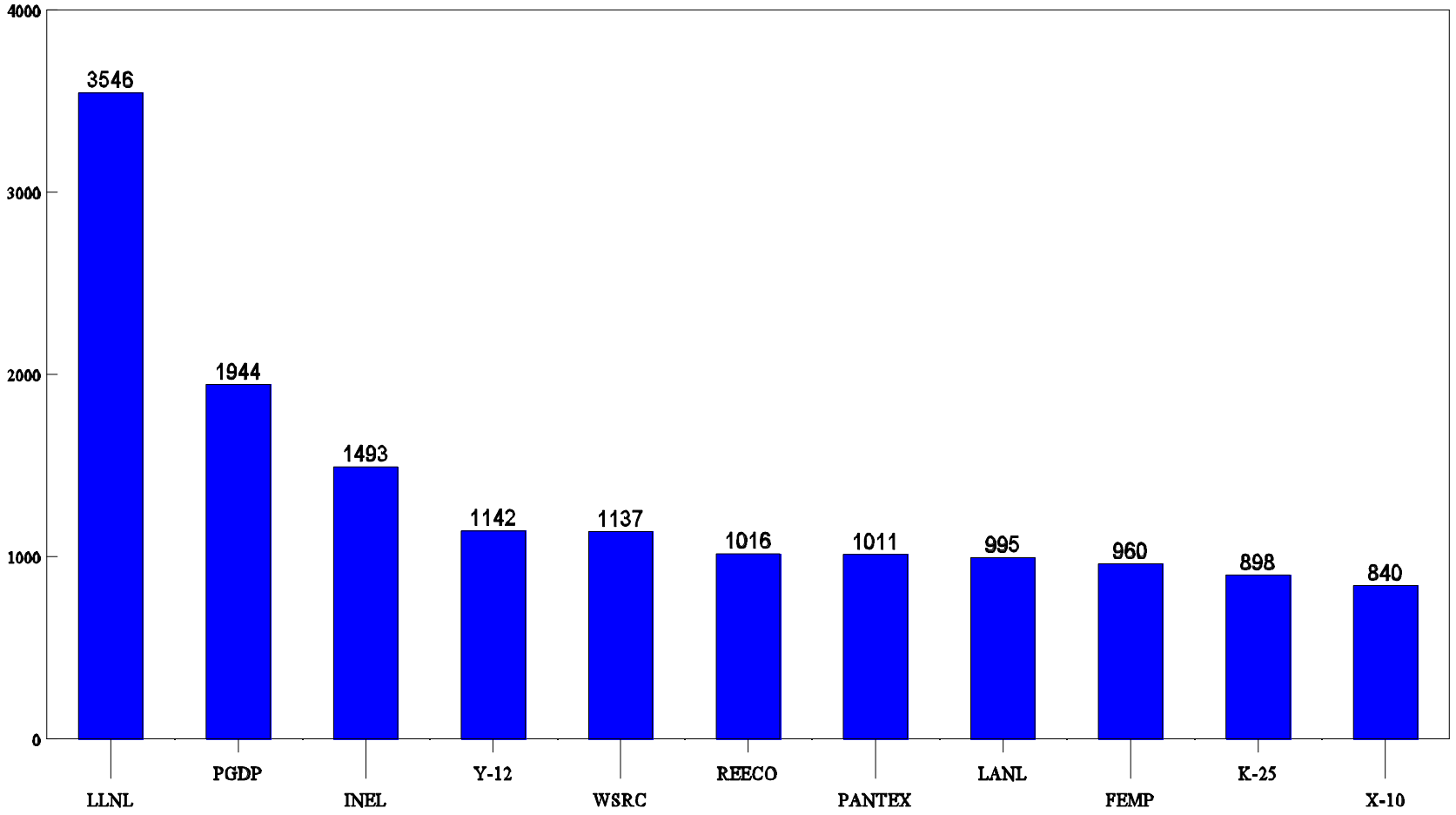

Fig. 1. Contractors conducting over 800 shipments during 1993 (SMAC) data).

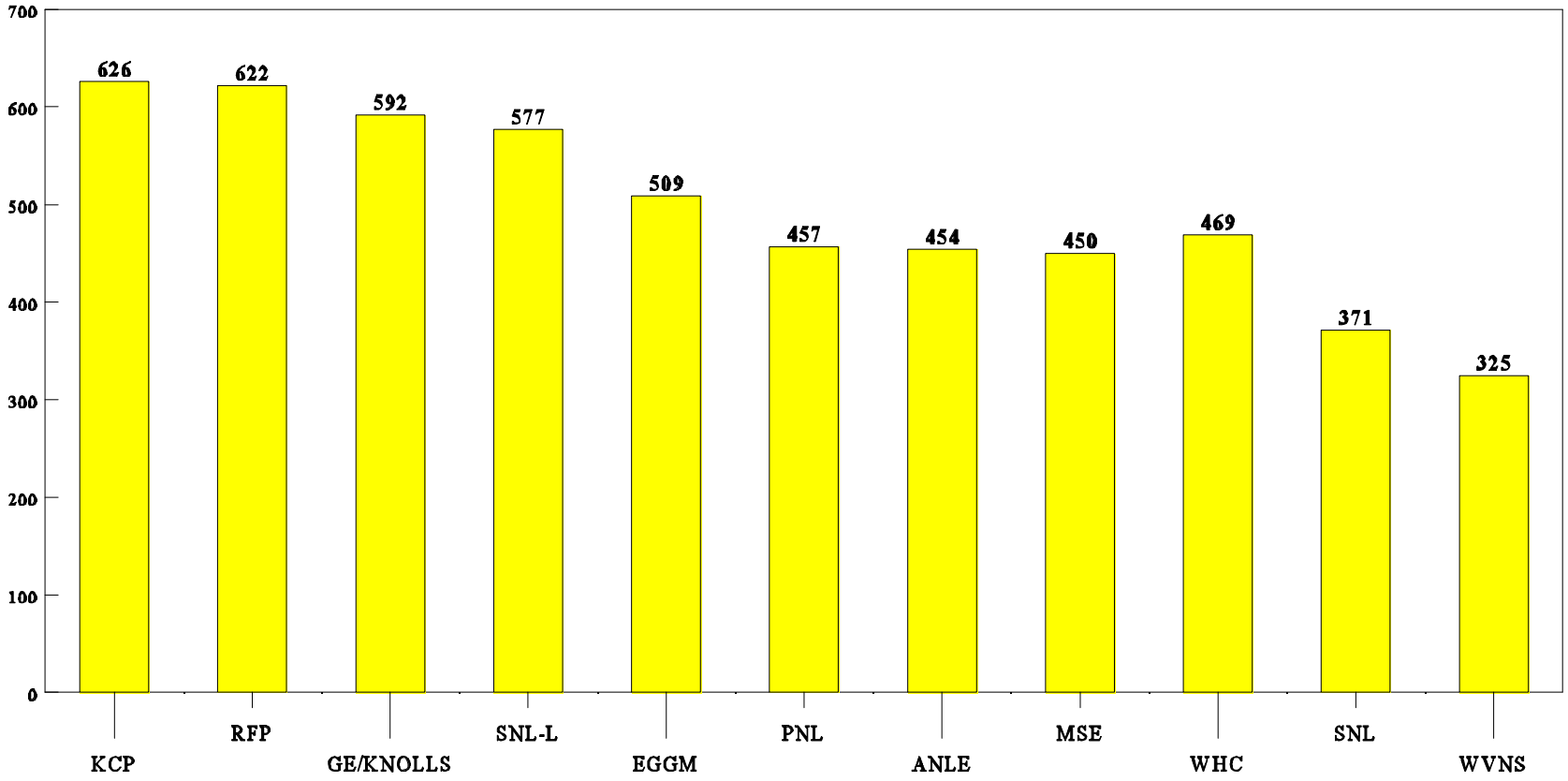

Fig. 2. Contractors with between 300 and 800 shipments during 1993 (SMAC data).

Table 1. ORs per year for contractors with >300 shipments in 1993

Contractor	Year	Onsite	Offsite	Others	Contractor	Year	Onsite	Offsite	Others
PANTEX	1991	1	0	2	WHC	1990	2	1	1
	1992	3	3	0		1991	7	5	2
	1993	2	5	0		1992	10	7	4
						1993	28	3	8
LANL	1991	3	0	0					
	1992	1	1	5	PNL	1990	2	1	0
	1993	14	7	16		1991	1	3	0
						1992	3	0	0
Y-12	1990	1	0	0		1993	1	1	1
	1991	4	1	0					
	1992	0	2	2	ANLE	1990	1	0	1
	1993	3	3	3		1991	0	0	0
						1992	1	1	
EGGR	1991	1	1	2		1993	2	1	1
	1992	1	1	1					
	1993	6	3	1	WVNS	1990	1	0	0
						1991	0	0	0
ORNL	1990	1	1	1		1992	0	1	0
	1991	5	1	0		1993	0	1	8
	1992	5	0	0					
	1993	3	1	2	BNL	1990	1	0	0
						1991	2	1	0
WSRC	1991	6	1	1		1992	1	2	0
	1992	7	5	0		1993	2	4	1
	1993	21	2	1					
					INEL	1990	0	1	2
REECO	1991	0	3	0		1991	0	0	1
	1992	3	1	1		1992	0	0	0
	1993	6	3	0		1993	2	0	0
EGGM	1991	0	0	2	SNL	1991	0	0	1
	1992	3	0	0		1992	0	0	1
	1993	1	0	1		1993	1	1	1

Table 1. (continued)

Contractor	Year	Onsite	Offsite	Others	Contractor	Year	Onsite	Offsite	Others
LLNL	1991	0	0	1	WSSRAP	1991	0	0	0
	1992	1	1	0		1992	2	0	0
	1993	3	2	0		1993	1	0	0
PGDP	1990	1	0	0	PINELLAS	1990	0	0	2
	1991	2	0	1		1991	0	0	1
	1992	2	0	0		1992	0	0	0
	1993	1	1	0		1993	1	0	0
K-25	1991	2	0	2	LBL	1991	0	0	0
	1992	4	1	1		1992	0	0	0
	1993	1	1	0		1993	1	0	0
FEMP	1990	0	0	0	KCP	1991	0	0	0
	1991	0	1	1		1992	0	0	0
	1992	2	2	3		1993	0	1	0
	1993	0	2	1					
					PPPL	1991	0	0	0
						1992	0	0	0
						1993	0	1	0

shipments to SMAC during 1993 and the occurrences attributed to these contractors. A study of Table 1 and a comparison of it with Fig. 1 and 2 show the lack of correlation between shipment volume and ORs reported.

Table 1 does reveal that almost every contractor reported more ORs during 1993 than during any of previous years. Data for 1990 cannot be considered as significant because many sites were not reporting completely to ORPS at that time since DOE 5000.3A guidance did not become effective until May 30, 1990. If one discounts 1990, the years 1991 and 1992 are relatively equal in numbers of ORs reported. But 1993 shows a significant increase for all major sites. Because, for transportation occurrences, the impact of the rewriting of DOE Order 5000.3B was expected to be in the reporting of occurrences generated by others, it can only be surmised that additional emphasis on regulatory compliance and increased vigilance and training has resulted in this trend.

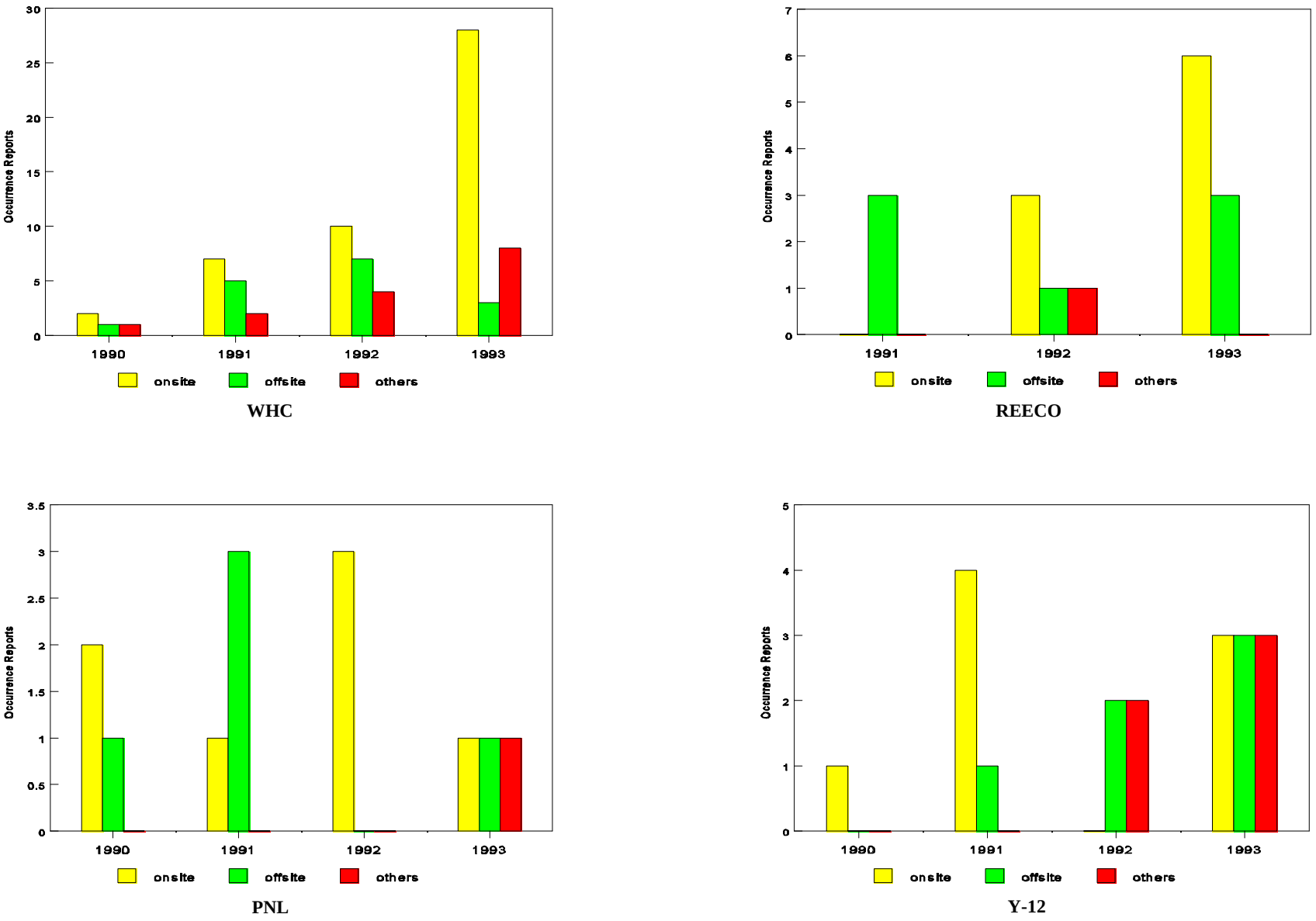

Fig. 3. ORs for major shippers (WHC, REECO, PNL, Y-12).

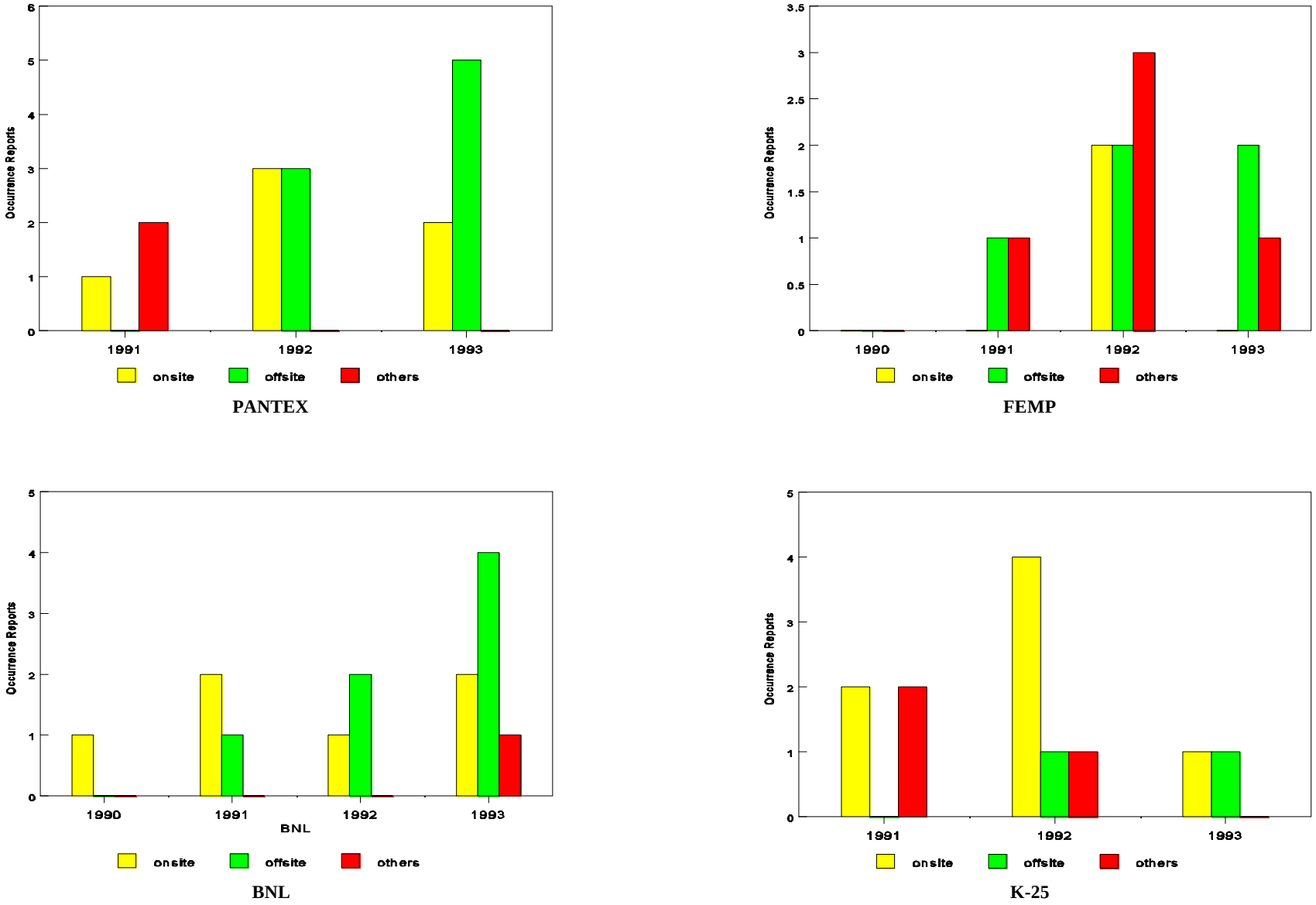

Fig. 4. ORs for major shippers (PANTEX, FEMP, BNL, K-25).

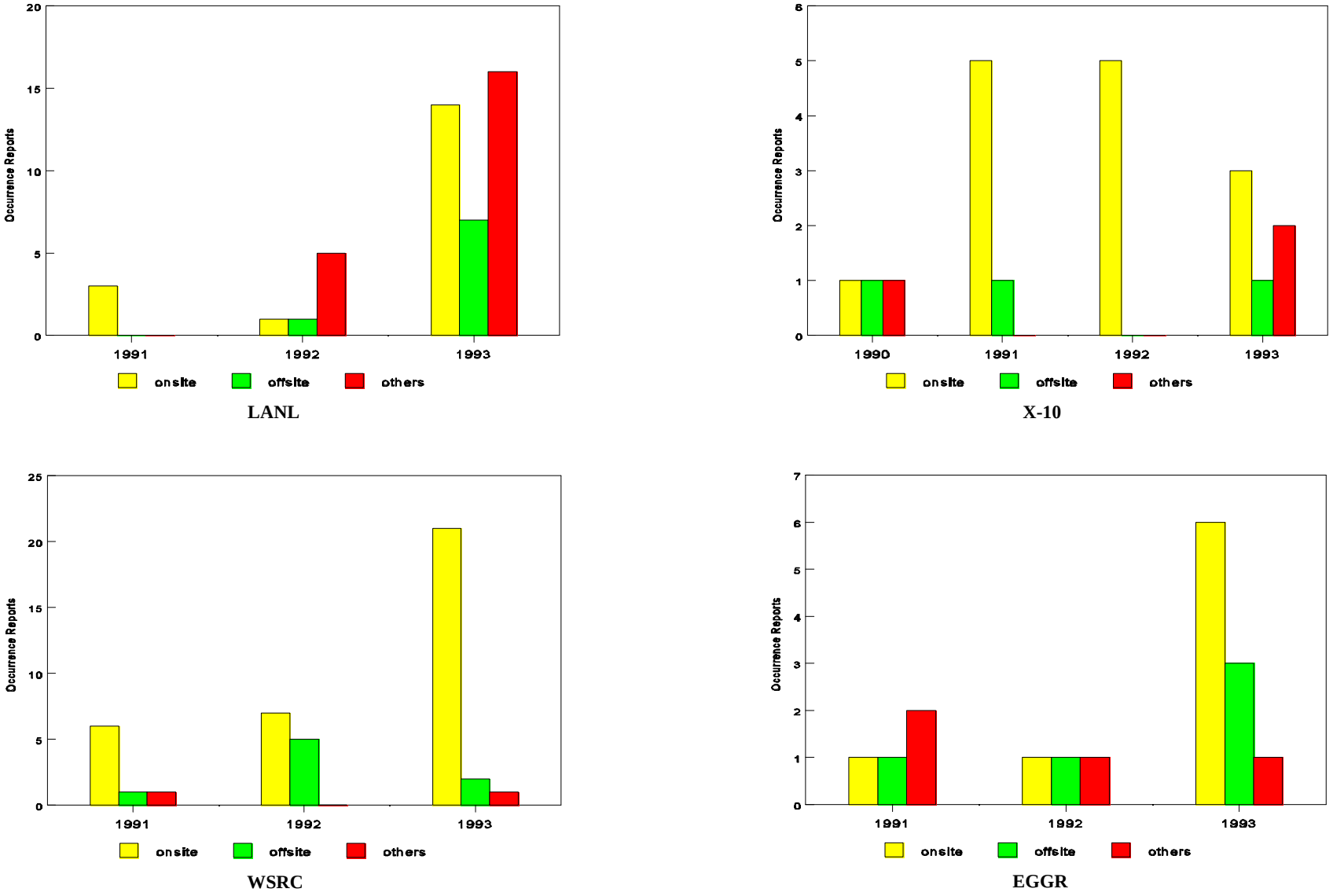

Fig. 5. ORs for major shippers (LANL, X-10, WSRC, EGGR).

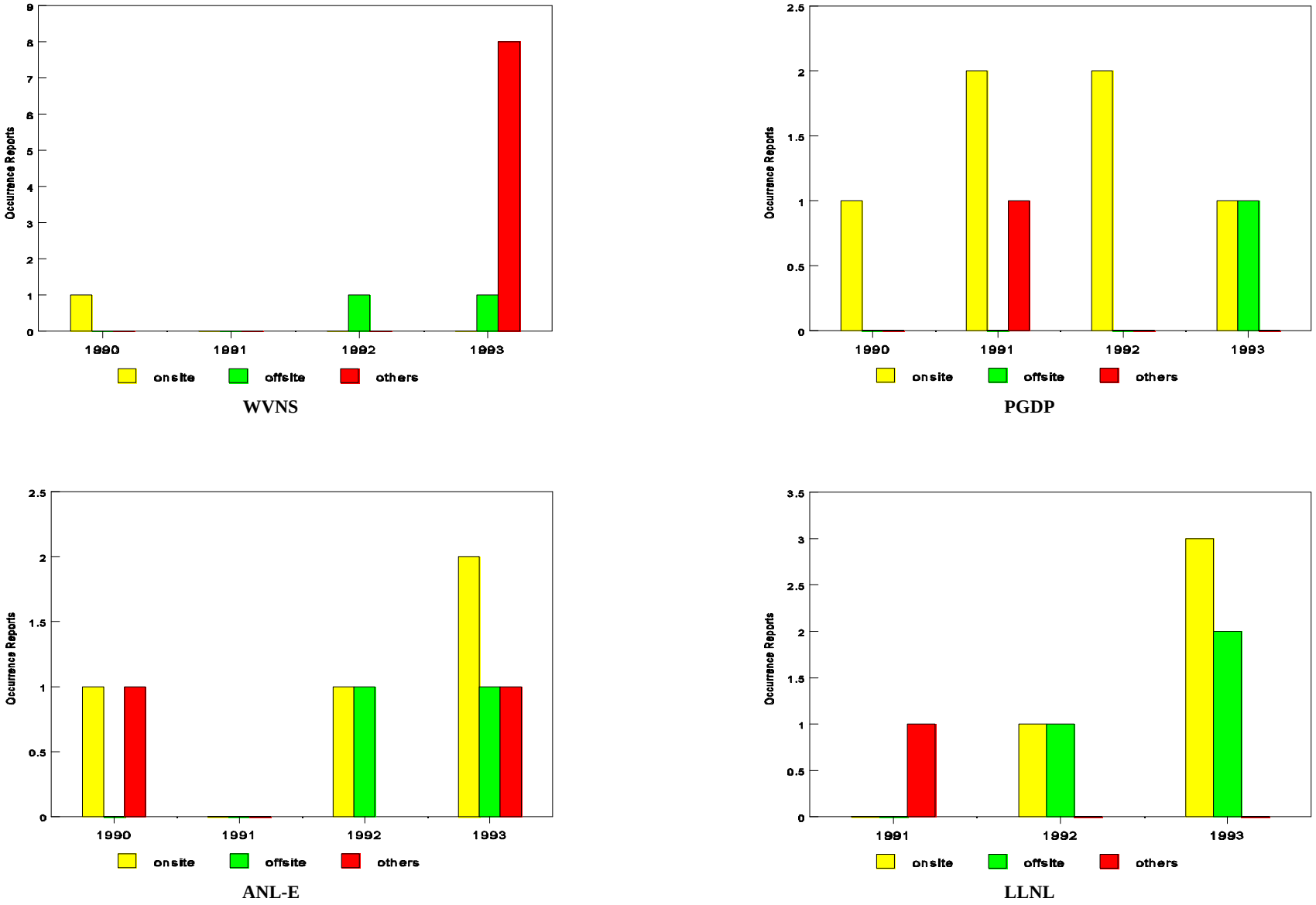

Fig. 6. ORs for major shippers (WVNS, PGDP, ANL-E, LLNL).

The increase in occurrence reporting in 1993 over previous years can be most quickly seen by referring to the graphs of ORs (Fig. 3–6) made by major shippers, which are those shippers that reported more than 300 shipments to SMAC during 1993.

3. THE NATURE OF OCCURRENCE OF THE INCIDENT

PATS-assigned nature of occurrence code (NOC) basically seeks to determine what occurred and classify the occurrence according to specific packaging- and transportation-related safety issues rather than use the more general ORPS "nature of occurrence" assigned to the incident. NOC coding categorizes ORs by unique packaging- and transportation-related criteria to focus on patterns and useful information for appraisals and "lessons-learned." NOC coding was developed to be more definitive than the ORPS code to transportation interests and to allow analysis of data accumulated in line with the concerns of EH-32. (For a complete discussion of the selection criteria, please reference the *PATS ORPS MANUAL*.) Table 2 presents a listing of the PATS-assigned NOC coding used to provide a preliminary identification of an OR to packaging and transportation issues.

The PATS_OR database was queried to obtain a break down of the ORs by NOC classification and whether each was considered as onsite or offsite occurrences. Any occurrence that happens 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. Table 3 lists the results of the query for ORs that were reported during 1993. Table 4 lists the classification of ORs that are package- or transportation-related for all years.

Table 3 shows that the majority of ORs in 1993 were classified as "contamination" followed by "shipping preparation" and "modal safety." The table further shows that most of the contamination ORs occurred onsite, whereas the shipping preparation and modal safety ORs are almost equally split between offsite and onsite. As expected (with one exception) the ORs caused by "others" were all offsite occurrences; and the occurrences created by non-DOE sites or non-DOE contractors (category 8) account for 21 percent of the total occurrences reported.

Table 2. PATS NOC categories

Categories/type or cause
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. Quality Assurance
5. Shipment Preparation
5A. Shipping Papers
5B. Marking
5C. Labeling
5D. Loading and Tie-downs
5E. Placards
6. Modal Safety
6A. Motor or Driver Safety
6B. Aircraft Safety
6C. Rail Safety
6D. Barge Safety
6E. Pipeline
7. Operations
7A. Lack of Procedures
7B. Training
7C. Supervision
7D. Disregard of Procedures
8. Occurrence Created by Others (non-DOE or DOE/Contractor)
8A. Shipping Preparation
8B. Packaging
8C. Quality Assurance
8D. Vehicle or Driver Safety
8E. Contamination
8F. NOS

Table 3. ORs classified by PATS NOC for 1993

NOC Category	Onsite	Offsite	Total
1	55	15	70
2	10	3	13
3	8	0	8
4	2	0	2
5	24	25	49
6	24	21	45
7	19	4	23
8	1	55	56
TOTAL ORs:	143	123	266

Notes: PATS NOC Codes
1. Contamination/Release
2. Packaging
3. Storage Incident to Transport
4. Quality Assurance
5. Shipment Preparation
6. Modal Safety
7. Operations
8. Occurrences Created by Others

Table 4. ORs of PATS_OR data base classified by PATS NOC for all years

NOC Category	Onsite	Offsite	Total
1	100	33	133
2	18	8	26
3	8	2	10
4	5	1	6
5	33	44	77
6	52	47	99
7	56	26	82
8	1	107	108
TOTAL ORs:	273	268	541

Notes: PATS NOC Codes
1. Contamination/Release
2. Packaging
3. Storage Incident to Transport
4. Quality Assurance
5. Shipment Preparation
6. Modal Safety
7. Operations
8. Occurrences Created by Others

Table 4 reveals a very consistent pattern of reporting during the history of the ORPS. A comparison of the historic totals of Table 4 to the categories of for calendar year 1993 shows that similar percentages of occurrences continue to fall into same groupings. This historic pattern confirms the data for 1993 and, more importantly, confirms the methodology for selection of the NOC by the PATS methodology. Too, it says that problems with contamination, shipping preparation, and modal safety continues. Table 4 also shows that operations-related deficiencies (category 7) continue to occur with about the same frequency. Continuing with the comparison of historic data of Table 4 with the data of Table 3, 1993 data reveals only a very slight increase in the percentage of occurrences created by others in 1993 (21% in 1993 versus 20% for all years). A rise in the percentage of reporting in the "others" category had been expected for 1993 because of the issuance of new guidance by DOE 5000.3B in February 1993. (ORPS officials report that a 10-12% rise was observed overall for this category.)

There were increases in all of the PATS NOC categories if one views them on a quantity basis. However, if they are viewed as percentages, the categorization of the occurrences reported is consistent. Table 5 shows the ORs generated during the years by their notification date on a

Table 5. Percentage of ORs by notification year

	Percent totals by notification year			
PATS NOC	**1990**	**1991**	**1992**	**1993**
1	20.0	21.78	24.60	26.30
2	5	4.95	5.22	4.51
3	0	0.99	0.75	3.00
4	0	2.97	0.75	0.75
5	12.5	11.88	8.21	18.42
6	30	20.79	15.67	16.92
7	15	13.86	28.36	9.02
8	17.5	22.77	16.42	21.05
Total ORs:	40	101	134	266

percentage basis; the total ORs that the percentages are based on are shown at the bottom of the table. The largest increase in a NOC category was in category 3 (storage incident to transport); however, since they were only 8 ORs that were categorized with this code in 1993, this seems insignificant. The second largest increase was seen in category 5 (shipment preparation)—though this increase should not be cause for alarm since it is thought that this increase results from better quality assurance (QA) and self-assessment than because of increased negligence. The largest decrease in a category was seen in category 7 (operations). Because there is (1) not enough historic data to establish a definite trend, and (2) the number of occurrences is still relatively low, no real significance can be associated with these minor increases and decreases. However, that these categories are relatively stable historically indicates that PATS NOC coding is consistent and valid.

As shown by Fig. 7, packaging- and transportation-related ORs have shown a yearly increase during the operation of the ORPS, though the total that include all categories showed a decline in 1993. It is uncertain what effect resulted in more than 1,000 fewer ORs being reported overall in 1993 than in 1992. However, it is sure that part of this decrease in reporting resulted from the revised reporting criteria and more definitive guidelines for reporting occurrences that became effective with the approval of DOE 5000.3B on Feb. 22, 1993. On the other hand, the addition of onsite reporting requirements for transportation in DOE 5000.3B and doubling of the detailing of the transportation group requirements probably explains the doubling of the packaging- and transportation-related ORs observed in 1993 over those of 1992.

Table 6 shows the number of ORs reported by contractors to their respective Program Offices during 1993. Table 7 shows the number of ORs reported by the contractors to their respective Operations Offices during 1993. Figures 8 and 9 are a graphical representation of this data.

Table 6 reveals that the Program Office to which the most occurrences were reported to was EM, which received 110 ORs for the 1993. The second largest receiver of ORs was Defense Programs (DP), which had 102. The Operations Office that reported the most occurrences to EM was Richland Operations Office (RL) with 44 (39 of which were reported by WHC). The Operations Office under DP which received the most ORs from its contractors was the Albuquerque

ORNL-DWG 94-9190

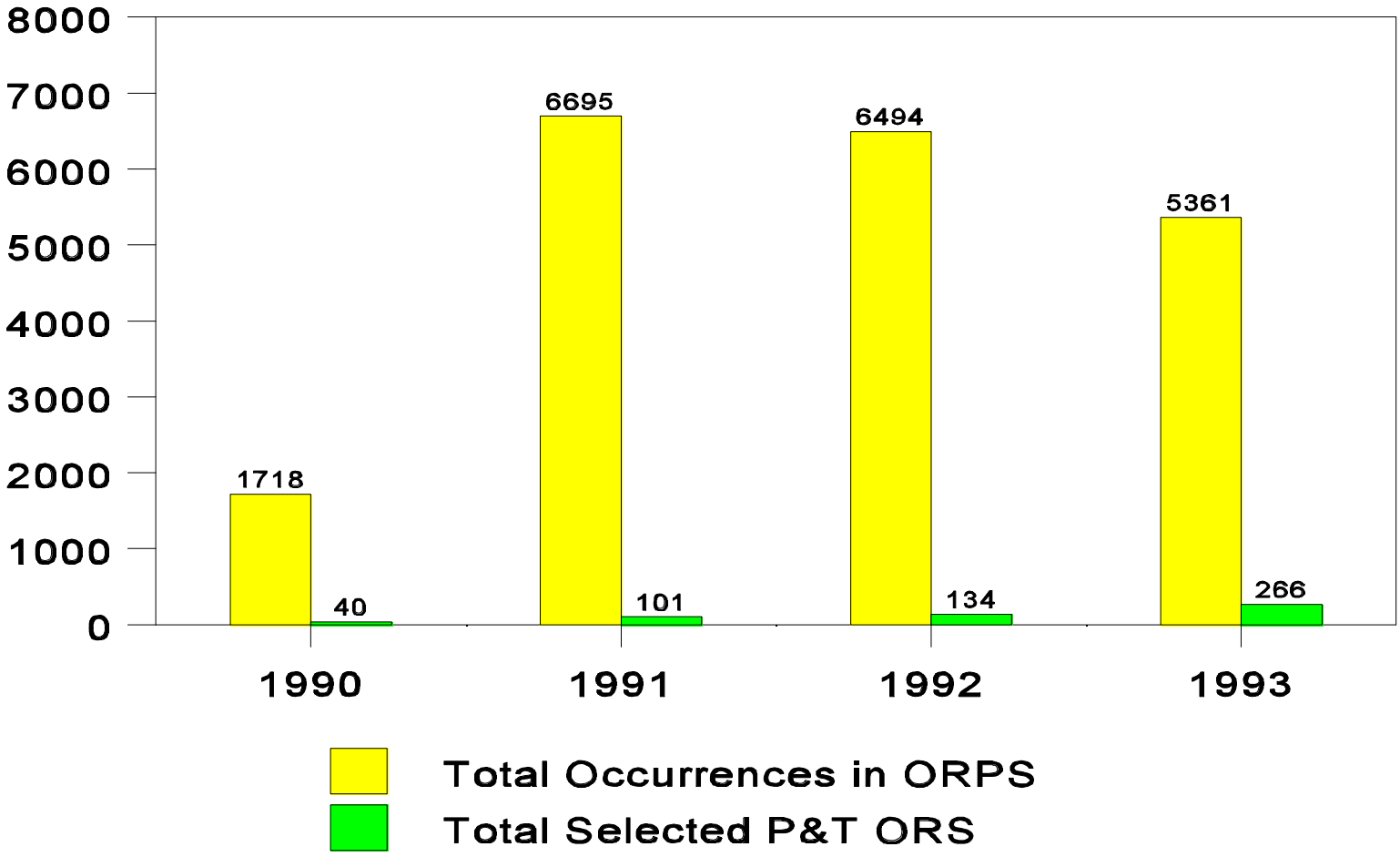

Fig. 7. ORs and packaging- or transportation-related occurrences by year.

Table 6. OR distribution by DOE Program Office

		No. of ORs	
Code	Description	Owner	Others
CE	Conservation and Renewable Energy (now EE)	0	0
DP	Defense Programs	77	25
EM	Environmental Restoration and Waste Management	89	21
ER	Energy Research	17	6
FE	Fossil Energy	18	1
NE	Nuclear Energy	7	2
RW	Radioactive Waste Management	2	1
	Sub Totals	210	56
	Grand Total	266	

Table 7. OR distribution by DOE Operations Office

		No. of ORs	
Code	Description	Owner	Others
ALO	Albuquerque Operations	61	19
CH	Chicago Operations	10	2
HQ	DOE Headquarters	19	2
ID	Idaho Operations	12	10
NVO	Nevada Operations	12	2
ORO	Oak Ridge Operations	21	9
RFO	Rocky Flats Operations	9	1
RL	Richland Operations	37	9
SAN	San Francisco Operations (now Oakland)	6	0
SR	Savannah River Operations	23	56
	Sub Totals	210	56
	Grand Total	266	

ORNL-DWG 94-9191

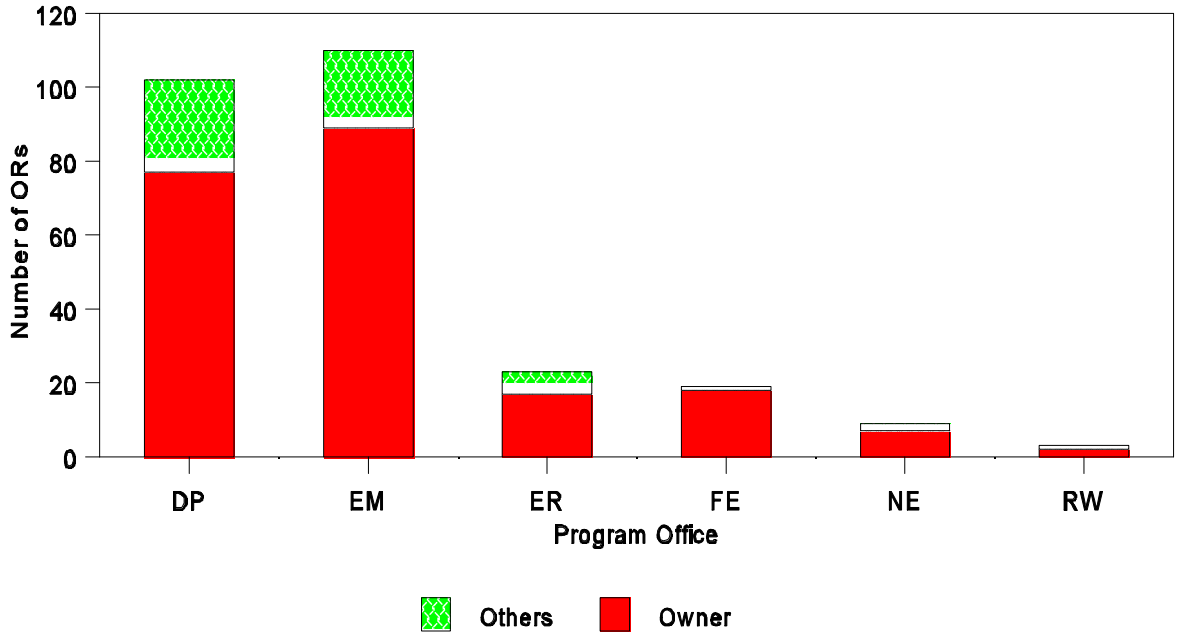

Fig. 8. OR distribution during 1993 by DOE Program Office.

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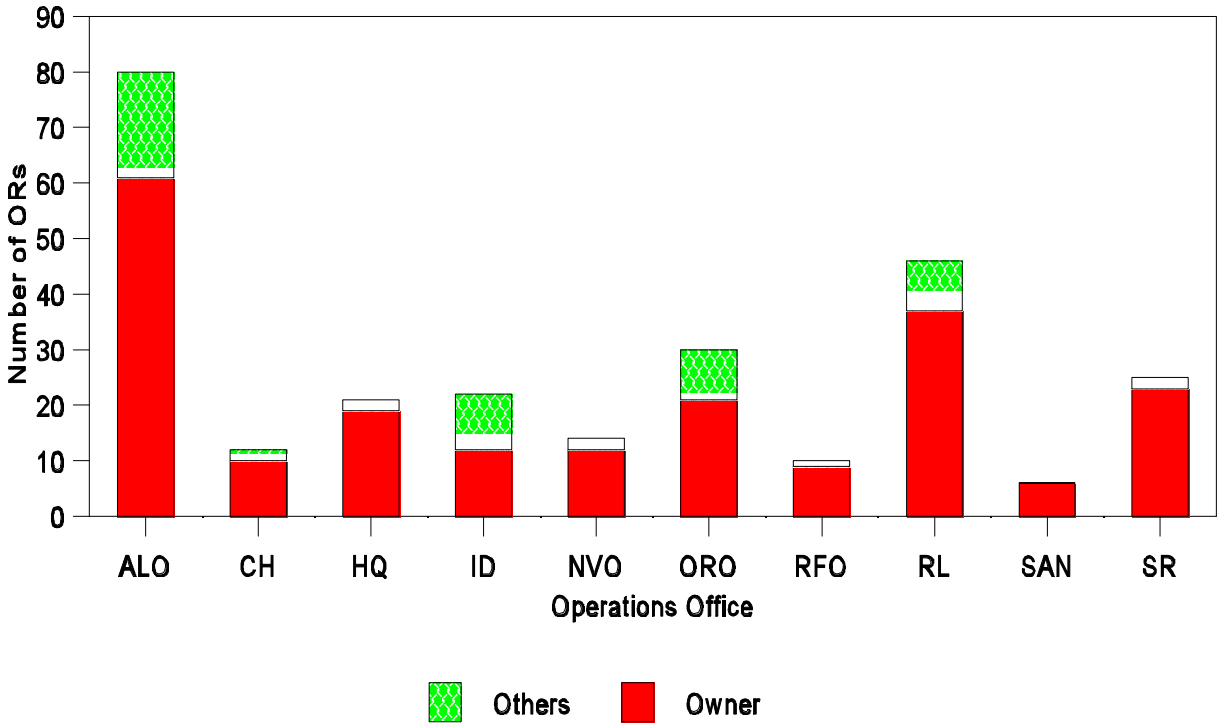

Fig. 9. OR distribution during 1993 by DOE Operations Office.

Operations Office (ALO), which reported 52 (28 of which were from the Material Warehouse). The Savannah River Operations Office (SR) reported 20 occurrences to DP, only one of which did not originate from Westinghouse Savannah River Company (WSRC).

From Table 7 it can be seen that the Operations Office that reported the most occurrences during 1993 was ALO, which received 80. The UMTRA Project was responsible for 23 of the ORs; another 20 was reported by LANL's Material Warehouse. The office which received the second largest number of reports was RL, with 46 ORs, 41 of which were reported by WHC.

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 will be called "ORPS-assigned" root cause to distinguish it from PATS-assigned NOC coding. Table 8 presents the ORPS root-cause codes from DOE 5000.3B.

The root causes of the occurrences, which were determined by the facility, were examined and compared. No changes or interpretations were made to the ORPS-assigned root cause. Root-cause assignment for the total ORs in the PATS_OR data base is given in Table 9. Because root-cause codes are generally assigned only to final reports, the reports listed in the table are final ORs. Table 10 gives a matrix of the PATS NOC codes and the ORPS root-cause codes. (Note that because the previous Table 4 total number of ORs in the data base includes ten-day reports, its total is more than those of Tables 9 and 10 because the totals of the latter are based on final ORs).

Table 8. ORPS root-cause codes

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. Contamination

2. Procedure Problem
   - 2A Defective or inadequate procedure
   - 2B Lack of procedure

3. Personnel Error
   - 3A Inadequate work environment
   - 3B Inattention to detail
   - 3C Violation of requirement or procedure
   - 3D Verbal communication problem]
   - 3E Other human error

4. Design Problem
   - 4A Inadequate man-machine interface
   - 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

Table 9. ORs of database classified according to root cause

Code	Onsite	Offsite	Total
1	35	51	86
2	33	25	58
3	72	70	142
4	14	10	24
5	11	12	23
6	69	58	127
7	4	6	10

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

Table 10. PATS NOC codes and ORPS root cause code

	PATS NOC CODE								
	1	2	3	4	5	6	7	8	
Root Cause									Total
1	32	1	1	2	2	15	0	33	86
2	12	3	2	1	12	3	14	11	58
3	24	6	1	1	24	41	17	28	142
4	7	4	0	0	2	4	5	2	24
5	4	1	0	0	7	1	8	2	23
6	38	9	4	2	19	15	27	13	127
7	1	0	1	0	0	3	2	3	10
Total	118	24	9	6	66	82	73	92	470

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

PATS NOC Codes
1. Contamination/Release
2. Packaging
3. Storage Incident to Transport
4. Quality Assurance
5. Shipment Preparation
6. Modal Safety
7. Operations
8. Occur

Table 9 shows that, almost equally, facilities have assigned personnel error and management problems as the most frequent root cause. The third highest cause of incidents was assigned to equipment/material problems. The assignment of these root causes suggests that EH-332 may be able to provide assistance in these areas to help prevent these incidents. Of course, more detailed analysis would be warranted before this conclusion could be made or a determination of the specific nature of the assistance could be determined. It is significant, though, that EH-332 has already determined that help is needed at the sites for training (to reduce personnel error) and in the identification and implementation of managerial responsibilities for the field elements.

Table 10 shows the PATS NOC code cross-referenced with the ORPS-assigned root cause. This very useful table gives the analyst an indication of what the specific problem is (NOC). Hence, the analyst has more information 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. The table shows that 33% of contamination incidents (NOC code 1) have been caused mainly by management problems (root cause code 6) and that 28% of contamination incidents have been caused by equipment/material problems (root cause code 1). Further, 29% of shipping preparation incidents (NOC code 5) have also been caused mainly by management problems (root cause code 6) and 36% of shipping preparation incidents have been caused by personnel error (root cause code 3). Modular safety incidents (NOC code 6) have overwhelmingly been caused by personnel error (50%). Operations-related incidents (NOC code 7) have been primarily caused by management (39%). Finally, occurrences caused by others have been attributed to equipment/material problems (36%) and personnel error (30%).

Section 3 has established the validity of the categorization of ORs by NOC coding. Table 10 shows that PATS NOC coding can be used with ORPS-assigned root cause coding to present more meaningful data. Classification by the NOC provides a useful tool and does not claim to be definitive. It complements the root cause assignment of ORPS and does not attempt to usurp the site's authority or responsibility by labeling its occurrences. Notwithstanding the possibility of subjectiveness in classification by NOC, PATS strives to classify the ORs consistently and performs quality checks of its work to assure uniformity.

Table 10 presents a table that reveals a great opportunity for analysis and for guidance for program direction. Technical Assistance Programs should focus on the root causes of the most prevalent occurrences. Assessments by HQ and Operations Offices should look to the chart for clues as underlying problems of a particular site. Analysis of this chart could provide the basis for future programs, though follow-up by PATS staff may be necessary to validate further the accuracy of the chart and supplement it with additional information.

5. EVALUATION OF EFFECTIVENESS OF CORRECTIVE ACTIONS

To determine the appropriateness of reported corrective actions to remedy an occurrence and prevent recurrence, 10% of the final ORs (not including actions created by others) were randomly checked. Final reports were evaluated because they contain the assigned root cause and corrective action. To achieve a representative spread of ORs, 10% of the number of packaging and transportation finals reported to an Operations Office were picked for detailed investigation of the effectiveness of close-out actions. If more than one OR was chosen to represent an Operations Office, a different reporting contractor was selected for the additional OR so that a broader perspective of responses could be evaluated. The discussion of these chosen ORs is presented in Appendix A.

The database contained 167 total packaging- and transportation-related ORs were finalized during 1993 and did not include occurrences created by others. Hence, review of 17 reports would be considered representative. However, because the number of occurrences reviewed per Operations Office were rounded upward to assure adequate coverage, and an additional OR was pulled for an Operations Office if there were some doubt of the effectiveness of closure of previous findings, a total of the corrective actions for 20 ORs were reviewed. Table 11 presents a summary of the ORs investigated and the evaluation of their corrective actions.

It must be emphasized that it will require more than reviewing a site's suggested corrective actions to determine whether the action is suitable to close-out an OR and prevent recurrence. More details surrounding the close-out, an understanding of site procedure, and the occurrence history

Table 11. Selected Off-normal categorized packaging and transportation finals occurring during 1993 (Evaluation of representative final packaging and transportation-related ORs corrective actions)

Ops Office	Total	Report Number	Description	Closure Effectiveness
ALO	55	ALO-LA-LANL-WASTEMGT-1993-0002	Rail guide roller bearing failure	Satisfactory.
		ALO--ROSS-TSS-1993-0001	Distance measuring equipment of helicopter failure	Satisfactory.
		ALO-LA-LANL-ESHSUPT-1993-0002	Incorrectly filled out waste form	Satisfactory.
		ALO-LA-LANL-MATWAREHS-1993-0001	Suspect counterfeit bolts in forklift	Will mitigate but not eliminate.
		ALO-AO-MHSM-PANTEX-1993-0041	Improper instrument used for radiation measuring	Satisfactory.
CH	9	CH-BH-BNL-BNL-1993-0012	Rad-contaminated gas cylinder	Satisfactory.
HQ	21	HQ--BPOI-NPRC-1993-0005	Tank overflow due to instrument air failure	Uncertain.
		HQ--FDS-NPOSRCUW-1993-0008	Old flowline failure, spilling oil	Unsatisfactory.
ID	8	ID--EGG-ATR-1993-0007	Transfer of spent solvent without manifest	Satisfactory.
		ID--WVNS-EOT-1993-0006	Incorrect markings on shipping paper	Satisfactory.
NVO	10	NVOO--EGGO-RSLO-1993-0004	Engine problems with helicopter	Uncertain.
		NVOO--REEC-SSDO-1993-0003	Leak from "empty" chlorine gas cylinder	Satisfactory.
ORO	14	ORO--MMES-PGDPGENPLT-1993-0001	Radiological survey missed on vendor vehicle	Satisfactory.
		ORO--MMES-X10IANDC-1993-0001	An $18,500 trash monitor felled from forklift	Satisfactory.
RFO	5	RFO--EGGR-SUPPORT-1993-0005	Scrap empty drums found contaminated	Satisfactory.
RL	25	RL--KEH-KEH-1993-0016	Tractor trailer fuel tank damaged, spilling fuel	Satisfactory.
		RL--WHC-SOLIDWASTE-1993-0003	Incompatible waste packaged together	Uncertain.
		RL--WHC-TPLANT-1993-0002	Almost violating the 90-day storage requirement	Satisfactory.
SAN	2	Two few ORs for statistical inclusion		
SR	18	SR--WSRC-HBLINE-1993-0002	Unposted operating room found contaminated	Satisfactory.
		SR--WSRC-REACL-1993-0013	Improperly secured box cover felled off	Satisfactory.
Total	167			

need to be known. Therefore, the evaluations made on the effectiveness of close-out must be seen as opinion based on a limited

presentation of facts and information contained in the OR itself. The evaluation does give a guide of how a packaging and transportation specialist or independent appraiser may view a site's corrective actions. In all likelihood, the appraiser would chose to follow-up on the OR and corrective actions as part of his review and evaluation.

All finals of "unusual" or "emergency" ORs were investigated for effectiveness of closeout actions. Of all the ORs reported in the Weekly Reports during 1993, 16 were categorized as "unusual." Ten of these were finalized, and two of the finals were downgraded to the off-normal category. Moreover, an occurrence that was initially reported as off-normal was upgraded and categorized as an unusual occurrence. An evaluation of the effectiveness of the corrective actions proposed and completed to address the occurrence and prevent recurrence is presented in Table 12. Table 12 also contains the final of an OR that was categorized as "emergency." The other 1993 emergency-categorized occurrence has not yet been finalized. A more detailed discussion of the ORs of Table 12 is presented in Appendix A.

It is not useful to evaluate the unusual reports that are still ten-day reports because, in general, they have not been evaluated by the site to the degree that meaningful corrective actions could be assigned. One of the two occurrences which was downgraded from the unusual category was ALO--TSD-TSS-1993-0002. The reason offered for its downgrade to an off-normal was that "its review was nearing the completion of the review cycle." The other occurrence, SR--WSRC-REACP-1993-0018, which was downgraded after a critical evaluation of the OR by established procedure, revealed that it was less serious than initially categorized. One OR was upgraded to unusual because a vehicular accident victim died.

6. TIMELY UPDATE OF TEN-DAY REPORTS TO FINALS

Because the root cause and the associated corrective actions are such a valuable tool for assessors to use to identify program deficiencies and because these data are not a required until the OR is final, we performed an analysis on the timeliness of the packaging- and transportation-related ORs that were categorized after March 22, 1993, when DOE 5000.3B became effective. This

Table 12. Unusual- and emergency-categorized finals occurring during 1993
(Evaluation of packaging and transportation-related emergency (E)
or unusual (U) ORs corrective action)

Report Number	Category	Description	Closure Effectiveness
ALO-KC-AS-KCP-1993-0019	E	PCB spill resulted from a single vehicle accident	Satisfactory.
ALO-AO-MHSM-PANTEX-1993-0008	U	loading dock limit for high explosives and PU exceeded	Satisfactory.
ALO-KO-SNL-2000-1993-0003	U	nitrogen gas cylinder contaminated with CO-60	Satisfactory.
ALO-LA-LANL-MATWAREHS-1993-0007	U	3 improperly labeled packages containing radioactive sources	Satisfactory.
ALO-LA-LANL-PHYSCOMPLX-1993-0004	U	a shipped electronics test chamber found to be contaminated	Satisfactory.
HQ--FDS-NPOSRCUW-1992-0057	U	0.5 bbl of oil leaked from corroded flowline	Satisfactory.
HQ--FDS-NPOSRCUW-1992-0059	U	2 bbl of oil and 20 bbl water leaked from injection line	Satisfactory.
HQ--SPR-BM-1993-0004	U	brine pipeline leaked, contaminating ~1250 yd^2	Will limit but not eliminate.
ORO--MKFO-Y12CENTENG-1993-0009	U	employee who was speeding died in vehicle accident	Satisfactory.
SR--WSRC-LTA-1993-0026	U	high gamma contamination on waste trailer	Satisfactory.

Order included time requirements in its reporting criteria for finalizing reports. It can be seen from Fig. 10 that approximately 50% of the packaging- and transportation-related ORs were finalized within 68 calendar days. The 68-calendar-day period is derived from the time limits for OR processing in the Order (45 calendar days from categorization to Facility Manager submittal, 9 calendar days for Facility Representative approval, and 14 calendar days for Program Manager approval). This percentage is much higher than an analysis reported by both DP in its quarterly reports and the ORPS quality assessment, which was sponsored by EH-63.

Because the majority of the packaging- and transportation-related ORs are being finalized in compliance with the Order, timeliness will continue to be monitored but timeliness probably will not be included in the next report.

7. CONCLUSION

This annual is an oversight tool and may be the basis for further examination of ORs. For example, perhaps he evaluation of 10% of the ORs for the effectiveness of closure of corrective actions is not sufficient. It may be appropriate for PATS to investigate all ORs for effectiveness of closure. What certainly will be necessary is for someone associated with PATS to establish a direct line of communication with the initiators and approvers of ORs. More detail on the occurrences is needed for better analysis. It could not be determined whether the downgrade of the two unusual ORs to off-normal was appropriate because limited information was provided and because PATS did not have the authorization to contact the sites for clarification.

This annual study did establish that PATS categorization by NOC was an effective means of highlighting packaging- and transportation-weaknesses. Table 10, PATS NOC codes and ORPS root cause code, should be of use to (1) assessors to identify likely program deficiencies and root causes, (2) sites to identify issues that need to be addressed to establish a more effective packaging and transportation program, and (3) HQ to aid in determining where and assistance to the respective Operations Offices might be needed.

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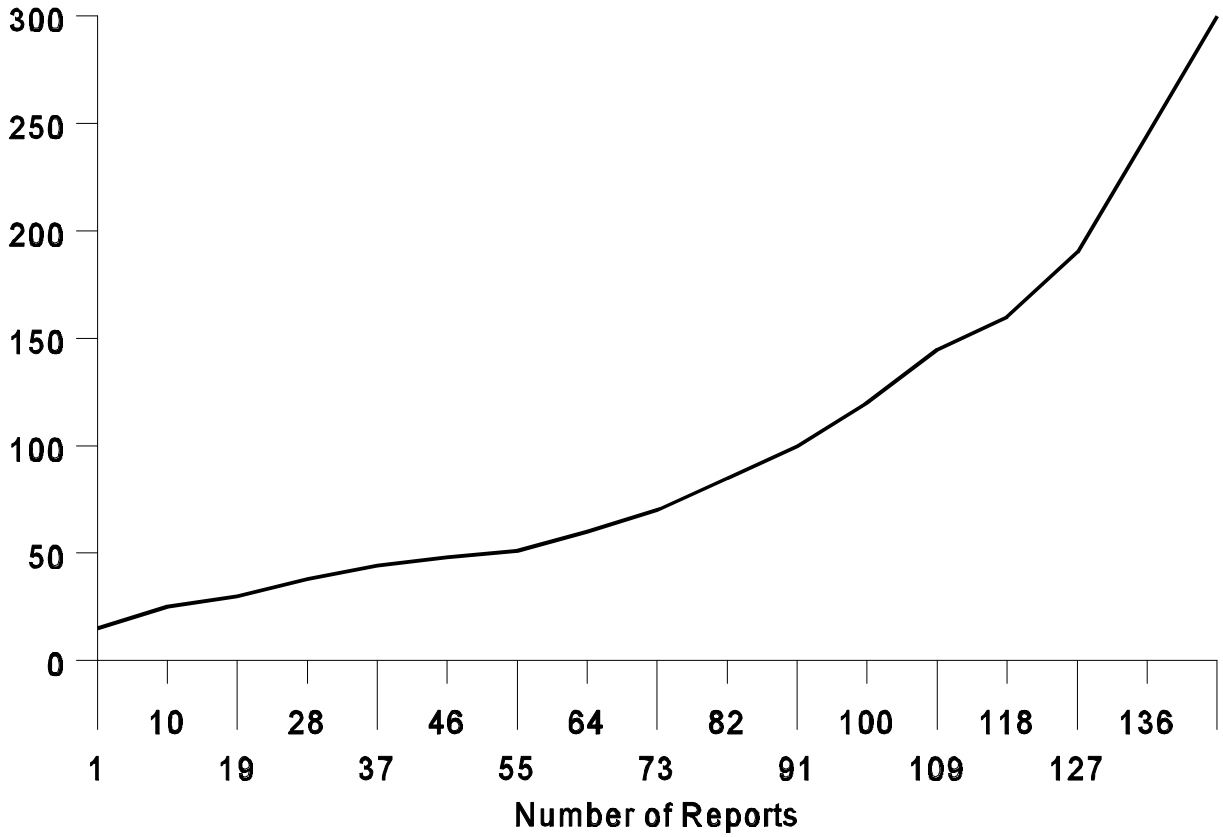

Fig. 10. Timeliness of final reports.

APPENDIX A. EVALUATION OF EFFECTIVENESS OF CORRECTIVE ACTIONS

Off-normal Final ORs

Report Number: **ALO-LA-LANL-WASTEMGT-1993-0002**

Description: A rail guide roller bearing and associated mounting hardware (~500 gram weight) came loose from a 10-ton overhead crane and fell, almost hitting an employee.

Corrective Actions: Replacement of the guide, realignment of the end trucks, and a new design from the crane design company of the roller guide's adjustment slot to prevent rail contact.

Closure Effectiveness: These actions seem to be sufficient to prevent recurrence of such an event.

Report Number: **ALO--ROSS-TSS-1993-0001**

Description: The failure of distance measuring equipment in an aircraft caused the plane to abort its trip and return to its origination point.

Corrective Actions: Maintenance Action Documents issued for visual inspection of all similar parts; Federal Aviation Administration (FAA) contacted and asked to review report and consider if an Airworthiness Directive is necessary; requested that all modifications to instruments from the parent company be sent direct to Ross Aviation for monitoring.

Closure Effectiveness: Satisfactorily closed.

Report Number: **ALO-LA-LANL-ESHSUPT-1993-0002**

Description: A shipment of LSA radioactive material was transported onsite with an incorrectly filled out waste form.

Corrective Actions: A procedure was issued that stated all hazardous material shipping documentation must be reviewed and approved by Material Packaging and Transportation; and additional training was provided.

Closure Effectiveness: Seems satisfactory.

Report Number: **ALO-LA-LANL-MATWAREHS-1993-0001**

Description: Seven suspect counterfeit Grade 5 bolts identified in the hydraulic fork of a Toyota forklift.

Corrective Actions: Bolts were removed and replaced. Distribution of the unsatisfactory report was sent to the vendors, maintenance, the buyer, the inspectors, and the purchaser to make them aware of counterfeit bolts.

Closure Effectiveness: It is questionable that these actions will prevent recurrence since some

of the manufacturers and suppliers are unfamiliar with suspect counterfeit components and fail to recognize them when they are fabricating their products. However, this increased vigilance may reduce the number of occurrences of this type.

Report Number: **ALO-AO-MHSM-PANTEX-1993-0041**

Description: A package was shipped from Pantex which exceeded DOT radiation limits because of the use of an improper instrument for measuring radiation.

Corrective Actions: The mistake was recognized and use of an instrument with the beta window open for package surveys was recommended. Existing packages were resurveyed with the appropriate instrument, and the most conservative reading was used on the package. The operating procedure was revised to clearly state the radiation exposure survey requirements for packages; and training on the revised procedure was conducted.

Closure Effectiveness: Seems satisfactory.

Report Number: **CH-BH-BNL-BNL-1993-0012**

Description: A gas cylinder returned by a vendor was found to be radioactively contaminated.

Corrective Actions: Supply and Material drivers will document that they have driven through the vehicle monitor. Cylinders will be required to be surveyed before being picked up for transport.

Closure Effectiveness: Actions taken seem satisfactory.

Report Number: **HQ--BPOI-NPRC-1993-0005**

Description: A mixture of approximately 45 barrels of oil and 5 barrels of water overflowed from a tank when the instrument air failed because it had not been turned on after servicing. The lack of instrument air pressure caused the oil separator to carry over into the gas line which resulted in the relief regulator opening to the skim tank, allowing the overflow.

Corrective Actions: The instrument air was simply restored, and a vacuum truck was used to remove the standing liquid.

Closure Effectiveness: These actions of themselves do not appear to be sufficient to prevent recurrence. Possibly additional training, follow-up checks of work, the use of a checklist, or closer supervision should have been stressed as part of the corrective actions.

Report Number: **HQ--FDS-NPOSRCUW-1993-0008**

Description: A old flowline failed, spilling 2.5 barrels of oil to the ground.

Corrective Actions: A pipe repair clam was installed, and the well was returned to production.

Closure Effectiveness: Inadequate to prevent recurrence. The line that failed was in an older

part of the field which has degraded over time and will require upgrading. As stated in the Final Evaluation and Lessons Learned: ... need to accelerate replacement of pipe in these areas should be done as economics of the project permit.

Report Number: **ID--EGG-ATR-1993-0007**

Description: A spent solvent was being transported by a vendor without a hazardous waste manifest. This vendor had previously been disqualified to service EG&G because of an unsatisfactory hazardous waste shipping and handling compliance record.

Corrective Actions: Refresher training was provided to (1) personnel who oversee subcontract work maintenance planners, and (2) personnel who authorize or initiate shipments to ensure that they consult experts when needed.

Closure Effectiveness: Seems satisfactory.

Report Number: **ID--WVNS-EOT-1993-0006**

Description: Post-shipment review of documentation revealed incorrect markings on shipping paper.

Corrective Actions: Conducted additional training for all personnel involved in the preparation and review of shipping documentation.

Closure Effectiveness: Seems satisfactory.

Report Number: **NVOO--EGGO-RSLO-1993-0004**

Description: Low rotor rotations per minute caused engine problems resulting in the emergency landing of a helicopter.

Corrective Actions: The failed part was replaced.

Closure Effectiveness: Uncertain that this will prevent future problems.

Report Number: **NVOO--REEC-SSDO-0003**

Description: An "empty" chlorine gas cylinder leaked about 3 to 5 pounds of gas because its check valve was not closed. (Empty cylinders generally contain 3 to 5 pounds of residual gas.)

Corrective Actions: The cylinder was isolated and allowed to vent. New procedures state that the user will assure that the cylinder is closed and that the storage area should check inhalation poisonous gas cylinders as they are returned.

Closure Effectiveness: Seems satisfactory.

Report Number: **ORO--MMES-PGDPGENPLT-1993-0001**

Description: Vendor vehicle allowed to leave the plant site without a radiological survey being performed, as required by procedures.

Corrective Actions: Carrier given verbal instructions concerning their responsibility to be monitored before returning to service. A monitoring checklist was implemented with designated sign-offs for the driver, escort, and HP technician.

Closure Effectiveness: Seems satisfactory.

Report Number: **ORO--MMES-X10IANDC-1993-0001**

Description: A trash monitor valued at $18,500 slid off its cart while on a forklift and was destroyed in the fall.

Corrective Actions: Training sessions were conducted to instruct riggers on proper fastener verification procedures and practices.

Closure Effectiveness: Seems satisfactory.

Report Number: **RFO--EGGR-SUPPORT-1993-0005**

Description: A subcontractor was reducing 70 empty product drums to scrap when monitoring revealed that 3 of the drums were radiologically contaminated. Old detection devices had missed the spot contamination.

Corrective Actions: Radiological Operation Instruction Manual and Health & Safety Practice Manual have been revised. Newer more sensitive radiological monitoring equipment will be used to detect low level radiation.

Closure Effectiveness: Seems satisfactory.

Report Number: **RL--KEH-KEH-1993-0016**

Description: The fuel tank of a tractor trailer struck a valve box, which caused a rupture that spilled 40-50 gallons of diesel fuel.

Corrective Actions: Driver counseled on the importance of inspecting the worksite for obstacles prior to entry.

Closure Effectiveness: Since this was personnel error, the action taken is sufficient but recurrence cannot be ruled out.

Report Number: **RL--WHC-SOLIDWASTE-1993-0003**

Description: Because of a caustic solid being mistakenly designated as an acid liquid, incompatible waste was packaged together. The waste designator's (who had two weeks operational experience and was performing the work as part of the on-the-job training) analysis data is supposed to be oversighted by a reviewer and an approver prior to issuance of the

Hazardous Waste Disposal Analysis Record.

Corrective Action: Management conducted a safety meeting to discuss this incident and necessary measures to prevent recurrence. Additional emphasis has been placed on performing a detailed review of waste analysis.

Closure Effectiveness: The corrective actions seem insufficient to prevent recurrence of the problem. Possibly an experienced reviewer should work more closely with the trainee during the first months to ensure quality. Perhaps a checklist should be signed to ensure that corrected analysis report data is transferred to the Hazardous Waste Disposal Analysis Record (which provides direction to the generator for packaging and labeling).

Report Number: **RL--WHC-TPLANT-1993-0002**

Description: Adverse shipping conditions caused the scheduled shipment of radioactive, hazardous liquid waste to be delayed, which threatened to result in the violation of the requirement to ship hazardous waste within 90 days of generation.

Corrective Action: Because of an extension for additional time being requested and approved before the violation actually occurred, this event has been determined to be a non-reportable occurrence.

Closure Effectiveness: Satisfactory.

Report Number: **SR--WSRC-HBLINE-1993-0002**

Description: An operating room was erroneously posted as no detectable contamination with no respiratory requirements necessary. The room contained relocated waste pails of which personnel were not aware.

Corrective Action: Modified health physics procedures to include surveys of transuranic pails after that have been relocated to storage areas.

Closure Effectiveness: Seems satisfactory.

Report Number: **SR--WSRC-REACL-1993-0013**

Description: An improperly secured cover dropped from a box during transport.

Corrective Actions: Required all construction craft personnel to review the pertinent procedure on securing and tieing down loads and adhere to its requirements.
Closure Effectiveness: Seems satisfactory.

Emergency and Unusual Final ORs

Report Number: **ALO-KC-AS-KCP-1993-0019**

Description: Approximately 500 pounds of PCB-contaminated soil spilled to the ground after a single vehicle accident. Additionally, about 2000 pounds of soil were inadvertently spilled to the ground during clean up operations. It is estimated that 3.25 pounds of PCBs were released during these spills.

Corrective Actions: No corrective actions set by AlliedSignal could have prevented this occurrence. They state that DOT has jurisdiction over this occurrence.

Closure Effectiveness: Satisfactory.

Report Number: **ALO-AO-MHSM-PANTEX-1993-0008**

Description: While unloading weapons at an onsite dock, the posted high explosives weight limit and the limit for plutonium on the dock were exceeded because of an insufficient procedure.

Corrective Actions: The procedure was revised to require the Transportation Supervisor to be present during all loading and unloading operations of weapons.

Closure Effectiveness: Satisfactory.

Report Number: **ALO-KO-SNL-2000-1993-0003**

Description: A nitrogen gas cylinder was found to have fixed radiological contamination of cobalt-60 during a routine baseline survey. (Gas cylinders are not ordinarily surveyed, and this cylinder was not labeled radioactive.)

Corrective Actions: An ES&H Operating Experience Report was prepared and issued which described considerations for transferring contaminated items both on and offsite.

Closure Effectiveness: Satisfactory.

Report Number: **ALO-LA-LANL-MATWAREHS-1993-0007**

Description: Two 30-gal drums containing Americium-Beryllium neutron source and a 5-gallon drum containing a single 5 curie Am-Be neutron source were improperly labeled; too, the transport vehicle was improperly placarded. This shipment was received from another site at the Nuclear Regulatory Commission's (NRC) request.

Corrective Actions: The unspecified NRC-shipper was informed of the problem, and a requirement to follow the procedure for all neutron source shipments was made.

Closure Effectiveness: Satisfactory.

Report Number: **ALO-LA-LANL-PHYSCOMPLX-1993-0004**

Description: An electronics test chamber which had not been surveyed for direct beta-gamma was found to be internally contaminated, probably from Californium-252 activity.

Corrective Actions: The Radiological Control Manual procedures for performing radiological surveys was amended and additional employee training was provided.

Closure Effectiveness: Satisfactory.

Report Number: **HQ--FDS-NPOSRCUW-1992-0057**

Description: About 0.5 barrels of oil leaked from corroded flowline and covered 75 yards of a creek's tributary.

Corrective Actions: The aged line was shut in and abandoned; spill was washed downstream and picked up by vacuum truck.

Closure Effectiveness: Satisfactory.

Report Number: **HQ--FDS-NPOSRCUW-1992-0059**

Description: Internal corrosion of a water injection line allowed 2 barrels of oil and 20 barrels of water to leak. A check valve failure was also responsible for the leak developing.

Corrective Actions: The line was shut in and abandoned; the spill was recovered.

Closure Effectiveness: Satisfactory.

Report Number: **HQ--SPR-BM-1993-0004**

Description: A brine pipeline (which has a history of failure due to corrosion) leak allowed ~1250 square yards of contamination to the Gulf.

Corrective Actions: Limit use of the line for brine disposal and provide visual observation for possible leaks of the line during all brine disposal operations. It is recognized that a new brine line needs to be constructed.

Closure Effectiveness: Leaks will be minimized but will likely not be eliminated.

Report Number: **ORO--MKFO-Y12CENTENG-1993-0009**

Description: An employee who was speeding (and suspected of not wearing a seatbelt) died as the result of a vehicle accident; the vehicle was extensively damaged. This event was upgraded from an offnormal to an unusual occurrence because the injured employee died following the initial report.

Corrective Actions: The vehicle safety program was strengthened to require defensive driver training for employees and subcontractors. Central Management will also conduct regular, unannounced surveys to verify seat belt usage.

Closure Effectiveness: Satisfactory.

Report Number: **SR--WSRC-LTA-1993-0026**

Description: High gamma radiation contamination was discovered on the treads of a waste trailer's tires. The trailer is allowed to be transported with fixed contamination on the tires, but the tires were not adequately surveyed.

Corrective Actions: Communicate new policy of checking all accessible tire surfaces on the high level waste trailer for fixed or transferable contamination.

Closure Effectiveness: Satisfactory.