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August 1998

DOE Performance Indicators

Environment, Safety & Health

Period Ending March 1998

DOE Operating Experience Analysis
Safety Management Through Analysis
http://tis.eh.doe.gov/web/oeaf/

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Introduction

As we were preparing this report for print, we were especially disheartened to learn that DOE suffered its first fatality of FY1998. An electrician at the Test Reactor Area, Idaho National Engineering and Environmental Laboratory was killed July 28th when fire retardant carbon dioxide was accidentally released during routine maintenance. Just 65 days short of achieving our first fatality free fiscal year in recent memory, the accident is a somber reminder of the constant vigilance required to achieve and maintain a safe and healthy workplace for all DOE complex workers.

Trends

In reviewing overall trends for the past two years, the following general observations can be made: Four of the indicators demonstrated favorable trends, six of the indicators demonstrated unfavorable trends, and eleven of the indicators demonstrated no significant trends.

Indicators showing favorable trends are as follows:

- OSH Cost Index - The DOE-wide occupational safety and health cost index for 1997 decreased to 16.3 from a six-year average of 25. Although revisions in lost work time and late reporting will cause some increases in the cost index, the downward trend is expected to continue. (PI-2)
- Environmental Releases - The data reflected a downward trend over the past 16 quarters with the number of environmental releases remaining well below the five-year average of 64. (PI-6)
- Environmental Permit Exceedances - After an increase in the number of permit exceedances from 1993 to 1995, the exceedances for 1996 showed a 20 percent decrease from those tabulated in 1995. In 1996, as in previous years, the vast majority (96.5 percent) of exceedances was due to violations of Clean Water Act permits for discharge to surface waters. (PI-8)
- Inadequate Procedures/Procedures Not Followed – This quarter's data strengthens the observation of a decreasing trend in procedure-related problems since 93Q1. This trend was especially apparent since 94Q3. The number of events involving procedure violations or inadequacies in 98Q1 decreased by 12 percent when compared to the number of events reported in 97Q4 (263). (PI-13)

Several indicators show either a potential decrease in performance or a need for a focused effort to reverse the trend:

- Chemical Hazard Events - Since 97Q1, there has been an increasing trend in the number of chemical hazard events. In 98Q1, the number of events (109) rose above the five-year average of 96 for the first time since 96Q4 and had the largest number of events since 95Q4. Further, the more serious class 1 and 2 events showed an increase for the past five quarters. Reasons for this increase may include increased emphasis on reporting chemical hazards following the Hanford Plutonium Finishing Plant incident of May 1997 and increased deactivation, decontamination, and decommissioning activities. (PI-5)
- Cited Environmental Violations - The number of violations of the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) continues to increase as it has for the past two and one-half years. Half the violations cited in 98Q1 involved RCRA. More than half of the total violations cited in 98Q1 resulted from an EPA comprehensive inspection at Brookhaven National Laboratory in 1997 following identification of tritium contamination in groundwater at the High Flux Beam Reactor. (PI-7)

- Radiological Events – Although the number of radiological events reported per quarter since 96Q1 demonstrated no statistically significant trend, the number of internal contaminations have increased. There were nine reported internal contaminations in 98Q1 compared to four reported in 97Q4. (PI-11)
- Industrial Operations Safety - The majority of industrial operations events and near misses involved employees of subcontractors working for the site prime contractors. Although subcontractors perform a large fraction of the hazardous work in the DOE complex, the occurrence reports indicate that this might be a reflection of less safety training and awareness of safe work practices by subcontractors (as compared to prime contractors) and poor interaction between the prime contractor and subcontractors. (PI-4)
- Safety System Actuations - The number of safety system actuation events reported in 98Q1 was consistent with the average number of actuation events reported since 96Q1, with more than half involving non-spurious actuation of alarms. System failures, primarily in process ventilation and electrical systems, continue to constitute a significant portion of the safety system actuations reported. (PI-14)
- Price Anderson Amendments Act Enforcement - The number of cases self-identified by the responsible contractor via the Noncompliance Tracking System continues to be a small fraction (7.5 percent) of the total reported cases. As expected, the total number of cases continues to increase with the continuing development of the enforcement program infrastructure, the issuance of guidance documents, and the dissemination of information. (PI-18)

Detail Opportunities

Detail slots are still available in our office for FY99. We bear most of the travel/living expenses for these details. Over the past two years, four detailees from the field have gained a better understanding of Headquarters' operations by participating in our analyst detailee program. We most recently hosted two Russian engineers representing GAN, Russia's Federal Nuclear and Radiation Safety Authority (GOSATOMNADZOR). We believe these detail opportunities are mutually beneficial. We gain valuable field insights and experience to improve our products and you gain exposure to ES&H analysis techniques and a Headquarters perspective on the development and utility of emerging programs. All past detailees have indicated that they increased their knowledge and skills in analysis of environment, safety and health data. If you or someone you know is interested in our detailee program, please email an attached resumé to Andy.Marchese@eh.doe.gov.

On the Web

This report and additional analytical tools, techniques, and data can be found at our Internet Web site. Please visit us at http://tis.eh.doe.gov/web/oeaf.

Tom Rollow, PE
Director
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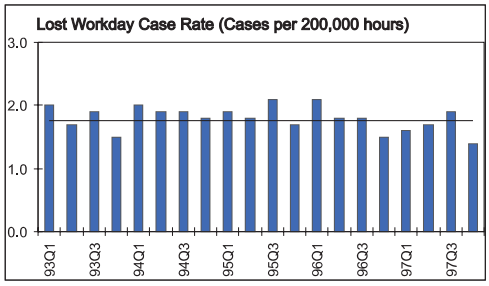
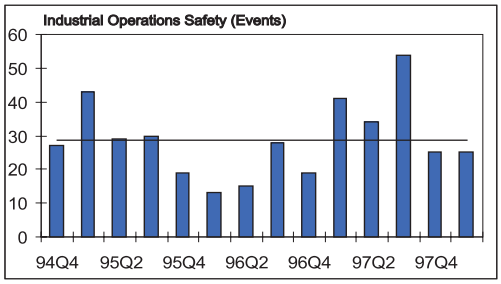
Management Summary

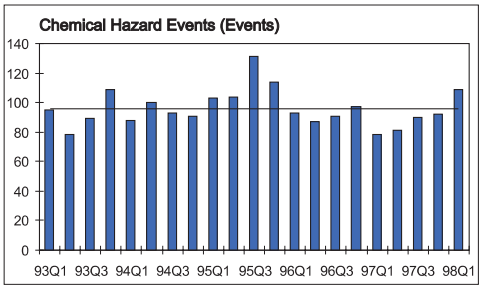
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. The horizontal lines on the graphs represent the DOE averages. Quarterly data is presented as calendar quarters.



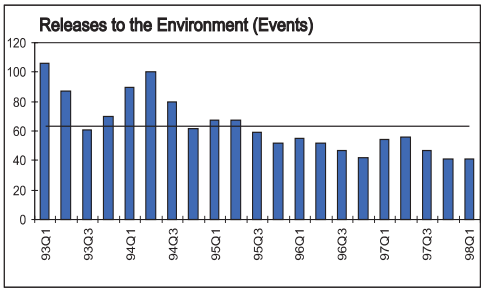
A lost workday case is a work-related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday Case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



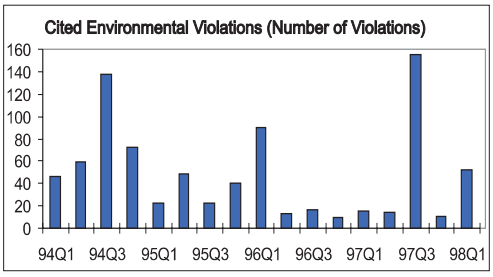
The number of operations-related events involving construction equipment, machining operations, forklift operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



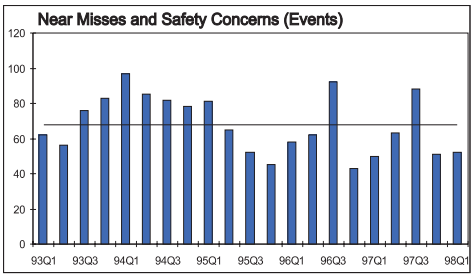
The number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Number of environmental violations cited in enforcement actions by regulators at DOE facilities.



A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain.

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List of Performance Indicators

The performance indicators are organized into four major categories. The numbers correspond to the section numbers used in this report.

1. Accidents/Events that have already happened

Accidents/Events are injuries, fatalities, releases, uptakes, etc.

1. Lost Workday Case Rate
2. Occupational Safety and Health Cost Index
3. Electrical Safety
4. Industrial Operations Safety
5. Chemical Hazard Events
6. Reportable Occurrences of Releases to the Environment
7. Cited Environmental Violations
8. Environmental Permit Exceedances
9. Radiation Dose to the Public
10. Worker Radiation Dose
11. Radiological Events

2. Precursors to accidents and near misses

Precursors are events that resulted in significant reduction of barriers that are depended upon for safety.

12. Near Misses and Safety Concerns
13. Inadequate Procedures/Procedures Not Followed
14. Safety System Actuations
15. Safety Equipment Degradation

3. ES&H Management

ES&H Management includes work planning, training, manager and worker involvement, and regulatory compliance.

16. Environmental Compliance Milestones Met
17. Open DNFSB Recommendations
18. Price-Anderson Amendments Act Enforcement

4. Hazards level of material at risk

Working with the program offices and sites, we hope to show how DOE is reducing hazards and vulnerabilities.

19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved
20. HEU Vulnerabilities Resolved
21. Waste Generation

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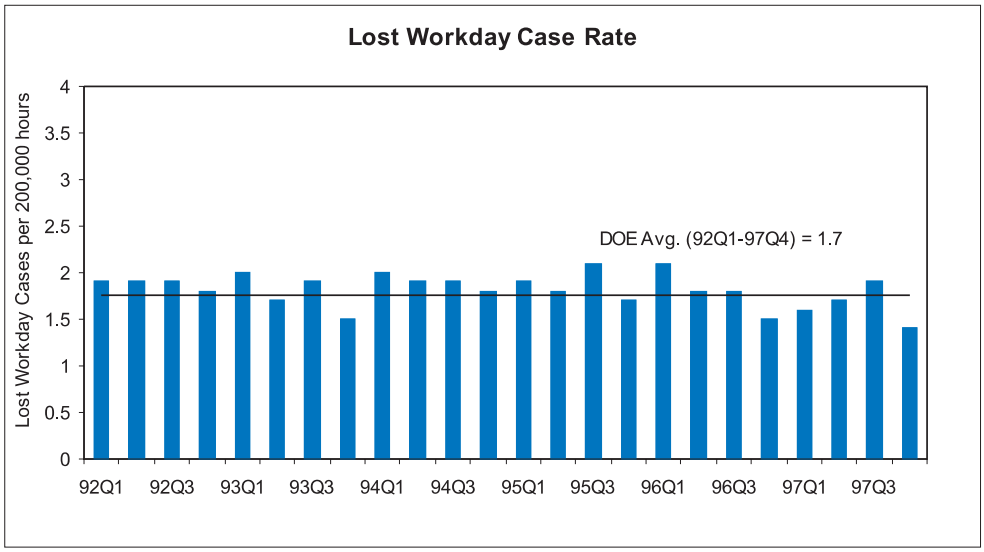
Indicator

1. Lost Workday Case Rate

Definition

Work-related injury or illness, beyond the day of injury or onset of illness, that involves days away from work or days of restricted work activity, or both.

Lost Workday Case (LWC) Rate is the number of lost workday cases per 200,000 hours worked. This rate does not include Federal employee lost workday cases.

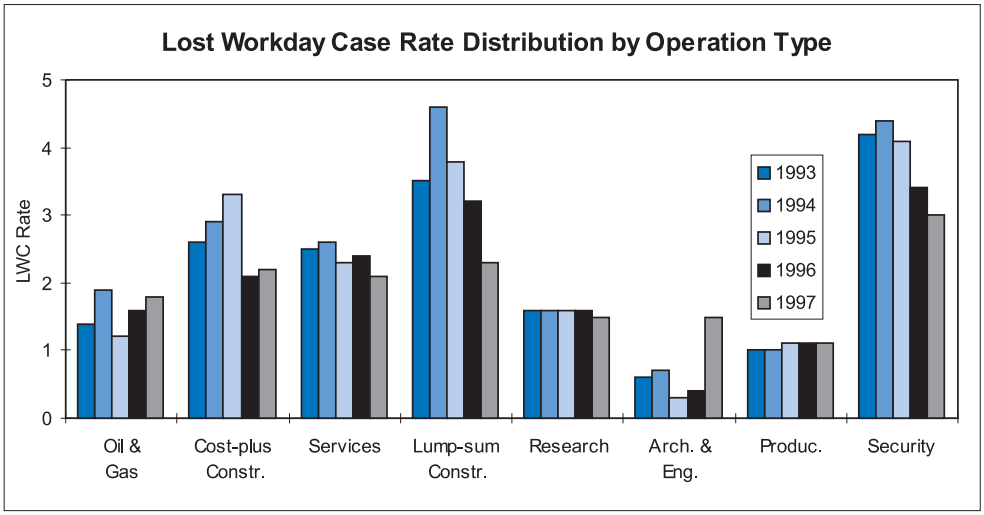


Source: DOE Data—Computerized Accident/Incident Reporting System

Key Observations

- The DOE lost workday case rate decreased from 1.9 in 1994 to 1.7 in 1997.
- Preliminary data for 1997 indicate there were 2,060 lost work day cases serious enough to cause either days away from work, days of restricted work activity, or both.
- The average number of total lost workdays per lost workday case was 21.2 days for 1997.

Distribution by Operation Type



- For 1997, the highest rate by operation type was security operations at 3.0. Construction and security also experienced rates above the Departmental year-to-date average.
- In 1997, 42 percent of all lost workday cases reported were serious enough to require days away from work. Workers in production, security, and research activities averaged 24.4, 22.2 and 21.5 lost workdays per lost workday case, respectively.
- For 98Q1, production, research, and services operations accounted for 80 percent of all lost workday cases.
- The 1997 preliminary DOE contractor rate for cases involving days away from work was 0.69 cases per 200,000 hours worked; this contrasted with a rate of 0.84 cases per 200,000 hours worked for 1996.

Additional Analysis

Indicator

2. Occupational Safety and Health Cost Index

Definition

Represents the approximate amount of dollars lost (indirect and direct) per 100 hours worked for all injuries/illnesses using the following formula. The coefficients used in the Cost Index formula are weighing factors derived from a study of the direct and indirect dollar costs of injuries. The index is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. This index does not include the cost associated with injuries/illnesses of Federal employees. The index is computed as follows:

Cost Index = 100 [(1,000,000) * D + (500,000) * T + (2,000) * LWC
+ (1,000) * WDL + (400) * WDLR + (2,000) * NFC] / HRS

where

D = the number of fatalities,

T = the number of permanent transfers or terminations due to occupational illness or injury,

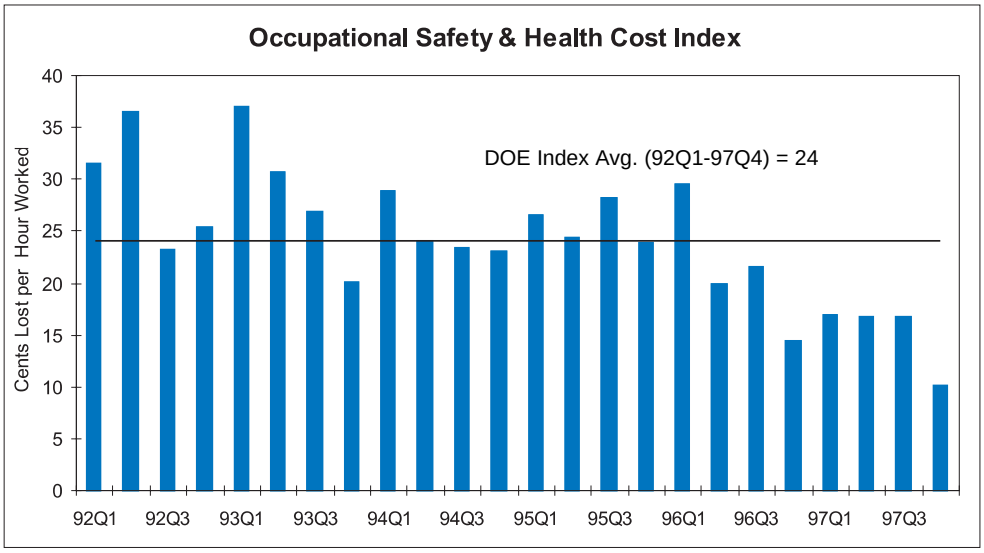
LWC = the number of lost workday cases,

WDL = the number of days away from work

WDLR = the number of restricted workdays,

NFC = the number of non-fatal cases without days away from work or restricted workdays, and

HRS = the total hours worked.



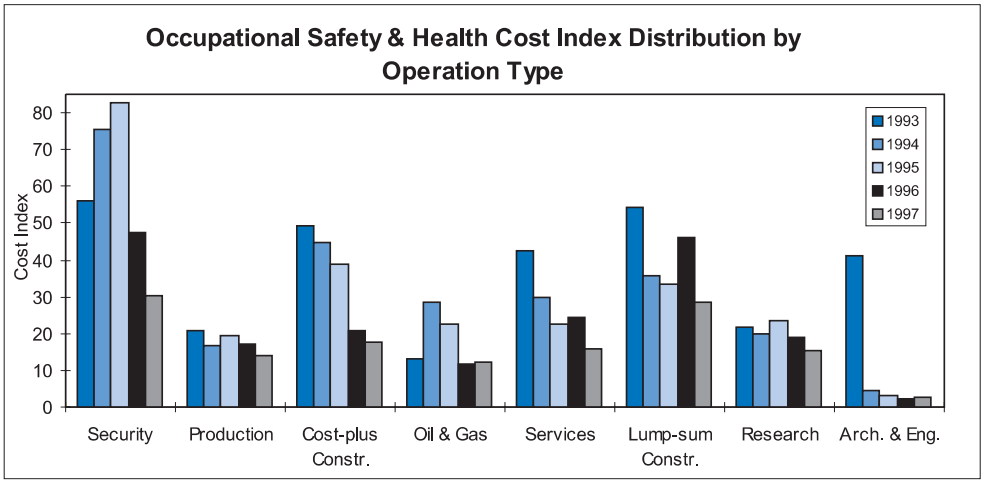
Source: Computerized Accident/Incident Reporting System.

Key Observations

- The DOE-wide cost index for 1997 was 16.34. Revisions and late reports are expected to cause this figure to increase. For example, the preliminary 1996 cost index was 17.10, but based on current information the 1996 cost index was 22.38.
- Although revisions in lost worktime and late reporting will affect the cost index, the overall downward trend is expected to continue based on previous adjustments to quarterly data.

Distribution by Operation Type

Additional Analysis



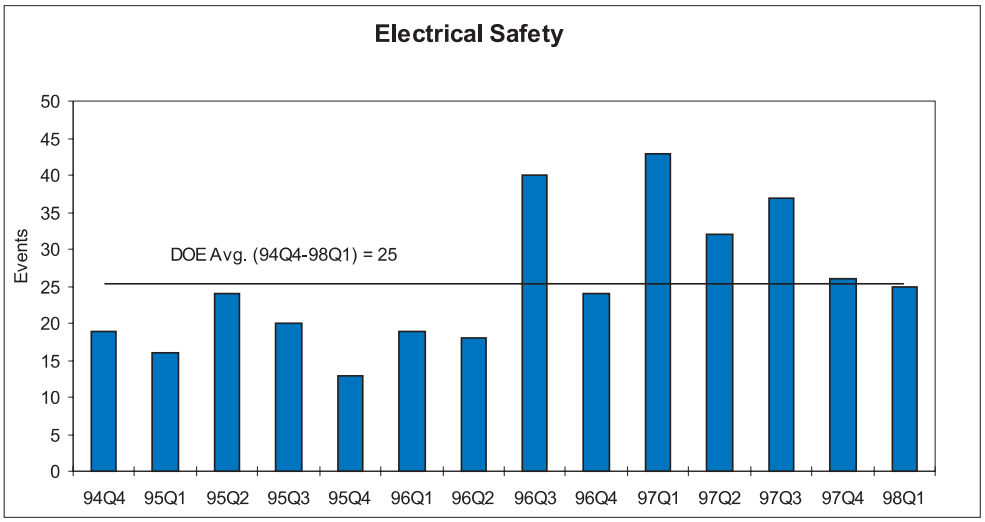
- Estimates indicate that the 1997 cost index declined below 1996 levels. Operations involving security and lump sum construction activities reported the highest Index for 1997: 30.15 and 28.66, respectively. Only architectural and engineering, and oil and gas had a small increase in the reported cost index: 2.1 to 2.5 and 11.87 to 12.39, respectively. However, both were below their five-year average.
- Although fatalities, transfers, and terminations were weighted the highest in the calculation, fluctuations in the other components often affect the index. For example, in 1997, two fatalities occurred in production and construction operations with cost indices of approximately 18; whereas, the highest cost index in 1997 was 30.15 for security operations with no fatalities.

Indicator

3. Electrical Safety

Definition

The number of events involving worker contact or the potential for contact with electrically energized equipment. These events are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department Analysts.

Key Observations

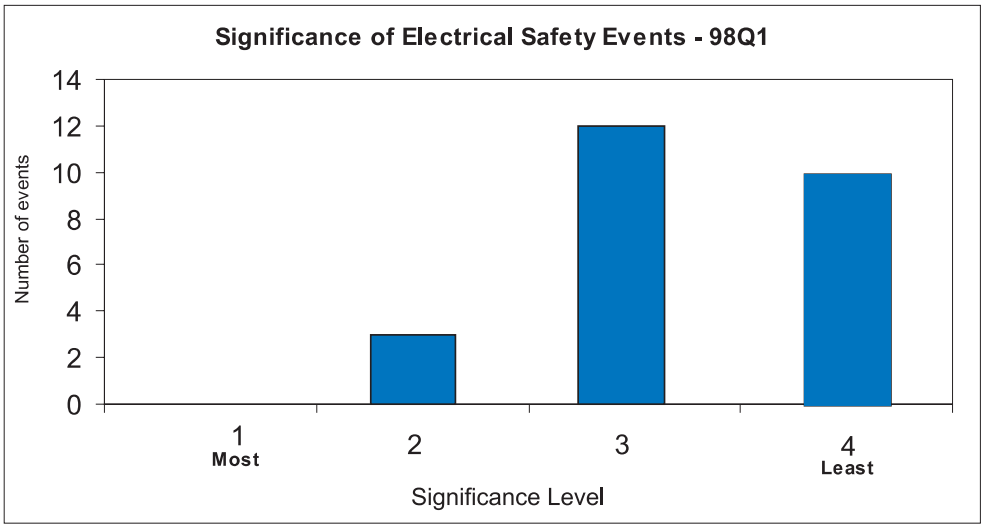
- After a significant increase in the number of electrical safety events starting in 96Q3 and continuing through 97Q3, the number decreased over the last two quarters. The decrease in electrical events over the last two quarters does not constitute a statistically valid decreasing trend. Furthermore, when normalized to the number of DOE total work hours, the rate of electrical events since 96Q3 remained high relative to the preceding two years. Additional data and analysis are required to determine if the recent data is indicative of improved electrical safety performance in the DOE.

Period	Avg. Events	Avg. Events/200,000 Hrs
94Q4 - 96Q2	18.4	0.063
96Q3 - 97Q3	35.2	0.141
97Q4	25.5	0.115*

*98Q1 total work-hour data not available

- The table above shows the average number and rate of events over the period before 96Q3, from 96Q3 to 97Q3, and for 97Q4.

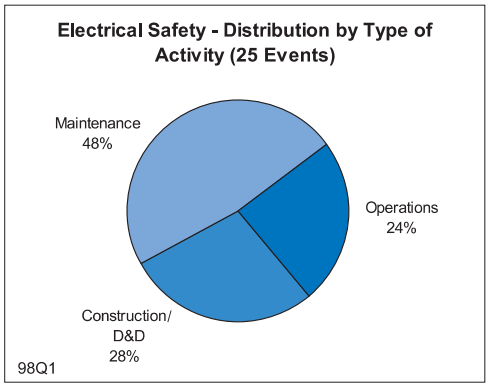
Significance of Events



- Significance of electrical safety events was ranked in accordance with Table 1, *EH-33 Performance Indicator Significance Criteria*, included in Appendix B-3 of this report. The table was developed for use with the PI report with input from various models, including the Savannah River Site Significance Categories Matrix and the Hanford Priority Planning Grid.
- There are four significance rankings – Level 1 through 4 – with Level 1 being the most significant and Level 4 the least. Generic criteria for areas such as worker and public safety are combined with PI-specific criteria (i.e., Electrical Safety) to rank the significance of events. For example, a minor event that would be ranked as Level 4 (least significant) under the generic criteria would, in accordance with the PI-specific criteria for Electrical Safety, be ranked as Level 3 if an electrical shock was involved.
- The larger number of Level 3 events relative to Level 4 was a reflection of the serious nature of electrical safety events. Of the 15 events rated Level 2 or 3, seven involved electrical shocks, one involved a flash burn, and one involved both. The remaining six involved personnel contacting energized equipment that should have been de-energized.
- The three Level 2 events all involved hospitalization of injured personnel. Two of these occurred during maintenance activities. The other involved an alarm station dispatcher who received an electrical shock at his computer station after site-wide power outage.

Additional Analysis

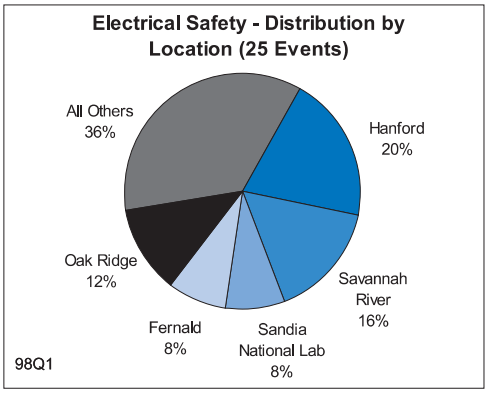
Distribution by Activity



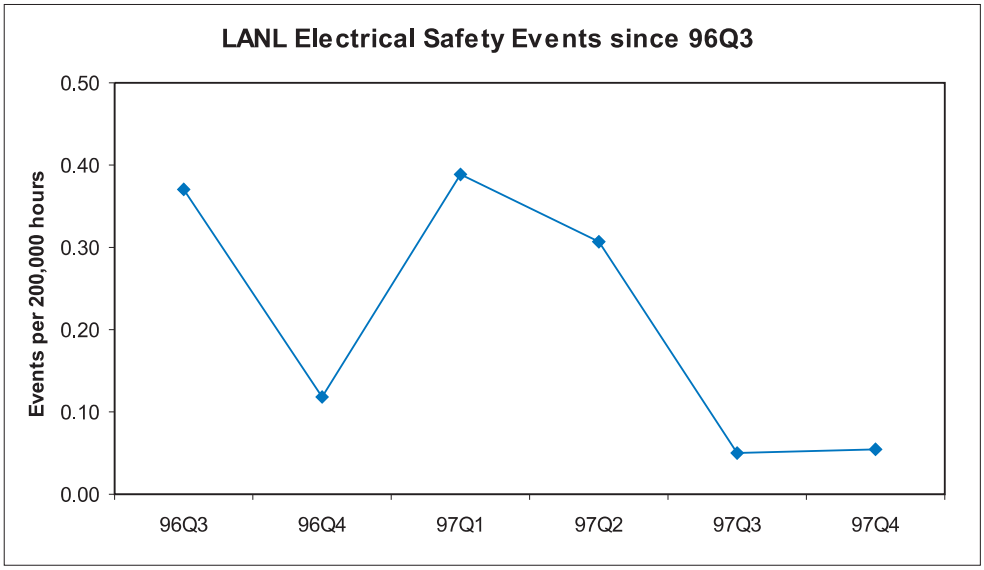
- The electrical safety events reported for 98Q1 fall into 3 major categories: construction, maintenance, and operations activities. Nearly half of the events in 98Q1 occurred during maintenance activities.
- Four of the 25 events in 98Q1 occurred during excavation or floor cutting. None of these events resulted in shock or injury.
- Three events occurred while drilling through trailer walls to hang items. In one event, maintenance workers were not aware of a power distribution panel on the other side of the wall and drilled into it. The other two events were caused by deficient wiring in the trailers constructed by the trailer manufacturers.

Distribution by Location

- As in 97Q4, electrical safety events occurring in 98Q1 were distributed equally among sites with no site reporting more than 4 events.
- Of particular interest was Los Alamos National Laboratory (LANL). As seen in the following table and graph, the number and rate of electrical safety events at LANL decreased notably since 97Q2.



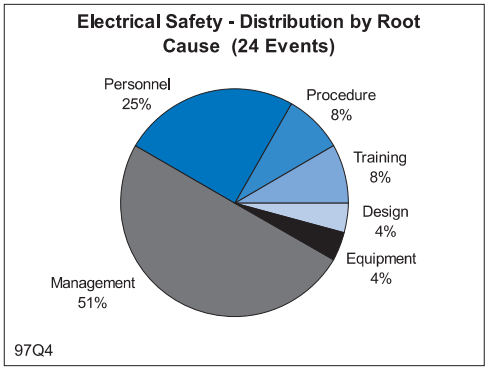
Period	96Q3-97Q2	97Q3-98Q1
Total Events	22	3
Avg. Events/Qtr	5.5	1



- LANL personnel indicated that, after a series of significant events in 1996 and 1997, they recognized that the existing electrical safety program was not effective in an R&D environment and developed a new one. Following were some of the key elements of the new program:
  - Trained Electrical Safety Officers for every department engaged in electrical work
  - ISMS-based commitment to improve safety performance (versus just measure it)
  - Required periodic electrical safety training for all electrical workers.
- Since March 1997, approximately 1,500 people have been trained. This, combined with a general increase in electrical safety awareness caused by the new program, may have accounted for the decrease in events. Quantifiable data on program implementation, which could be reviewed for possible correlation with electrical safety performance, is expected soon.

Distribution by Root Cause

- The distribution of 97Q4[a] electrical safety events by root cause was nearly identical to the two previous quarters.



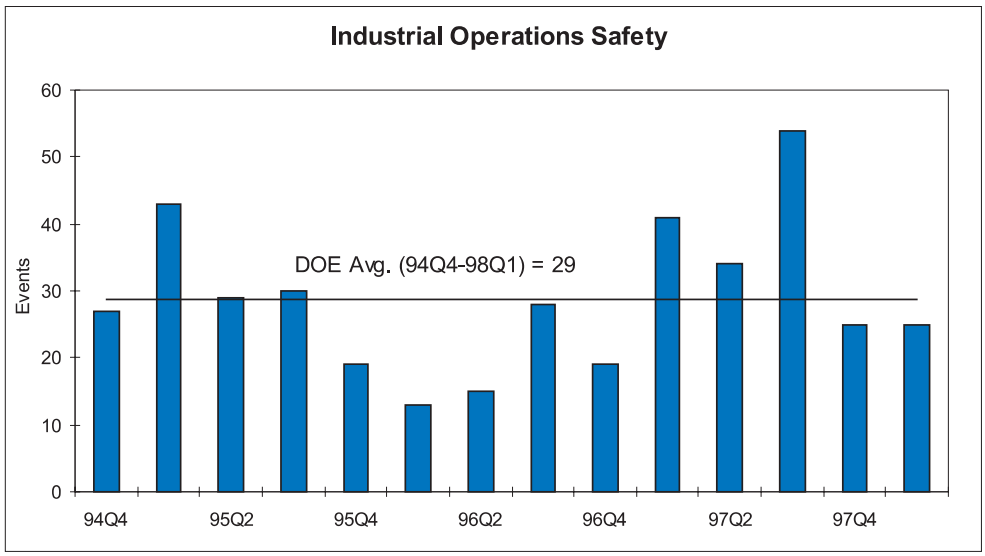
[a] Root cause analysis is displayed for the preceding quarter due to the time lag between notification of an occurrence and issuance of the final occurrence report. This practice is reflected in all performance indicators where a root cause analysis is performed.

Indicator

4. Industrial Operations Safety

Definition

Number of operations-related events involving construction equipment, forklift operations, machining operations, hoisting, rigging, or excavation reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

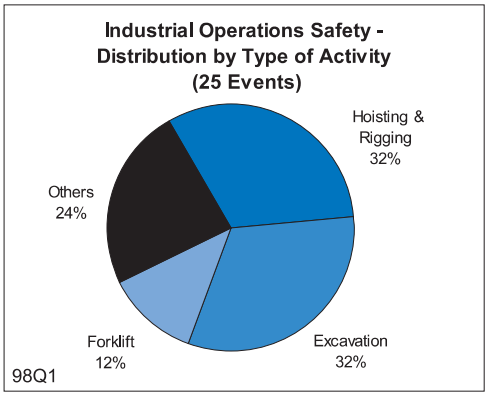


Source: Review of Occurrence Reports by Department Analysts.

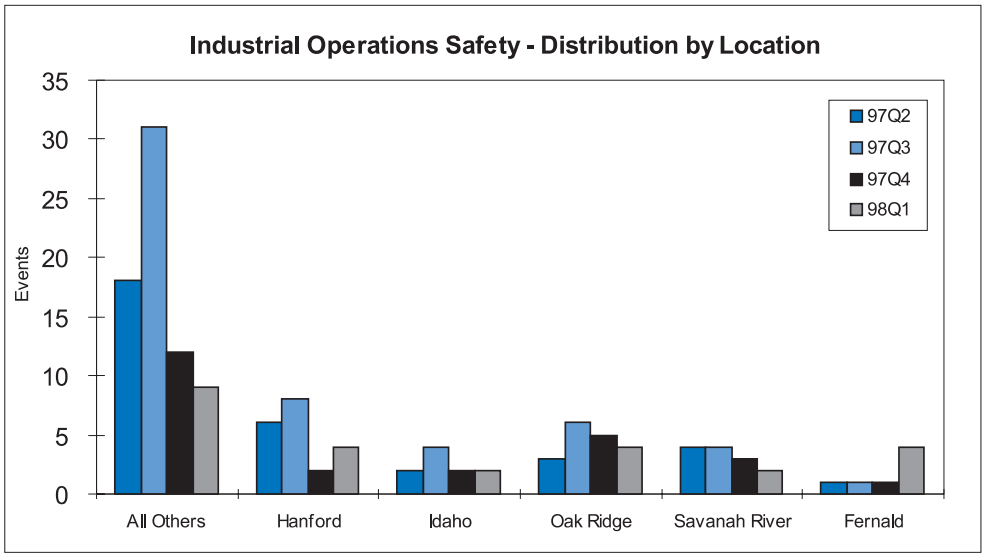
Additional Analysis

Distribution by Activity

- Excavation, hoisting, and rigging operations continue to be the lead activities in which industrial safety related events occur.

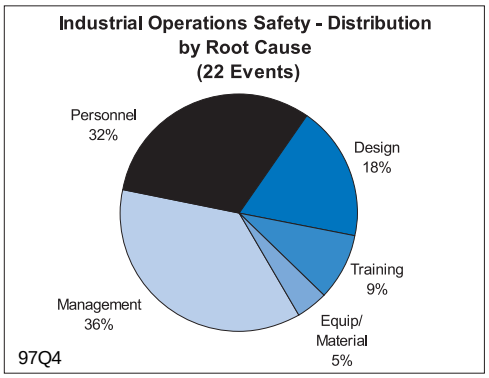


Distribution by Location



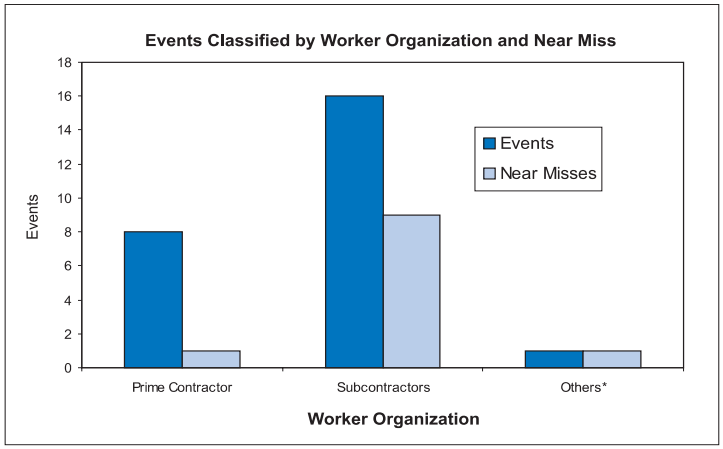
Distribution by Root Cause

- In 97Q4, root causes were identified for 22 events and remained comparable to those of 97Q3.



Distribution by Worker Organization, Event, and Near Miss

- The majority of industrial operations events and near misses involved workers employed by subcontractors working for the Prime Managing & Operating or Managing & Integrating contractors at DOE sites. A review of the near miss ocurrence reports indicates that less safety training and awareness of safe work practices (compared to DOE contractors) by subcontractors or poor interaction between the prime contractor and sub- contractors are prime factors that either cause or contribute to near miss events.



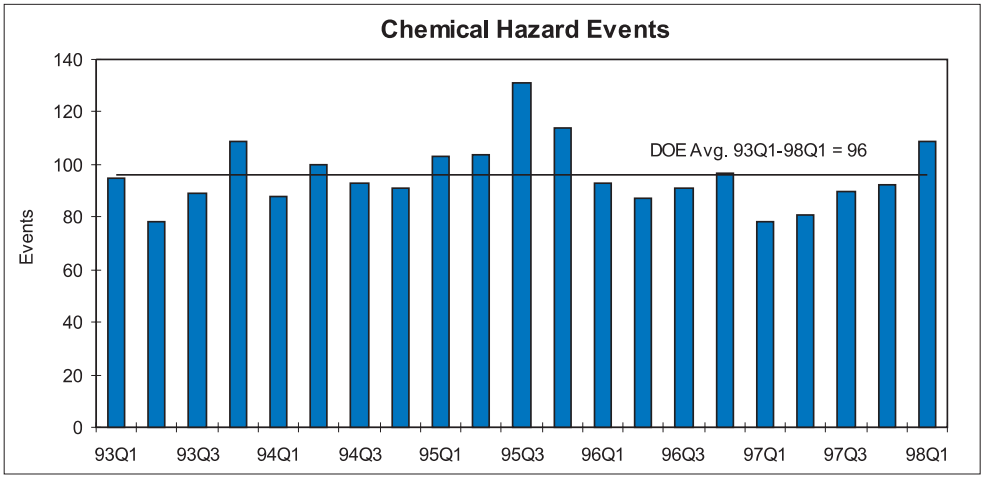
Indicator

5. Chemical Hazard Events

Definition

Number of events reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names. The selected events are reviewed and screened for conditions meeting one of the following categories:

- Class 1 - An injury or exposure requiring hospital treatment or confirmed, severe environmental effect.
- Class 2 - Minor injury (first aid) or exposure, or minor environmental damage.
- Class 3 - Potential precursors to the occurrences in Class 1 or 2.
- Class 4 - Minor occurrences such as leaks, spills, or releases that are significant by the frequency, but not by the consequences.

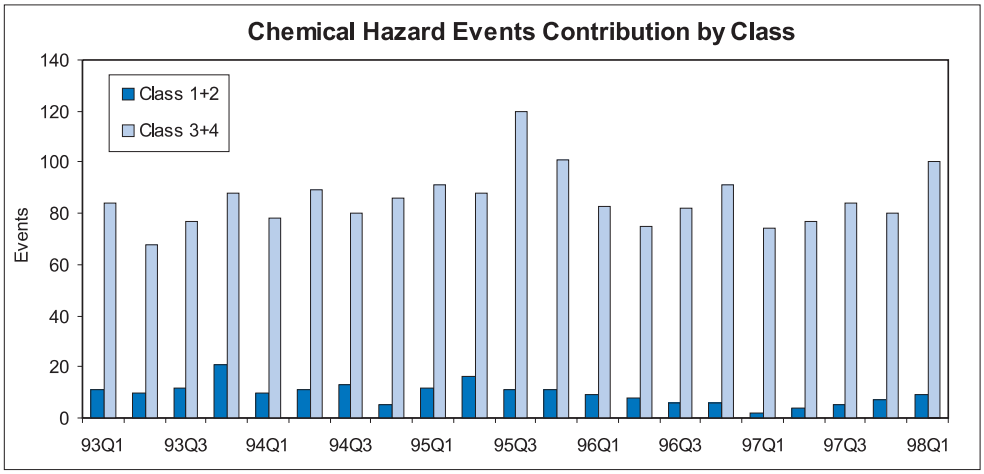


Source: Office of Field Support, EH-53, Chemical Safety Concerns: A Quarterly Review of ORPS (draft, posted on the Web at http://www.dne.bnl.gov/etd/csc/)

Key Observations

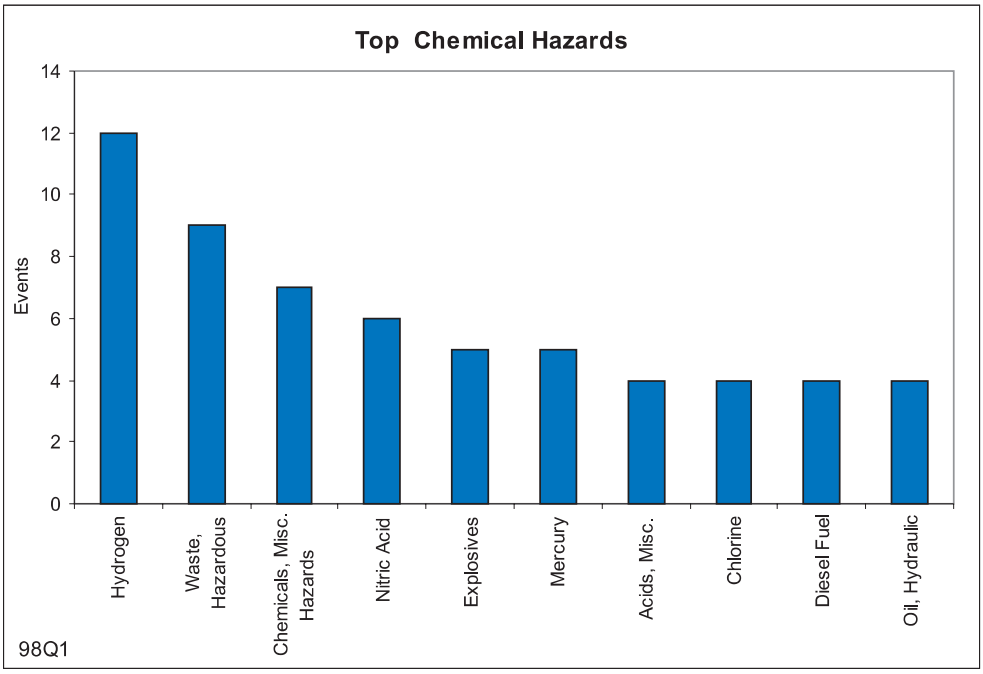
- There was a 17 percent increase in the number of chemical hazard events in 98Q1 (109) rising above the five-year average (93Q1-98Q1) of 96.0 for the first time since 96Q4. Since 97Q1, there has been an overall increasing trend in the number of chemical hazard events.
- Class 1 and 2 events showed an increase for the last five quarters. There were 9 Class 1 and 2 events for 98Q1 compared to 18 for all of 1997. This quarter had the largest number of events since 95Q4. Reasons for this increase might include increased emphasis on reporting chemical hazards following the Hanford PFP incident of May 1997 and increased deactivation, decontamination and decommissioning activities in the field.

Characterization of Chemical Hazard Events



- During 98Q1, there were:
  - One Class 1 event at Los Alamos National Laboratory that involved a fireball from aerosol cleaner that burned two workers.
  - Eight Class 2 events, including:
    - Exposures or potential exposures to beryllium oxide, chlorine, lithium bromide, nitric acid fumes, mineral spirit fumes, and paint fumes.
    - Two spills of caustic liquids: lithium hydroxide and sodium hydroxide.

Distribution by Chemicals Involved



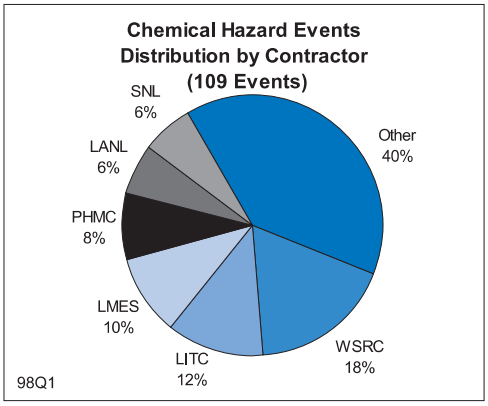
- The chemical most often involved in chemical hazard events was hydrogen with 12 occurrences.

Additional Analysis

- According to Field personnel, the hydrogen chemical hazard events involved issues related to:
  - Pressure build-up in containers at Savannah River Site, Los Alamos National Laboratory, and Hanford
  - Small releases throughout the complex due to aging equipment
  - Four ventilation and five monitoring/analyzing deficiencies from the Defense Waste Processing Facility at Savannah River Site.

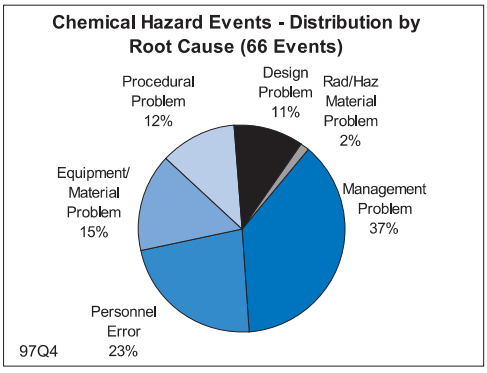
Distribution by Location

- The top two contractors involved in chemical hazard events in 98Q1 were Westinghouse Savannah River Company (WSRC) and Lockheed-Martin Idaho Technologies Company (LMITCO). WSRC reported 18 percent of the events (all Class 3 or 4) and LMITCO reported 12 percent of the events, including one Class 2 involving a reaction to paint fumes. There has been a decreasing trend in the number of chemical hazard events observed at WSRC since 95Q3. Since 97Q1, there was an increasing trend in the number of events at LMITCO.

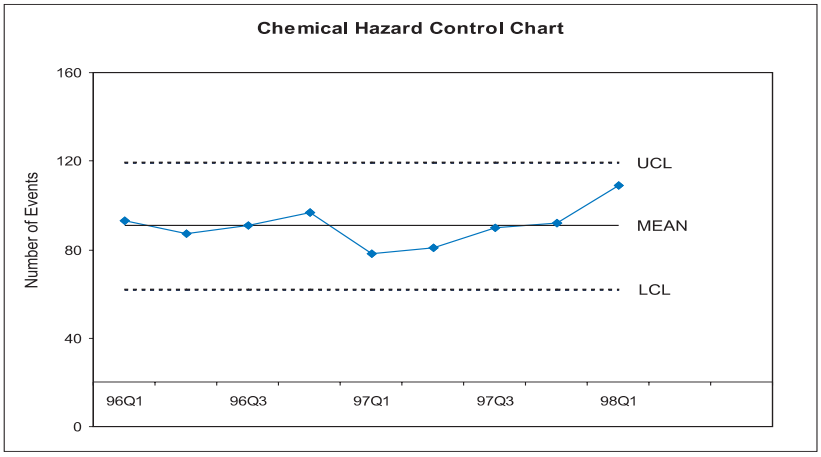


Distribution by Root Cause

- The root cause distribution for 97Q4 is shown in this chart for those events in which a root cause has been identified. Sixty percent were due to management problems or personnel errors.



Statistical Process Control (SPC) Analysis



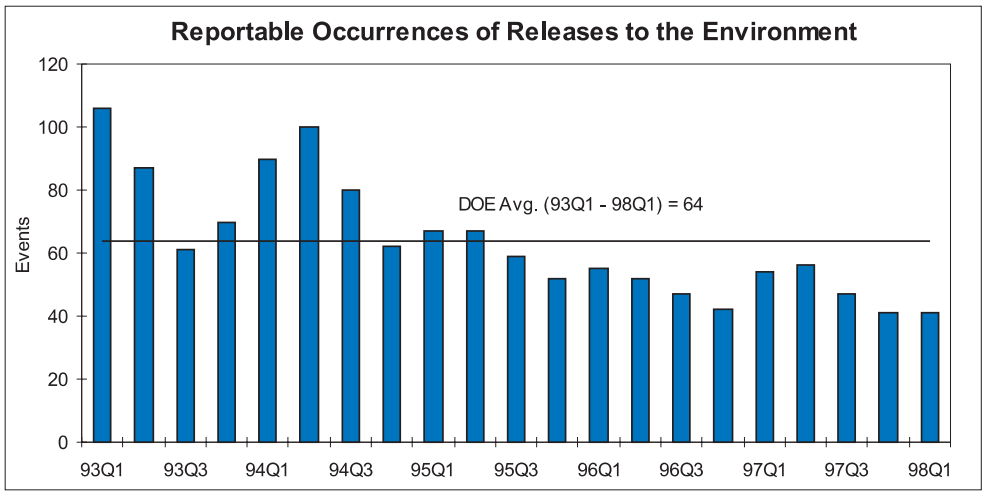
Beginning with 98Q1, Statistical Process Control analysis will be conducted for this performance indicator. Since data has been collected for only nine quarters, caution should be exercised when interpreting the stability of the centerline, and upper and lower control limits. At this time, the prediction of trends in the data is not advised and as such none have been made. As the number of quarters increases, analysis of the data will provide better confidence in trending analysis and prediction.

Indicator

6. Reportable Occurrences of Releases to the Environment

Definition

Releases of radionuclides, hazardous substances, or regulated pollutants that are reportable to federal, state, or local agencies.



Source: Review of Occurrence Reports by Department Analysts.

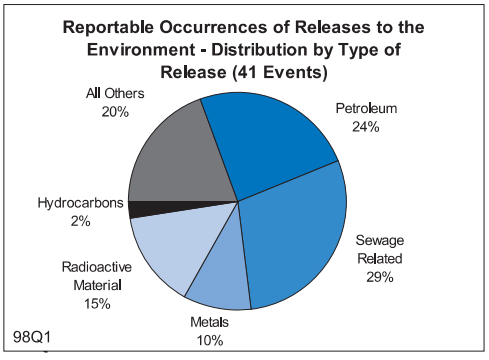
Key Observations

- The data reflected a downward trend over the past 16 quarters. Over the last 11 quarters, the number of environmental releases remained well below the average of 64 for 93Q1 through 98Q1.

Additional Analysis

Distribution by Type of Release

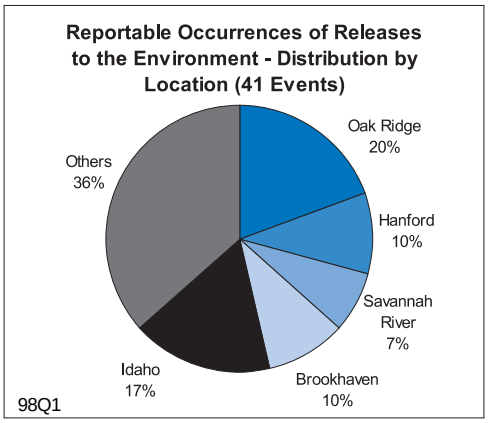
- Waste discharge and petroleum continued to account for most of the events, which was consistent with previous trends observed. Waste discharge includes sewage, liquids in sewage, flushing of water mains, chlorine in storm drains, total residual oxidant in water effluent, suspended solids, elevated pH levels in manholes, potable water for testing pipes, waste water spills, and coal burning boiler effluent.



- Overall, petroleum releases, 27 percent of the total reportable releases for 98Q1, were consistent with the past 8 quarters. There were 2 events involving crude oil in 98Q1 that spilled 104 barrels, of which 100 barrels were recovered. The amount of hydraulic fluid spilled in 98Q1 was 3 gallons.

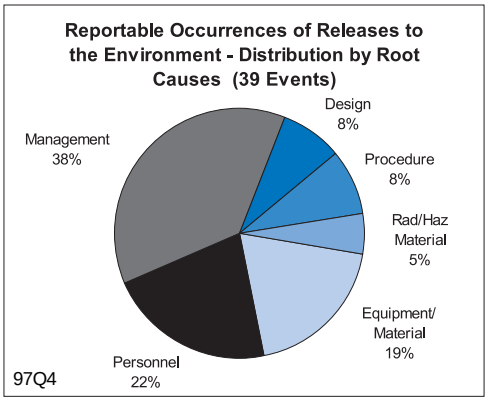
Distribution by Location

- Since 93Q1, Los Alamos and Oak Ridge have had the most releases, although Oak Ridge and Idaho were the leading sites for 98Q1.



Distribution by Root Cause

- Of the 39 release events with identified root causes, management, equipment, and personnel were the leading categories. Management was the only root cause that increased this quarter; all others decreased.

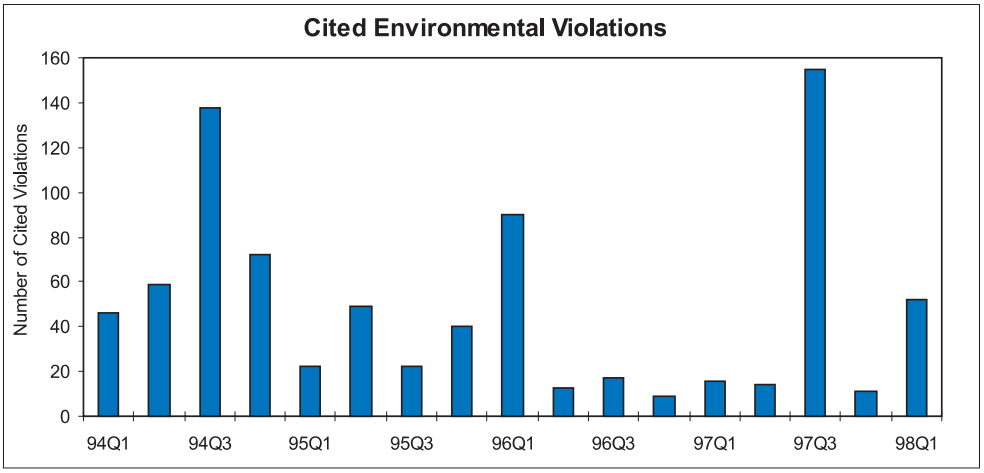


Indicator

7. Cited Environmental Violations

Definition

Number of environmental violations cited in enforcement actions, e.g., Notices of Violations (NOVs), by regulators at DOE facilities. (An NOV may cite one or multiple violations).



Source: EH-41 Compliance Database.

Key Observations

- More than half of the violations cited in 98Q1 resulted from an EPA comprehensive inspection at Brookhaven National Laboratory in 1997.
- Half the violations cited in 98Q1 involved RCRA (Resource Conservation and Recovery Act).
- The number of violations of the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) has increased over the past two and one-half years.

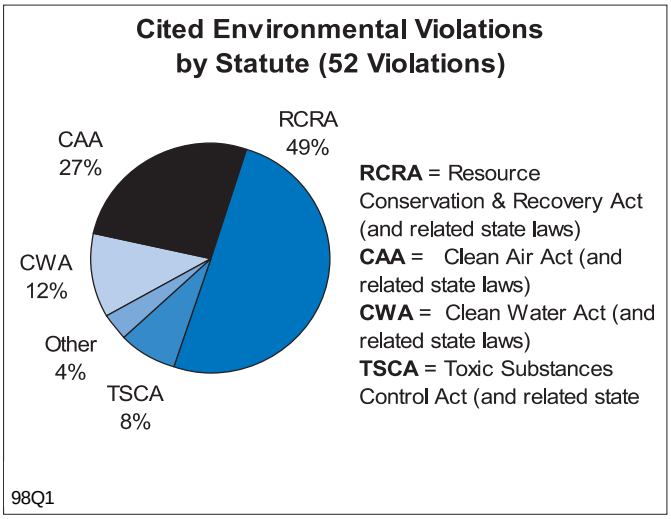
Additional Analysis

Number of Notices of Violation

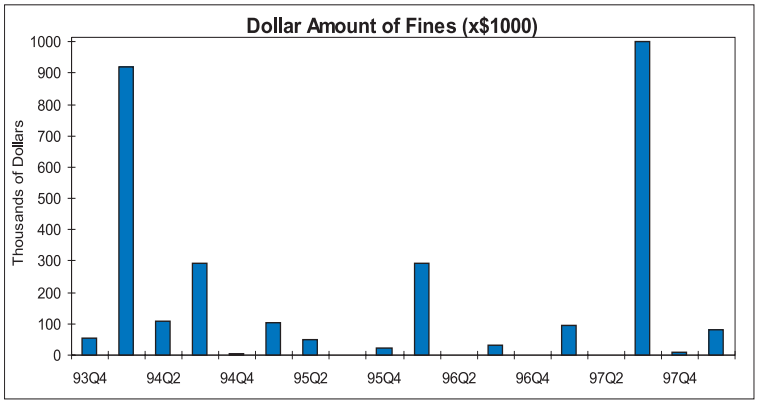
- DOE and its contractors received more NOVs (14) in 98Q1 than at any time since 96Q1 (18). Since a single NOV can cite one or numerous violations, the number of violations cited was much more variable than the number of NOVs issued.

Violations by Statute

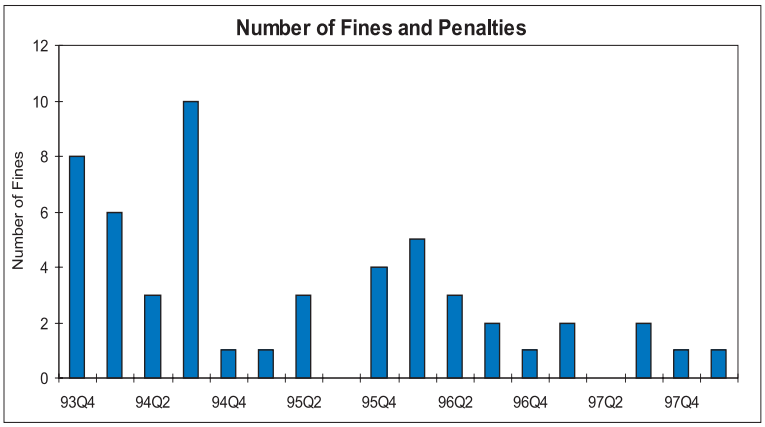
- Water
  - The number of violations cited under the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA) have increased over the past 10 quarters.
  - The same trend appears in the data for:
    - The number of NOVs that address CWA and SDWA violations
    - The percentage of NOVs that address CWA and SDWA violations
    - The percentage of total violations that are of CWA and SDWA.
- RCRA
  - RCRA continues to account for numerous violations:
    - Half the violations cited in 98Q1 involved RCRA.
    - Half the NOVs in 98Q1 cited violations of RCRA.
- Violations in 98Q1 were dominated by an enforcement action at Brookhaven National Laboratory, resulting from a comprehensive EPA inspection in 1997. The enforcement action (including NOVs, Compliance Orders, Consent Orders, Complaints) was treated here as 1 NOV, but cited at least 30 violations of 4 statutes.



Fines



- The only fine assessed in 98Q1 ($79,868) was for RCRA violations at Brookhaven National Laboratory. This continues the pattern that nearly all large fines assessed against DOE are under RCRA.



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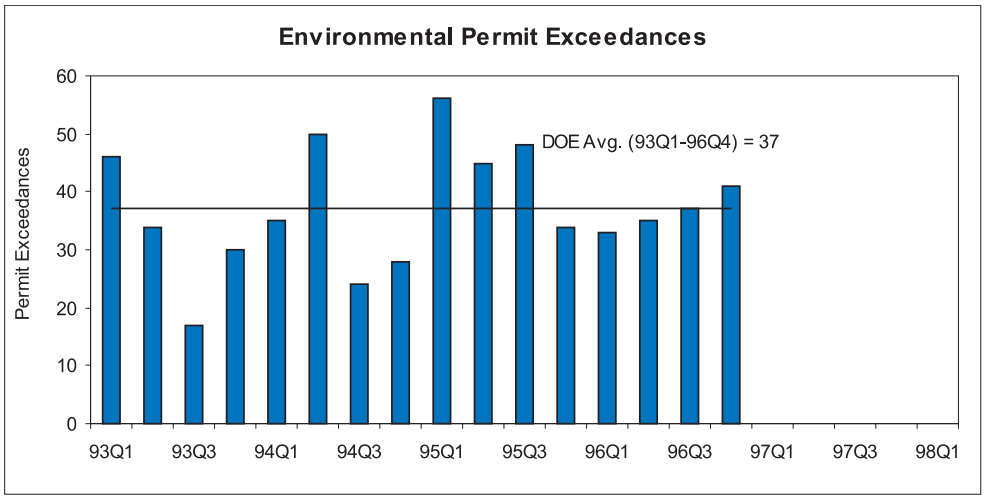
Indicator

8. Environmental Permit Exceedances

Definition

Exceedance of release levels specified in air and water permits during the quarter.



Source: Annual Site Environmental Reports, additional site data.

Key Observations

- After an increase in the number of permit exceedances each year from 1993-1995, the exceedances for 1996 showed a 20 percent decrease from those tabulated in 1995 (146 in 1996 versus 183 in 1995).
- In 1996, as in previous years, the vast majority (96.5 percent) of exceedances were due to violations of permits under the Clean Water Act for discharge to surface waters.

Additional Analysis

- Since 1993, there has been a trend in permit exceedances becoming more evenly distributed across more sites instead of being concentrated at a few sites.
- Most exceedances (96.5 percent) continued to occur under National or State Pollution Discharge Elimination System Permits. These permits are mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc. Other permit exceedances occurred under Clean Air Act permits (1.4 percent) and the Safe Drinking Water Act/ Underground Injection Control permits (2.1 percent).
- Twenty of the 51 sites (39 percent) that reported for 1996 indicated that no permit exceedances occurred at their sites.

Note: The number of exceedances—and the number of potential exceedances—was a function of the permit-specific parameters, number of outfalls at a facility, reporting frequency requirements, and the timing of renewal or changes to the NPDES/SPDES permit. In addition, changes in temperature, sunlight, and precipitation events all contributed to permit exceedances of non-toxic reporting parameters such as Biological Oxygen Demand, pH, and Total Suspended Solids.

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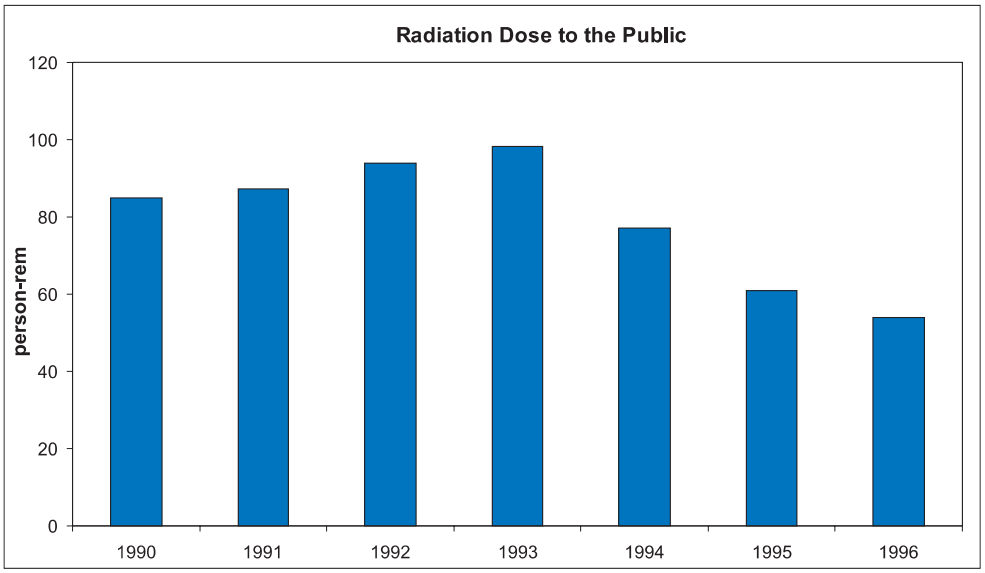
Indicator

9. Radiation Dose to the Public

Definition

Total collective radiation dose (person-rem) to the public within 50 miles of DOE facilities due to radionuclide airborne releases. ("Collective radiation dose" is the sum of the effective dose equivalent to all off-site people within a 50-mile radius of a DOE facility over a calendar year.)

No change to this section since last report.



Source: Annual reports to EPA; EH-41 data tabulation.

Key Observations

- Total collective radiation dose to the public from DOE sources was very low compared to the public dose from natural background radiation. The total collective radiation dose to the public around DOE sites from air releases was one ten-thousandth of the dose received by the same population from natural background radiation.
- Total collective radiation dose to the public in 1996 decreased 12 percent from the previous year. This continued the recent downward trend, attributable to reduced nuclear production activities.

Additional Analysis

- The top five sites in 1996 (in order: Rocky Flats, Oak Ridge, Savannah River, Princeton Plasma Physics Laboratory, and Fernald) accounted for about 72 percent of the total dose.
- The dose from Rocky Flats increased from negligible in 1995 to 10.5 person-rem in 1996 due to decontamination and decommissioning work, particularly excavations at the T-3 and T-4 trenches as part of the site remediation program.
- The dose from Princeton increased from negligible in 1995 to six person-rem in 1996 due to nonroutine upgrades to diagnostic systems which resulted in some additional tritium exhausted to the atmosphere.

- The decrease in collective radiation dose in 1996 reflected decreases in the dose from Lawrence Berkeley, Lawrence Livermore 300 Area, and Argonne-East; in 1995 they accounted for 42 percent of the dose; and in 1996 less than 7 percent. While the graph on the previous page reflects this overall decrease in collective radiation dose in 1996, there were large increases in 1996 at Rocky Flats and Princeton.

Indicator

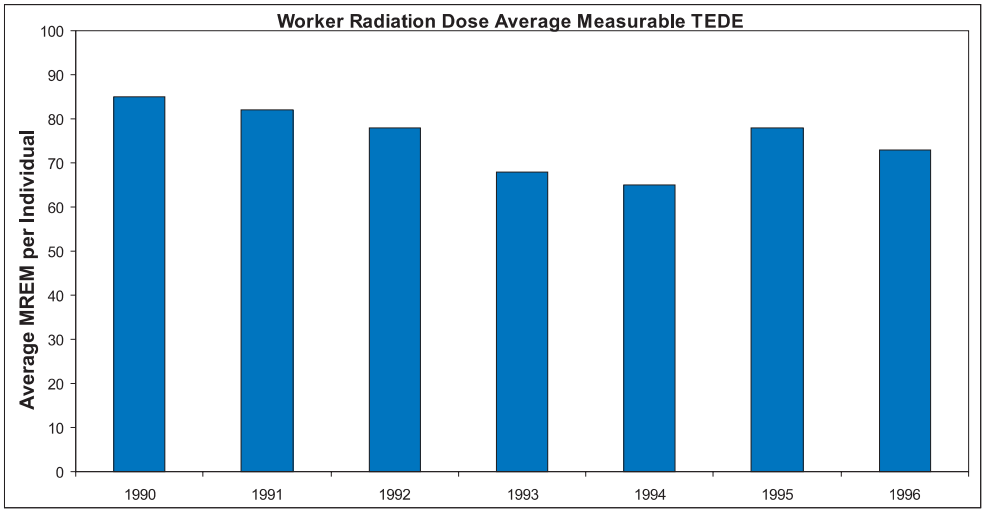
10. Worker Radiation Dose

Definition

Average measurable dose to DOE workers, determined by dividing the collective total effective dose equivalent (TEDE) by the number of individuals with measurable dose.

TEDE is determined by combining both internal and external contributions to an individual's occupational exposure. The number of individuals receiving measurable dose is used as an indicator of the exposed work force size.

No change to this section since last report.



Source: DOE/EH-52 and DOE Occupational Radiation Exposure Report 1996, DOE/EH-52, U.S. Department of Energy.

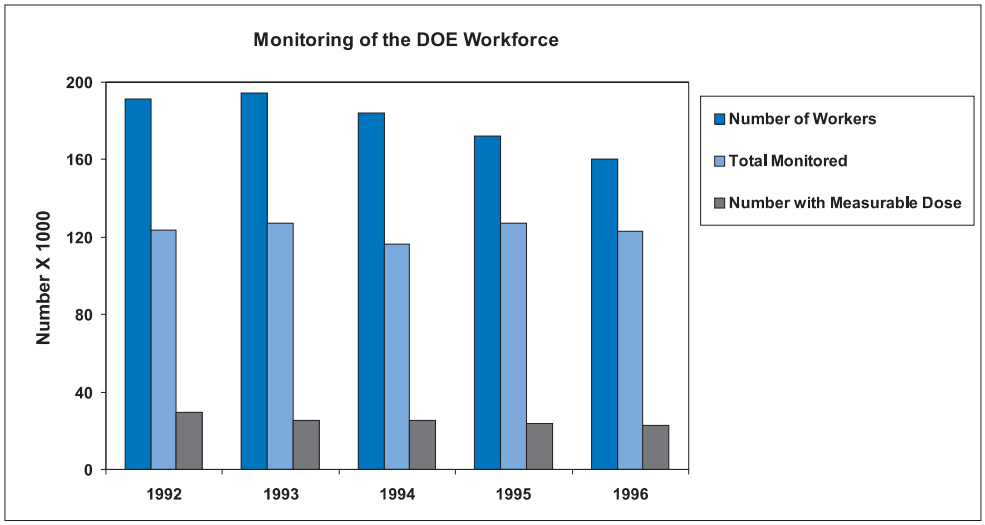
Key Observations

- Between 1995 and 1996, the DOE collective total effective dose equivalent (TEDE) decreased by 10 percent due to decreased doses at 5 of the 7 dose sites with the highest radiation dose. In addition, the average dose to workers with measurable dose decreased by six percent, the number of individuals receiving measurable dose dropped by four percent, and there was one exposure over the DOE five rem TEDE limit.

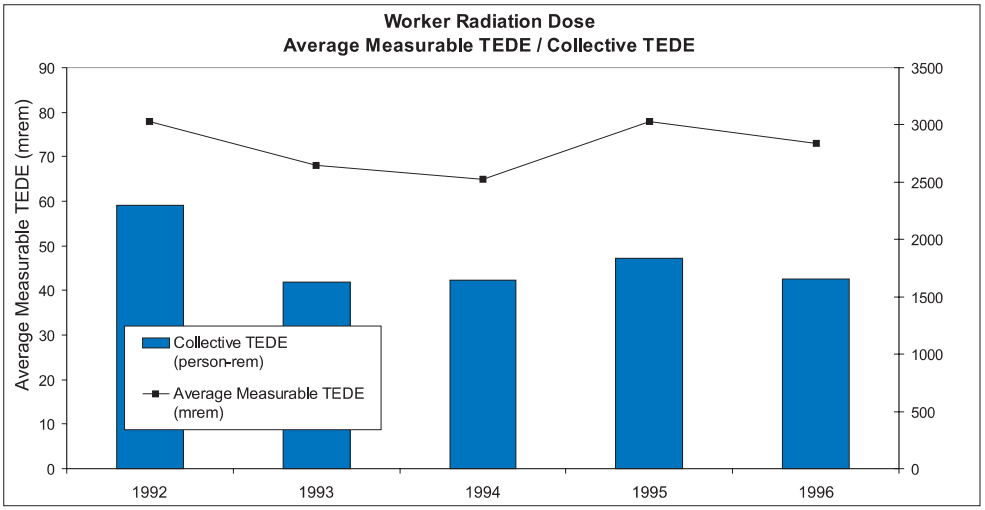
Additional Analysis

- Additional information concerning exposure received by individuals associated with DOE activities is included in the DOE Occupational Radiation Exposure Report 1996 DOE/EH-0564 (on line at http://rems.eh.doe.gov/annual.htm).

DOE Doses



- The percentage of the DOE workforce monitored for radiation exposure has increased by 12 percent from 1992 to 1996. However, most of the monitored individuals do not receive any measurable radiation dose. Only 20 percent of monitored individuals (14 percent of the DOE workforce) received a measurable dose during the past 5 years.
- Nearly 81 percent of the collective TEDE for the DOE Complex was accrued at 7 DOE sites in 1996. These 7 sites were (in descending order of collective dose) Rocky Flats, Hanford, Savannah River, Los Alamos, Idaho, Brookhaven, and Oak Ridge. Weapons fabrication and testing facilities accounted for the highest collective dose. It should be noted that Rocky Flats and Savannah River accounted for the majority of this dose. These sites were primarily involved in nuclear materials stabilization and waste management, but reported under this facility type. For the past four years, technicians received the highest collective dose of any specified labor category.
- The average measurable and collective TEDEs for all monitored individuals has been relatively constant from 1993 through 1996.

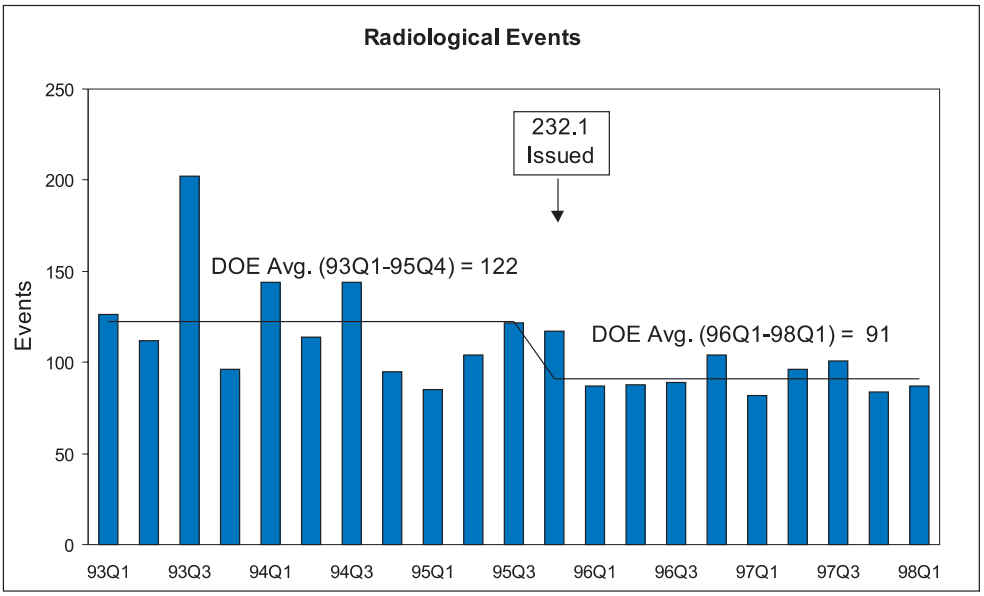


Indicator

11. Radiological Events

Definition

Number of reportable radiological events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. These events are made up of both personnel contaminations and radiation exposures that are reported as personnel radiation protection events.



Source: Review of Occurrence Reports by Department Analysts.

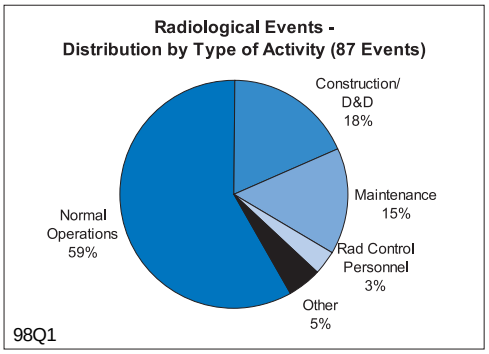
Key Observations

- The number of radiological events reported per quarter since 96Q1 demonstrated no statistically significant improvement or deterioration in Departmental performance.
- Ninety-nine individuals were contaminated in the 87 reported radiological events in 98Q1 as compared to an average of 112 contaminated individuals per quarter in CY 1997.
- There were nine reported internal contaminations in 98Q1 which represents a significant increase when compared to 97Q4 in which there were four internal contaminations reported.

Additional Analysis

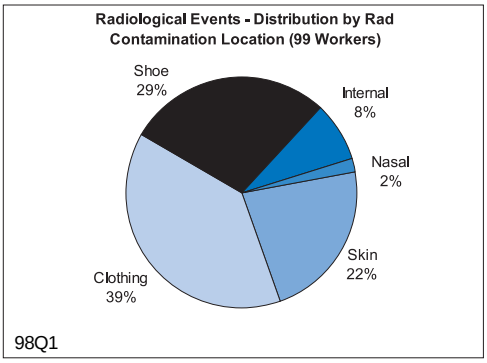
Distribution by Activity

- The percentage of radiological contamination events attributed to normal operations in 98Q1 (59 percent) was slightly higher than the quarterly average observed in calendar year 1997 (49 percent).



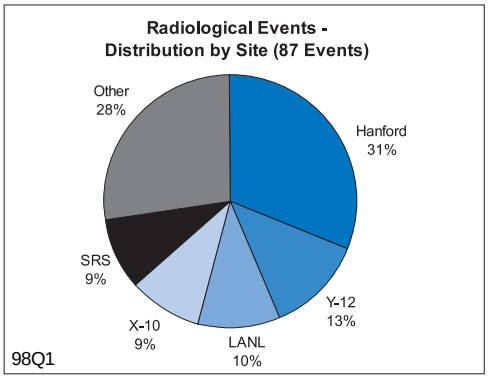
Distribution by Radiological Contaminant Location

- Thirty-nine of the 87 radiological events reported in 98Q1 identified the specific isotope involved in the contamination(s). Of these events, 10 involved Cesium 137, 10—Plutonium, 5—Cobalt 60, and 14—other isotopes.



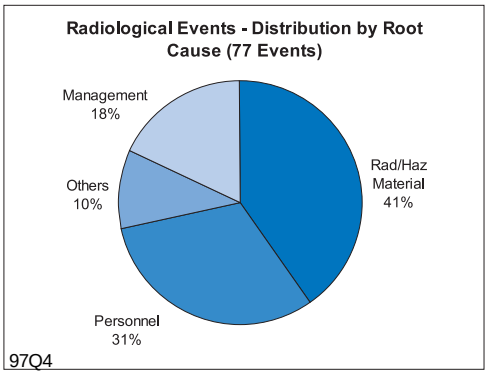
Distribution by Site

- The Hanford site has typically been one of the top three sites in total number of radiological events. Analysis of the 98Q1 data revealed that the Hanford site had 27 contamination events, representing an increase above the quarterly average of 17 for 1997. Further analysis of the Hanford data reveals that Bechtel Hanford, Inc. (BHI) had a marked increase in the number of contamination events reported in the quarter (9) when compared to the quarterly average (1.6 of contamination events per quarter) reported over the past 5 years. This increase in the number of radiological contamination events reported by BHI is attributed to increased work activity of 221V related to canyon initiative work, hazardous waste cleanout and remote monitoring systems installation. In addition, a third shift has been added to “wet work” currently being conducted at N-Basin. BHI is aware of the increase in radiological contamination events and efforts are being undertaken to reduce/eliminate future events.

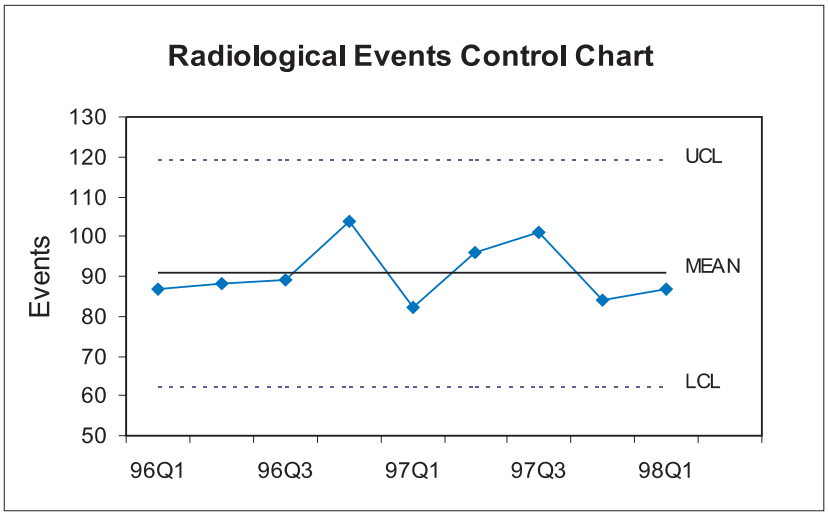


Distribution by Root Cause

- Of the 84 radiological events reported in 97Q4, 77 had root causes identified at the time of this report.



Statistical Process Control (SPC) Analysis



Beginning with 98Q1, Statistical Process Control analysis will be conducted for this performance indicator. Since data has been collected for only nine quarters, caution should be exercised when interpreting the stability of the centerline, and upper and lower control limits. At this time, the prediction of trends in the data is not advised and as such none have been made. As the number of quarters increases, analysis of the data will provide better confidence in trending analysis and prediction.

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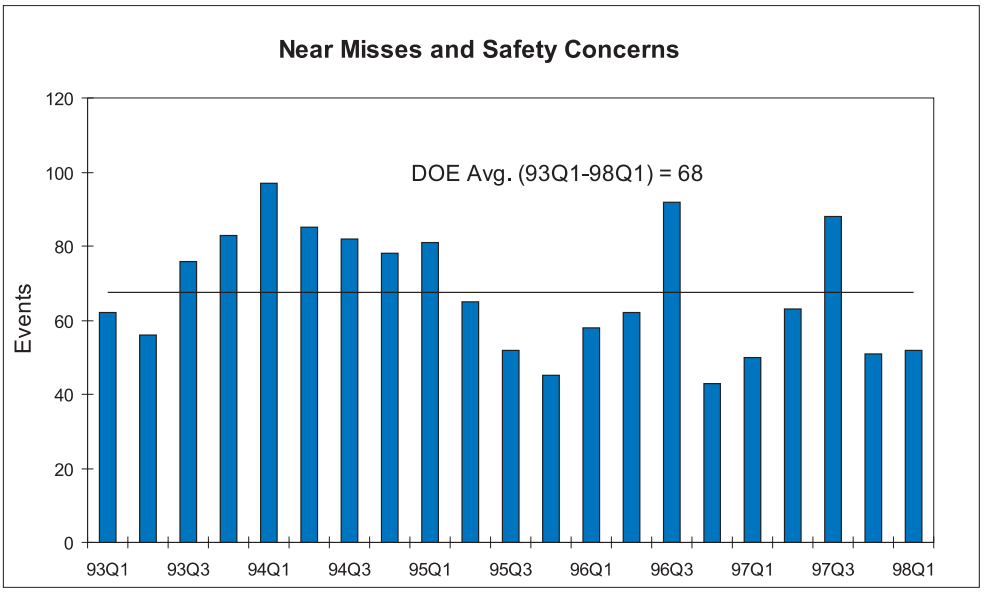
Indicator

12. Near Misses and Safety Concerns

Definition

A near miss is an operational event where barriers to an accident have been compromised such that no barriers or only one barrier remain (e.g., lack of fall protection, electric shock without injury, unauthorized confined space entry). A safety concern includes: the unauthorized use of hazardous products or processes, or when work is shut down as a result of an OSHA violation. Near misses and safety concerns are reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.



Source: Review of Occurrence Reports by Department Analysts.

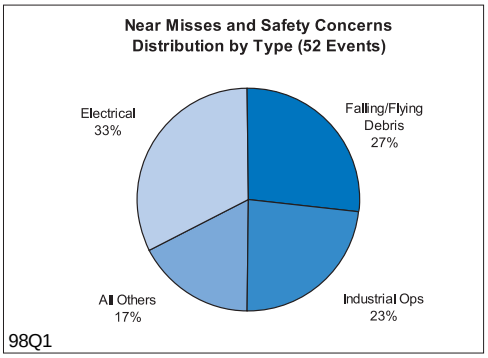
Key Observations

- In 98Q1, DOE reported a total of 52 near miss and safety concern events remaining below the DOE average.
- Of these 52 events, fourteen involved injuries ranging from minor scrapes to a gunshot wound. Other serious injuries included second and third degree steam and flash burns, fractured hand bones requiring surgery, and a sprained ankle.

Additional Analysis

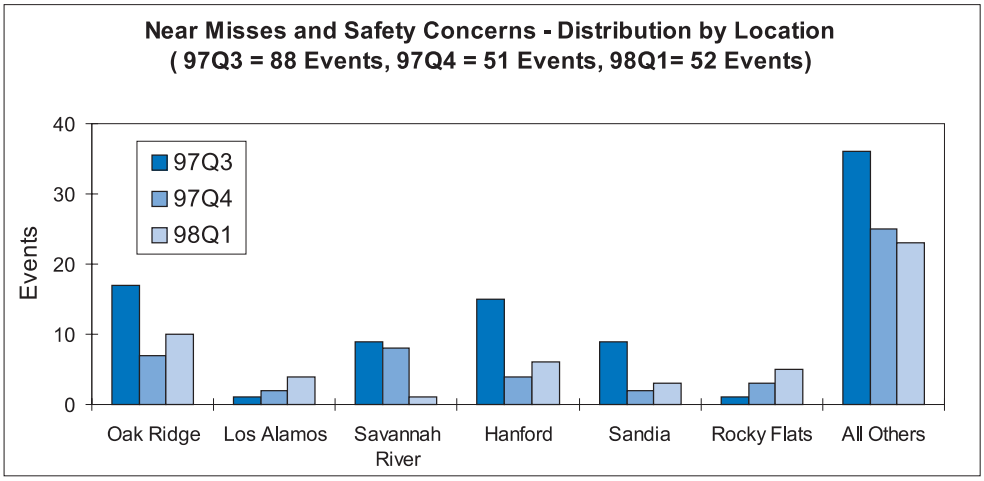
Distribution by Type of Hazard

- While Electrical and Industrial Operations continued to be activities contributing to the majority (56 percent) of the near misses and safety concerns events, Falling and Flying Debris (27 percent) is now becoming a significant fraction of the events.



- The previously mentioned 3 categories had 12 of the 14 reported injuries during the quarter with Industrial Operations leading with 8 events.
- The predominant causes for Falling and Flying Debris were personnel not paying attention to the activity at-hand, equipment and material failures causing objects to fall or the generation of projectiles, and work planning deficiencies.

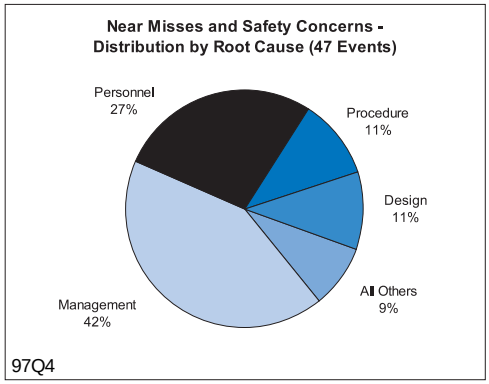
Distribution by Location



- While Savannah River Site reported significantly reduced near misses and safety concerns events in 98Q1, the remaining sites listed on the chart indicate increased numbers of reportable events from 97Q4 to 98Q1. In contrast, the remaining DOE sites reflect an overall decrease in near misses and safety concerns.
- Though additional data is needed to support a statistical trend, Los Alamos National Laboratory and Rocky Flats exhibited increasing numbers of near misses and safety concerns for the past three quarters.

Distribution by Root Cause

- Root causes were identified for 47 near misses and safety concerns events in 97Q4 as shown in this chart.
- Management problems were dominated by work planning deficiencies and inadequate definition, dissemination and enforcement of safety policies. This was consistent with previous quarters.
- The predominant personnel error involved workers not paying attention to the task they were performing—whether it was actual physical work or in the planning of the work. This was also consistent with previous quarters.

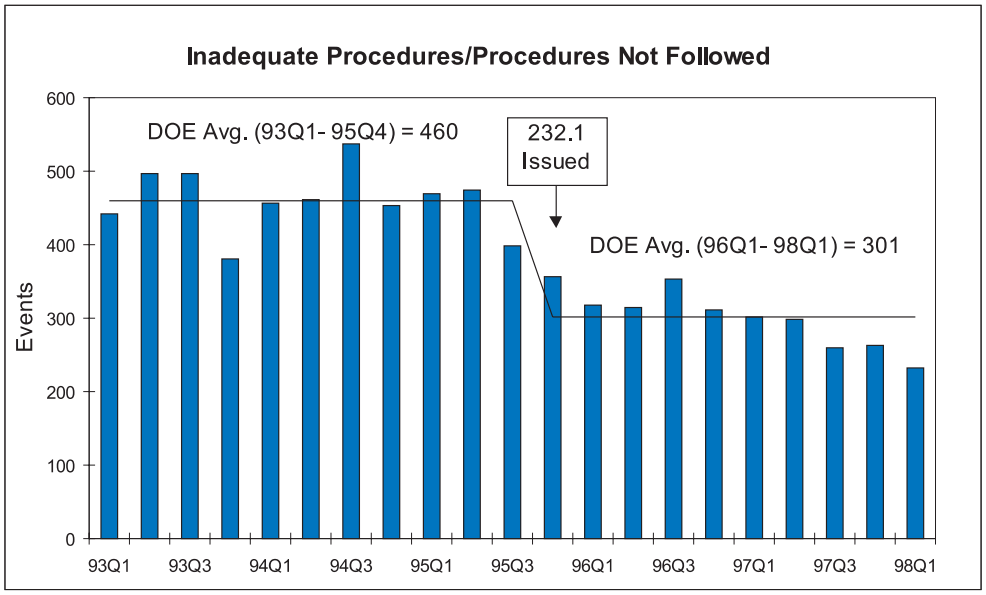


Indicator

13. Inadequate Procedures/Procedures Not Followed

Definition

Number of reportable events as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*, either categorized as procedure violations or problems, or reportable as being caused by a procedure violation or problem.



Source: Review of Occurrence Reports by Department Analysts.

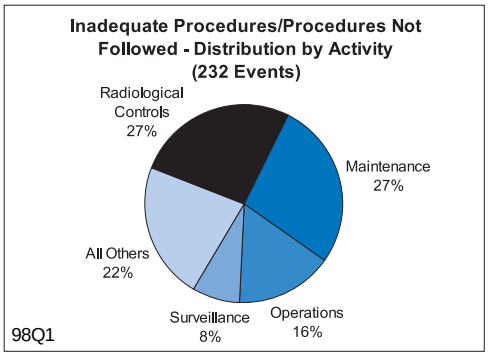
Key Observations

- A decreasing trend existed since 93Q1. This trend was especially apparent since 94Q3.

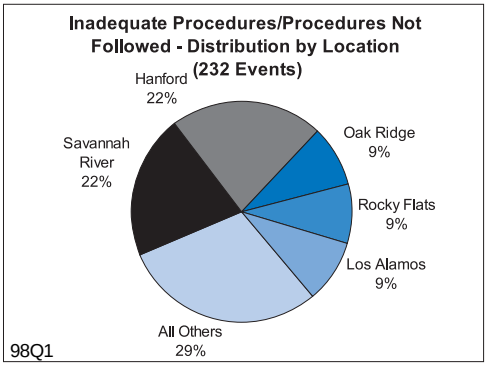
Additional Analysis

Distribution by Activity

- Maintenance, radiological controls, and operations were the major types of activities taking place at the time the procedural problems occurred during 98Q1.
- Of the radiological controls-related activities, the largest were material handling activities and conduct of radiological work violations.
- For maintenance, lockout/tagout and equipment testing tasks were the prevalent activities involving procedure violations. For operations, the leading cause was violations of procedures.

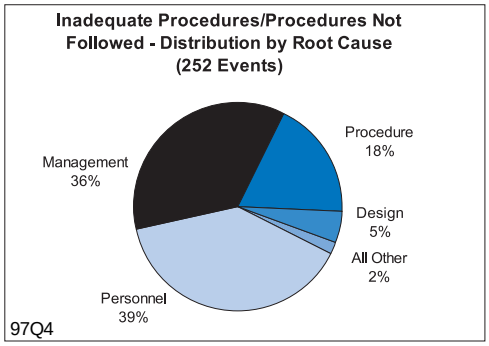


Distribution by Location



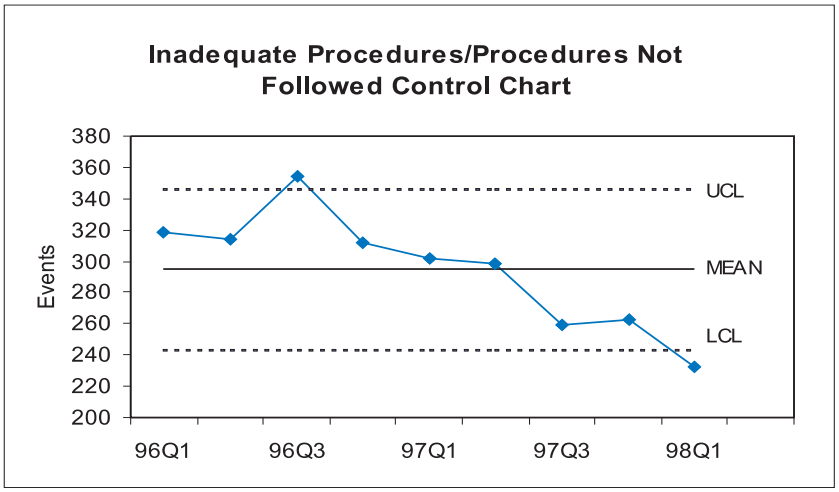
- These five sites have had the most events since 93Q1.
- Hanford replaced Savannah River as the leading site in 98Q1. The number of events at this site rose from 39 in 97Q4 to 52 in 98Q1, a 33 percent increase.
- Forty-six percent of the procedural violations reported at Hanford were associated with radiological work and the storage and handling of radioactive material. Hanford management attributed the rise in procedure violations to the increase in decontamination and decommissioning activities at the site and the increased scrutiny on safety issues as a result of the PFP explosion last year.
- Savannah River was the second leading site with 50 events, mostly from radiological control activities (20) and maintenance activities (18). This represents a 25 percent decrease from the 97Q4 total of 68 events.

Distribution by Root Cause



- Of the 263 events in 97Q4, 252 have root causes identified. As has been the case since 93Q1, for those events with root causes identified, the top 3 cited root cause categories were personnel (98 events), management (91 events), and procedure (46 events).
- Of the personnel errors cited, Procedures Not Used or Used Incorrectly and Inattention to Detail had the most events. This has been the case each quarter since 93Q1.
- The top two management causes cited were Inadequate Administrative Controls and Policies Not Adequately Defined, Disseminated, or Enforced. This was consistent with 97Q3.
- Defective or Inadequate Procedure was the major procedural root cause identified. This has been the case each quarter since 93Q1.

Statistical Process Control (SPC) Analysis



Beginning with 98Q1, Statistical Process Control analysis will be conducted for this performance indicator. Since data has been collected for only nine quarters, caution should be exercised when interpreting the stability of the centerline, and upper and lower control limits. At this time, the prediction of trends in the data is not advised and as such none have been made. As the number of quarters increases, analysis of the data will provide better confidence in trending analysis and prediction.

- The 98Q1 data point is expected to increase due to further identification of root causes by 98Q2.

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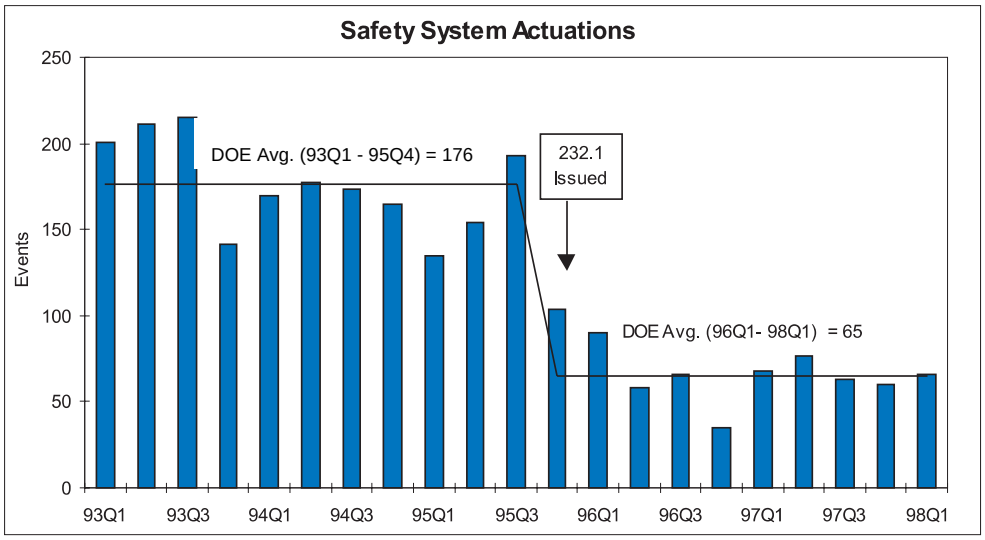
Indicator

14. Safety System Actuations

Definition

Number of operations-related events determined to be safety system actuations reportable under DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*. This includes real actuations of any safety-class equipment or alarm, unplanned electrical outages, unplanned outages of service systems, serious disruptions of facility activity related to weather phenomena, facility evacuations, or losses of process ventilation. These events have the potential to impact the safety and health of workers in the vicinity.



Source: Review of Occurrence Reports by Department Analysts.

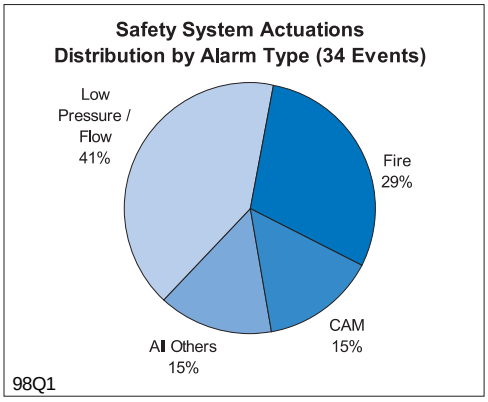
Key Observations

- The number of safety system actuation events reported in 98Q1 (66) was consistent with the average number of actuation events reported since 96Q1 (65).
- The Hanford site had 13 safety system actuation events attributed to loss of process ventilation for 97Q4; this contrasts with 7 reported in 98Q1.

Additional Analysis

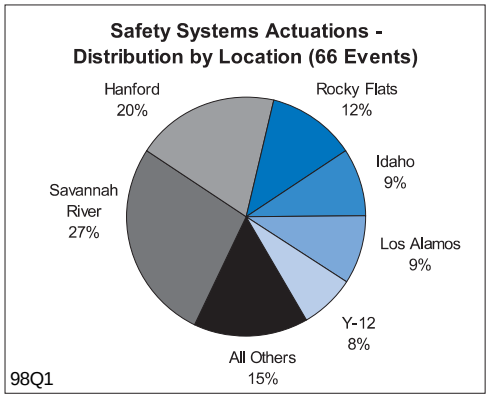
Distribution by Alarm System

- Of the 66 safety system actuations reported in 98Q1, 34 involved non-spurious actuation of alarms.
- System failures also constituted a portion of the safety system actuations reported in 98Q1. The two primary systems were process ventilation (17) and electrical (7). These values were consistent with those reported in previous quarters.
- Weather phenomenon (e.g., wind-related) was a factor in six of the reported safety system actuations in 98Q1.



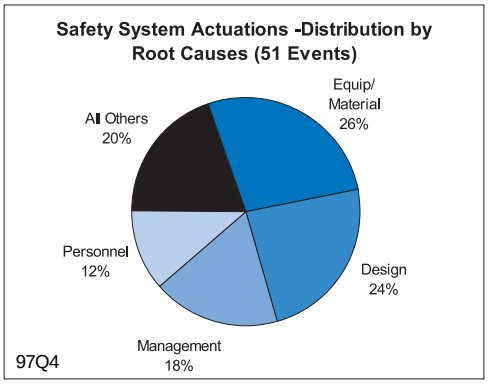
Distribution by Location

- No significant change occurred in the distribution between quarters.

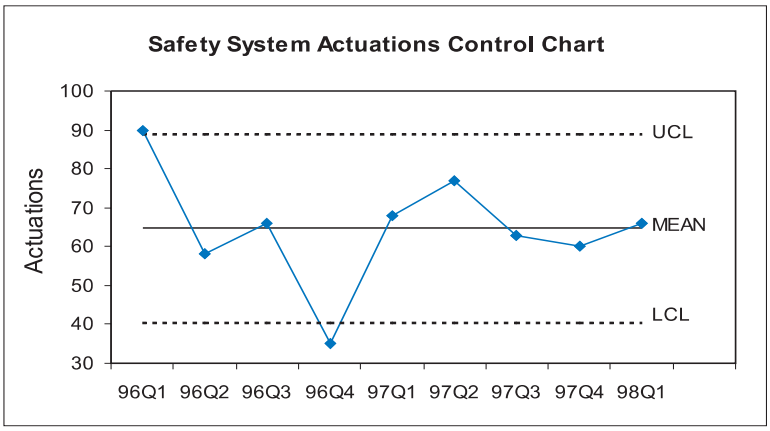


Distribution by Root Cause

- Of the 70 safety system actuation events for 97Q4, 51 had a root cause identified. No significant change occurred in the distribution between quarters.



Statistical Process Control (SPC) Analysis



Beginning with 98Q1, Statistical Process Control analysis will be conducted for this performance indicator. Since data has been collected for only nine quarters, caution should be exercised when interpreting the stability of the centerline, and upper and lower control limits. At this time, the prediction of trends in the data is not advised and as such none have been made. As the number of quarters increases, analysis of the data will provide better confidence in trending analysis and prediction.

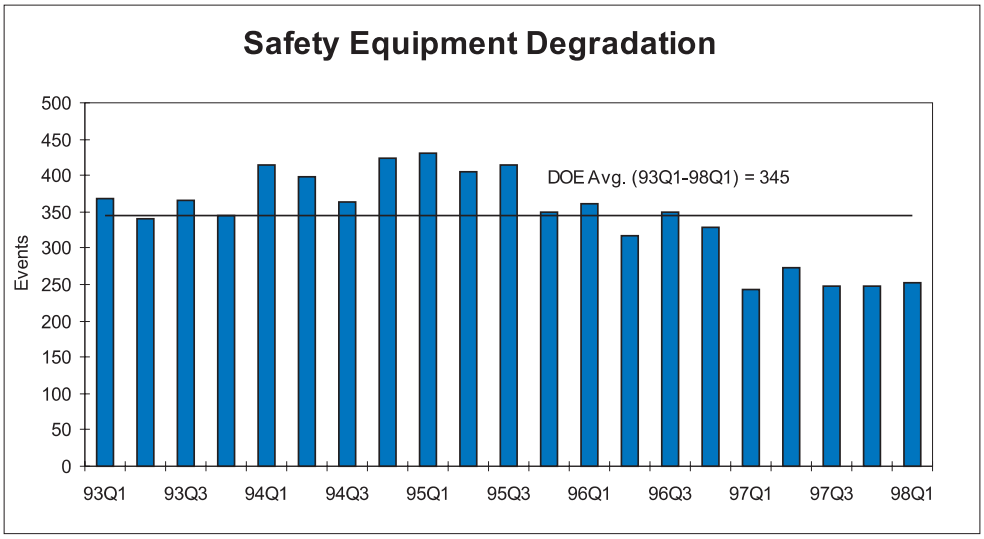
Indicator

15. Safety Equipment Degradation

Definition

Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Safety equipment degradation includes: (1) any unplanned occurrence that results in the safety status or the authorization basis of a facility or process being seriously degraded; or (2) a deficiency such that a structure, system, or component (SSC) vital to safety or program performance does not conform to stated criteria and cannot perform its intended function; or (3) unsatisfactory surveillances/inspections and appraisal findings of any safety SSC.



Source: Review of Occurrence Reports by Department Analysts.

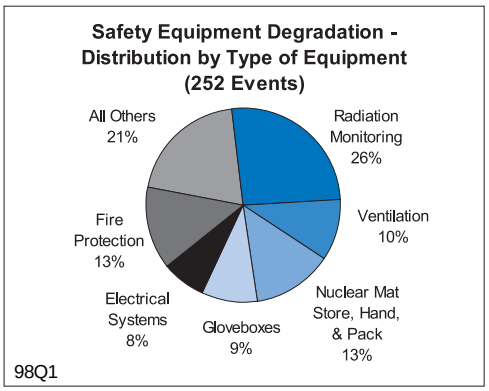
Key Observations

- The number of safety equipment degradation events has remained relatively stable since 97Q1.
- The total of 252 events for 98Q1 was significantly lower (27 percent) than the average of 345 for the past 21 quarters.

Additional Analysis

Distribution by Type of Equipment

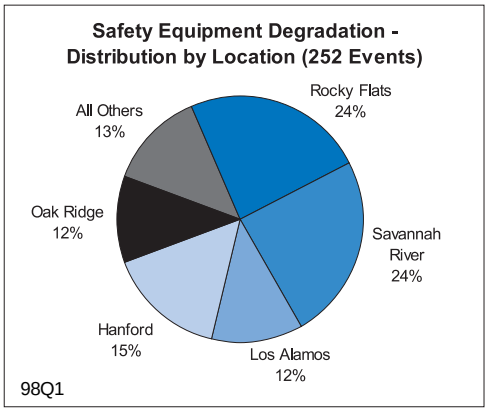
- In this quarter, a change in the trend for ventilation equipment occurred in that it was no longer a major factor. Radiation monitoring equipment events rose from 21 percent in 97Q4 to 26 percent in 98Q1. Except for the number of ventilation equipment events decreasing from 16 percent in 97Q4 to 10 percent in 98Q1, the percentage of most other types of events remained consistent with past quarters.



- For radiation monitoring equipment, the leading type of equipment suffering degradation was the Continuous Air Monitor with 68 percent of the radiation monitoring events. The second leading type of equipment suffering degradation was the Criticality Alarm System with 25 percent of the total.
- One item of note, in the All Others category, there were 15 events (6 percent) related to gas transport and analysis systems.

Distribution by Location

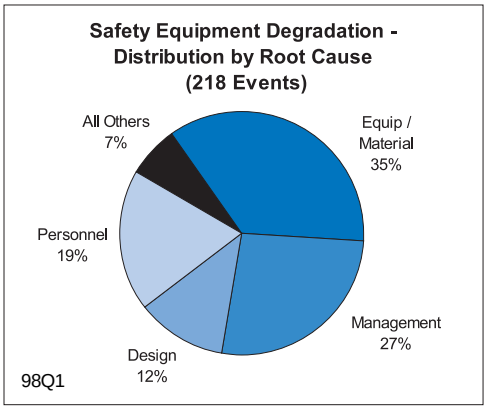
- Rocky Flats and Savannah River Site continued as the leading two sites. Rocky Flats had 67 events in 97Q3, 73 events in 97Q4, and 60 events in 98Q1—down by 60 percent from the highest number of events (158) in 96Q3. Savannah River Site has been constant with approximately 60 events for the past 3 quarters—down by 65 percent from the highest number of events in 94Q1.



- Hanford reported a continuing increase in events from 18 in 97Q3 to 39 in 98Q1. The increase was primarily due to an increase in events dealing with non-radioactive hazardous materials equipment, radiation monitoring equipment, and fire protection equipment. Hanford site personnel attributed this increase to aging equipment at the tank farms (some equipment is 40-50 years old) and an increase in decontamination and decommissioning activities.

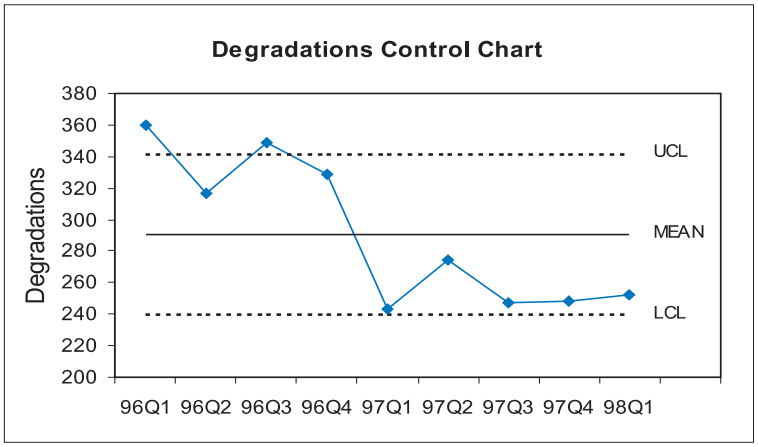
Distribution by Root Cause

- Of the 252 events reported in 97Q4, 218 (or 87 percent) had root causes established at the time that the analysis was performed.
- The root cause for 78 of the safety equipment degradation events was an equipment/material problem. Of these, the two most significant sub-categories of root cause were Defective or Failed Part (48 events) and End of Life Failure (19 events). The root cause for 58 safety equipment degradation events was a management problem. Of these, the most significant sub-category of root cause was Inadequate Administrative Control (24 events).



- Equipment/material problems and management problems have been identified as the leading root causes since 93Q1. The number of events with equipment/material problems identified as the root cause has decreased 20 percent since 95Q3 due to less equipment in service and better preventive maintenance practices. The percentage of events with management problems identified as the root cause has remained constant since 93Q1.

Statistical Process Control (SPC) Analysis



Beginning with 98Q1, Statistical Process Control analysis will be conducted for this performance indicator. Since data has been collected for only nine quarters, caution should be exercised when interpreting the stability of the centerline, and upper and lower control limits. At this time, the prediction of trends in the data is not advised and as such none have been made. As the number of quarters increases, analysis of the data will provide better confidence in trending analysis and prediction.

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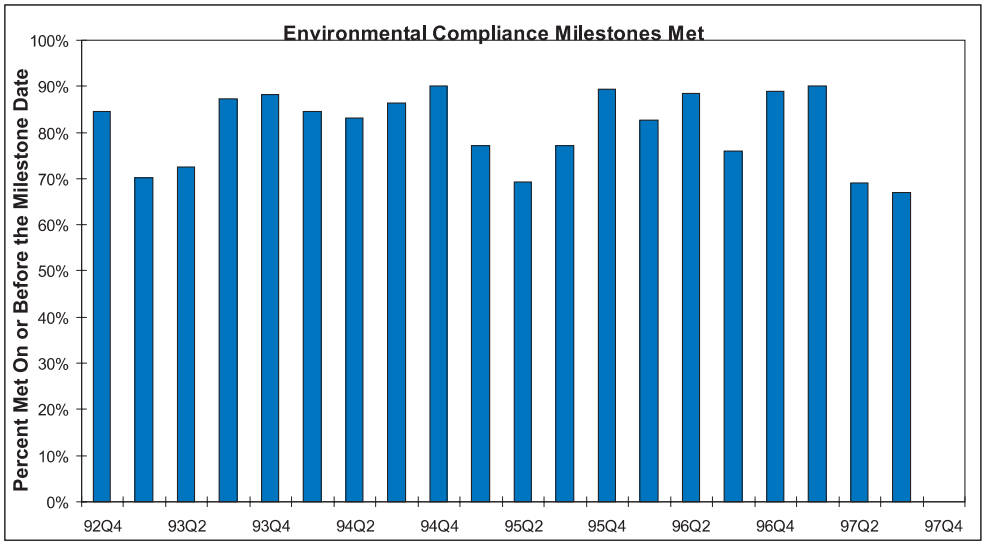
Indicator

16. Environmental Compliance Milestones Met

Definition

Enforceable requirements in environmental agreements met on or before the milestone date (percent).

No change to this section since last report.



Source: Progress Tracking System Data, Office of Environmental Management, EH-41.

Key Observations

- DOE met only 67 percent of its enforceable milestones in 97Q3. This was the lowest performance since 92Q4.
- In FY97, DOE met only 78 percent of its enforceable milestones. By comparison, in FY96, DOE met 83 percent of its milestones.

Additional Analysis

- Data for 97Q4 were not available from the Office of Environmental Management at press time.
- At the end of 97Q2, DOE projected it would meet 78 percent of its milestones in 97Q3. Actual performance was 69 percent of 97Q3 milestones.
- Revised data from 96Q4 and 97Q1 show slightly improved performance for those quarters over that reported in the June 1997 Performance Indicators Report (from 81 percent to 89 percent and from 85 percent to 90 percent, respectively).
- Final numbers show that 345 milestones were established for completion in FY97 and 498 in FY96. Of the FY97 milestones, over 30 percent had goal dates set in the third quarter. Both DOE and the regulator set milestones by the fiscal year; thus milestones tend to peak in the third quarter. This trend was observed for the last five fiscal years.
- These data do not capture all enforceable milestones. They reflect only those milestones under the purview of the Office of Environmental Management. EM's Progress Tracking System is believed to capture 85-90 percent of all DOE enforceable environmental milestones.

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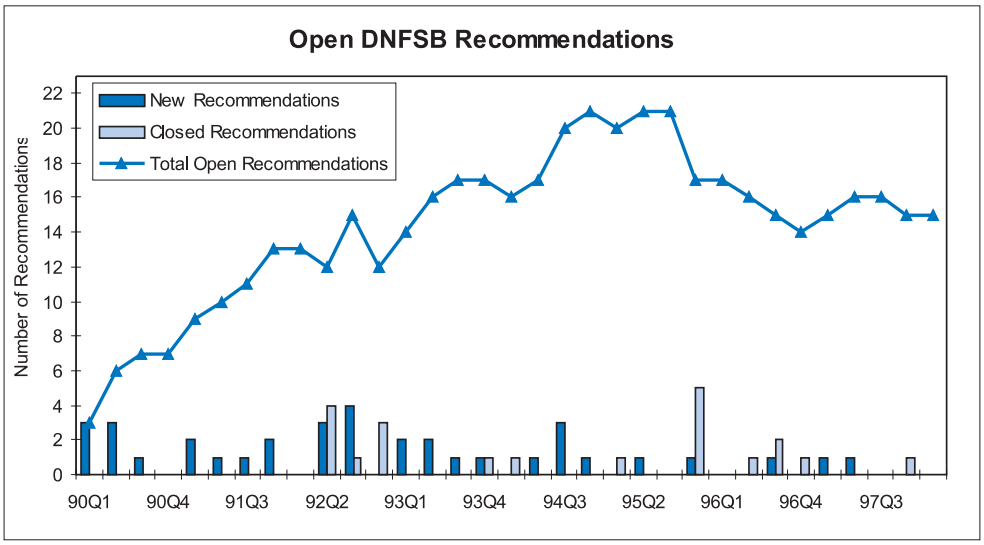
Indicator

17. Open DNFSB Recommendations

Definition

Cumulative number of open Defense Nuclear Facilities Safety Board (DNFSB) recommendations. DNFSB recommendations only apply to DOE defense nuclear facilities and, therefore, are representative only of DOE defense facilities.

Each DNFSB recommendation accepted by DOE leads to an implementation plan containing a set of commitments which, when fully implemented, will resolve the safety issues and lead to closure of the recommendation. A commitment is any documented obligation by the Secretary, or designee, that describes products to be delivered on a specified schedule. Commitments resulting from DNFSB recommendations are tracked by the Office of the Department Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System (SIMS)

Key Observations

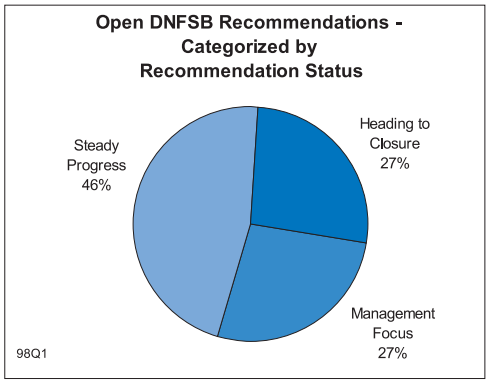
- As of March 1998, there were 15 open DNFSB recommendations representing 617 DOE commitments. Of the 617 commitments, 396 (64 percent) were completed, 150 (24 percent) were open and not yet due, and 71 (12 percent) were open and overdue. A total of 27 commitments were completed over the past quarter.
- While 71 (12 percent) of the total open commitments were considered overdue, 57 (80 percent) of the overdue commitments were overdue by 3 months or longer. The Office of Human Resources and Administration and the Office of Environmental Management have responsibility for 63 (89 percent) of the 71 overdue commitments.

Additional Analysis

Characterization of Recommendation Status

- This graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of “Heading to Closure” represents the existence of a clearly defined path to closure, and the expectation that the remaining commitments/actions can be completed within the next year. “Steady Progress” indicates the existence of an acceptable

implementation plan with most commitments/deliverables being completed on schedule. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (8) of overdue commitments.



- During this quarter, one new recommendation was added to the Management Focus list, Recommendation 96-1 (In Tank Precipitation System), due to the number of overdue commitments. Eight or more implementation plan commitments were overdue for each of the following recommendations: Rec. 93-3 (Improving Technical Capability), Rec. 94-1 (Improved Schedule for Remediation), Rec. 94-2 (Low-Level Waste), and Rec. 96.1 (In-Tank Precipitation System).
- The 93-3 implementation plan revision has been drafted and is expected to be approved and re-baselined in the second quarter of 1998.
- The Office of Environmental Management is working on a comprehensive revision to the 94-1 implementation plan, currently targeted for completion in December 1998.
- Office of Environmental Management and Savannah River Site personnel are evaluating alternatives for the treatment of high-level waste at the In-Tank Precipitation Facility. The marked increase in overdue commitments associated with Rec. 94-2 (Low-Level Waste) was the result of a shift in EM management focus to higher priority issues.

Distribution of Open Commitments

Office	DNFSB Recommendations	Total Commitments	Complete		Not Yet Due		Overdue		Open	
EM	7	394	235	60%	114	29%	45	11%	159	40%
DP	4	129	94	73%	32	25%	3	2%	35	27%
EH	2	21	15	71%	1	5%	5	24%	6	29%
HR	1	66	45	68%	3	5%	18	27%	21	32%
NE	1	7	7	100%	0	0%	0	0%	0	0%
DOE	15	617	396	64%	150	24%	71	12%	221	36%

NOTE: % is percentage of total commitments for that office.

- The table above provides an overview of the status of DNFSB recommendations and commitments. The following four implementation plans have 56 (79 percent) of the 71 overdue commitments: Rec. 93-3 (Improving Technical Capability), Rec. 94-1 (Improved Schedule for Remediation), Rec. 94-2 (Low-Level Waste), and Rec. 96-1 (In-Tank Precipitation Facility).
- There continued to be a constant trend in the number of open commitments. At the end of June 1997, there were 217 open commitments, September 1997 ended with 228 open commitments, December 1997 ended with 244 open commitments,

and the recent quarter ended with 221. The Office of Environmental Management had the largest number of open commitments or 159 (72 percent) of the total open commitments.

- The number of overdue commitments continued to rise over the past 3 months. The total number of overdue commitments increased to 71, the highest level of overdue commitments in over 21 months.
- Two recommendations have 100 percent of the associated commitments complete: Rec. 93-6 (Maintaining Access to Nuclear Weapons Expertise) and Rec. 95-1 (Cylinders Containing Depleted Uranium). One other recommendation was over 90 percent complete, Rec. 93-1 (Standards Utilization in Defense Nuclear Facilities). The Department proposed and is waiting closure of Rec. 93-6 (December 1996) and Rec. 95-1 (June 1997).

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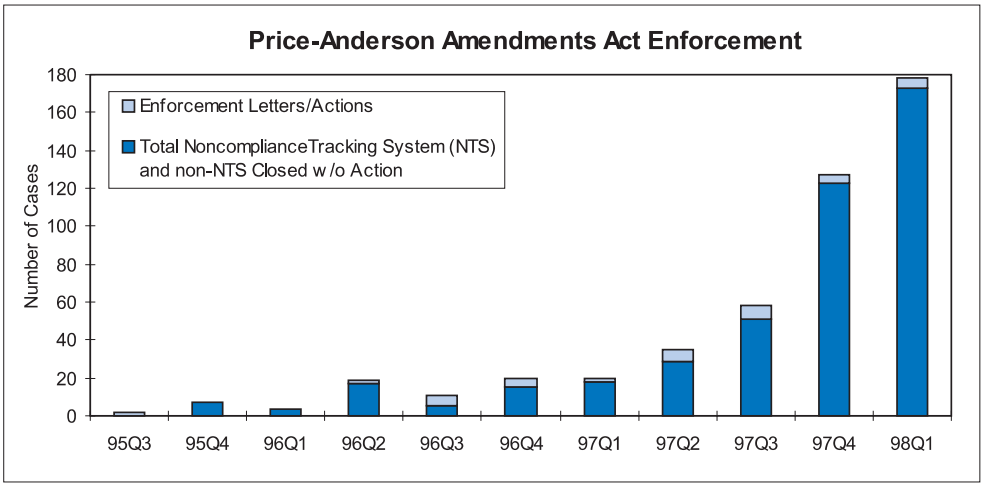
Indicator

18. Price-Anderson Amendments Act Enforcement

Definition

Total number of cases the Price-Anderson Amendments Act[a] (PAAA) Enforcement Office reviews per quarter.



Source: Office of Enforcement and Investigation Database.

Key Observations

- The number of cases the PAAA Enforcement Office reviewed on a quarterly basis continued to increase due to efforts in developing the enforcement program infrastructure which included establishing noncompliance reporting systems, enhanced documentation of cases reviewed by the PAAA Enforcement Office, issuing guidance documents, and disseminating information.

Additional Analysis

- There was one Preliminary Notice of Violation (PNOV) issued to Lawrence Livermore National Laboratory in 98Q1 with a waived civil penalty of $159,375 (waived due to statutory exemption for national laboratories) for unplanned personnel contaminations/intakes.
- There was one PNOV issued to Flour Daniel Hanford in 98Q1 with a civil penalty of $140,625 for criticality safety infractions and a violation of radiological controls.
- There were two Enforcement Letters issued in 98Q1. One was issued to Sandia National Laboratory for operational and work control deficiencies related to the use of three radiation generating devices. The other Enforcement Letter was issued to West Valley Nuclear Services Company for noncompliances with the requirements of 10 CFR 830.120 (Quality Assurance) and 10 CFR 835 (Occupational Radiation Exposure).
- As mentioned in last quarter's DOE ES&H Performance Indicator Report, Brookhaven National Laboratory was issued a PNOV for a number of radiological control deficiencies. Although Brookhaven's response admitted to some of the violations, it denied portions of others. DOE issued a Final Notice on 3/17/98.
- Of the 173 cases reviewed and closed without action by the PAAA Enforcement Office in 98Q1, 13 were self-identified by the responsible contractor via the Noncompliance Tracking System and 160 were identified independently by the PAAA Enforcement Office.

[a] 10CFR Parts 830.120, 835, 820.11.

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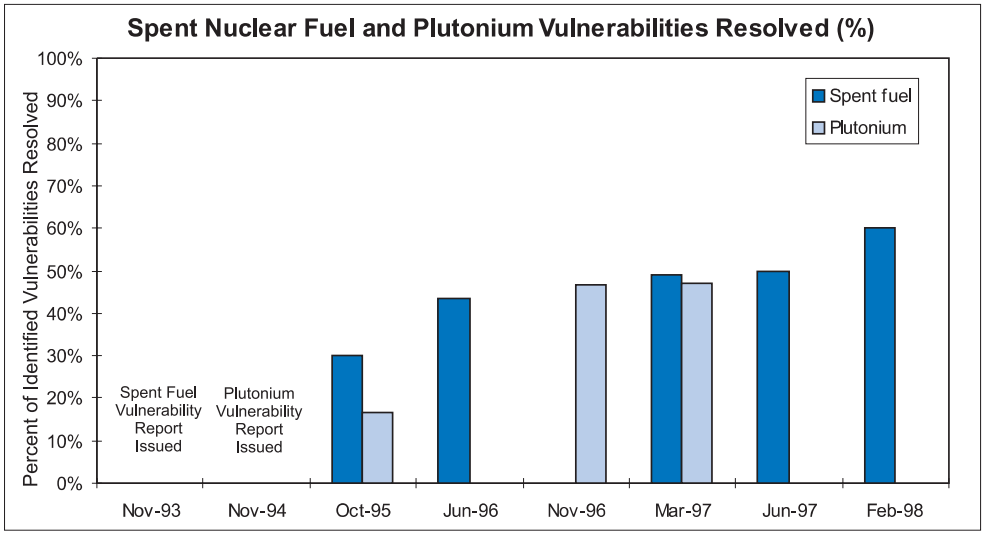
Indicator

19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition

Number of resolved plutonium and spent fuel vulnerabilities divided by the total number of vulnerabilities as defined in *Spent Fuel Working Group Report on Inventory and Storage of the Department's Spent Nuclear Fuel…and Their Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1993, and *Plutonium Working Group Report on Environmental, Safety, and Health Vulnerabilities*, Volume 1, November 1994 (DOE/EH-0415).

An ES&H vulnerability is defined in the plutonium and spent fuel vulnerability reports as "conditions or weaknesses that could lead to unnecessary or increased radiation exposure of workers, release of radioactive material to the environment or radiation exposure to the public." A resolved vulnerability implies that the cited condition no longer exists, the risk has been minimized to an acceptable level, or the risk has been evaluated at an active facility and judged to be acceptable. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weakness), or institutional (e.g., loss of experienced personnel) vulnerabilities. The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.



Source: EM-66, Draft Plutonium Vulnerability Management Summary Report; EM-67, Report on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities.

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 8 sites based on reports issued in 1993 and 1994.
- The most spent nuclear fuel vulnerabilities (34 percent) were identified at Hanford, which currently maintains 86 percent of the DOE total spent nuclear fuel inventory by weight.

Additional Analysis

- There were 536 identified corrective actions for the 106 spent nuclear fuel vulnerabilities. Of these 536 corrective actions, 432 (81 percent) have been completed.

Table 1

Spent Nuclear Fuel Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Hanford	36	23	64%
Idaho	33	11	33%
Savannah River	21	19	90%
All Others	16	11	69%
Total	**106**	**64**	**60%**

- The table above (Table 1) indicates the breakdown of spent nuclear fuel vulnerabilities as of 97Q2 by location and the progress in resolving the identified vulnerabilities.

Table 2

Plutonium Site	Vulnerabilities Identified	Vulnerabilities Resolved	Percent Resolved
Rocky Flats	87	33	38%
Los Alamos	60	41	68%
Savannah River	40	10	25%
Hanford	34	9	26%
All Others	78	47	60%
Total	**299**	**140**	**47%**

Vulnerability resolution status has been updated for this report from the Draft Plutonium Working Group dated March 1997.

- The most plutonium vulnerabilities (87) were identified at Rocky Flats, which maintains 80 percent of the DOE total plutonium inventory by weight. Of these 87 vulnerabilities, 15 have been eliminated and an additional 18 have had the risk reduced to an acceptable level.
- Los Alamos had similar results in closing plutonium vulnerabilities with 14 vulnerabilities eliminated and the risk in 27 other issues reduced to an acceptable level.
- Fifteen of the top 46 highest risk plutonium vulnerabilities, DOE-wide, have been resolved. Seven of the highest plutonium vulnerabilities were eliminated; the risk for 8 other vulnerabilities has been reduced to an acceptable level.
- The above table (Table 2) indicates the breakdown of plutonium vulnerabilities as of 97Q1 by location and the progress of resolving the identified vulnerabilities.

Indicator

20. HEU Vulnerabilities Resolved

Definition

Percentage of vulnerabilities identified in the *Highly Enriched Uranium Working Group Report on Environmental, Safety and Health Vulnerabilities Associated with the Department's Storage of Highly Enriched Uranium* (DOE/EH-0525) that have been resolved.

An ES&H vulnerability is defined in the HEU Working Group Report as "conditions or weaknesses that could result in the exposure of workers or the public to radiation, or in releases of radioactive materials to the environment."

This indicator will be used to measure the progress in resolving the total of 168 ES&H vulnerabilities found in the assessment, and also specific subsets of these vulnerabilities: 1) the facility and material condition vulnerabilities ranked by the HEU Working Group as being of highest significance, 2) vulnerabilities at specific sites, and 3) vulnerabilities involving U-233.

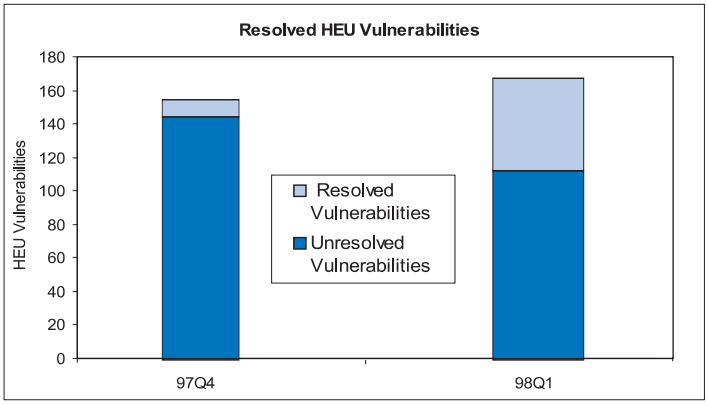
A significant fraction of the HEU Working Group's assessment involved U-233, stemming from this isotope's particular radiological properties (and those of U-232 co-produced with U-233). The HEU Working Group concluded that a special management plan is needed for safe interim storage of U-233 materials. Thus, U-233 vulnerabilities will be tracked as a separate group, even though this will involve "double counting" of some vulnerabilities ranked as having the highest significance.

Key Observations

HEU Vulnerablity Set	Vulnerabilities Identified	Vulnerabilities Resolved	P.I.= % Resolved
Total, DOE-Wide	168	55	33%
Highest Significance	21	5	24%
U-233 Vulnerabilities	13	2	15%

The table above summarizes the Department-wide status of HEU vulnerability resolution including the subsets of Highest Significance and U-233 Vulnerabilities:

- Fifty-five HEU vulnerabilities were resolved through 98Q1 as part of the DNFSB Recommendation 97-1 Implementation Plan actions.



The following table summarizes vulnerabilities on a site basis for 98Q1. Note that Oak Ridge Y-12 Plant stores a far greater amount of HEU (greater than 189 metric tons) than any other site. Also note that Oak Ridge National Laboratory and Idaho National Environmental Engineering Laboratory have the largest quantities of U-233 as shown in parentheses (424 and 351.6 kilograms, respectively). Actual inventories of U-233 are classified in cases where exact amounts are not shown.

HEU Site	HEU Inventory*	Vulnerabilities Identified	Vulnerabilities Resolved	P.I.= % Resolved
Oak Ridge Y-12 Plant	>189.0	54	13	24%
Rock Flats Env. Tech Site	6.7	31	8	26%
Los Alamos National Lab	3.2 (>1.0)	19	2	11%
Portsmouth Gaseous Diffusion Plant	22.0	18	7	39%
Idaho Nat. Engineering & Environmental Lab	>1.0 (351.6)	12	9	75%
Savannah River Site	13.8	9	4	44%
Oak Ridge K-25 Site	1.5	9	5	56%
Oak Ridge National Lab	1.2 (424.0)	6	1	17%
Pantex Plant	16.7**	5	3	60%
Sandia National Laboratories	<1.0	1	——	—
Argonne National Lab-West	<10.0	1	1	100%
Lawrence Livermore National Lab	<1.0 (3.1)	1	——	—
New Brunswick Laboratory	<1.0	2	2	100%

* Inventory of HEU produced in metric tons and U-233 in kilograms (shown in parentheses).

**Includes planned dismantlement.

Additional Analysis

- Led by the Office of Defense Programs (DP), DOE developed the HEU Vulnerability Management Plan, issued on June 13, 1997 by DP-1, that outlines a process for corrective actions and resolution of the HEU vulnerabilities. DP will track the resolution of the HEU vulnerabilities and report these either by a separate quarterly status report, or by information included in status reports that combine HEU vulnerability resolution with those for plutonium and/or spent nuclear fuel vulnerabilities. Moreover, the HEU Vulnerability Management Plan sets dates for resolution of the rest of the 19 HEU vulnerabilities (two have been resolved) designated by the HEU Working Group as being the highest significance. Thus, tracking of the PIs for these vulnerabilities can be shown against scheduled completion dates.
- The resolution of the other 113 HEU vulnerabilities identified in the HEU Vulnerability Assessment will depend on site-specific plans. Because of the need to work with separate Field Offices, scheduling and tracking of PIs concerning the other 113 vulnerabilities will take more effort and time to perform than those explicitly covered in the HEU Management Plan.

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Indicator

21. Waste Generation

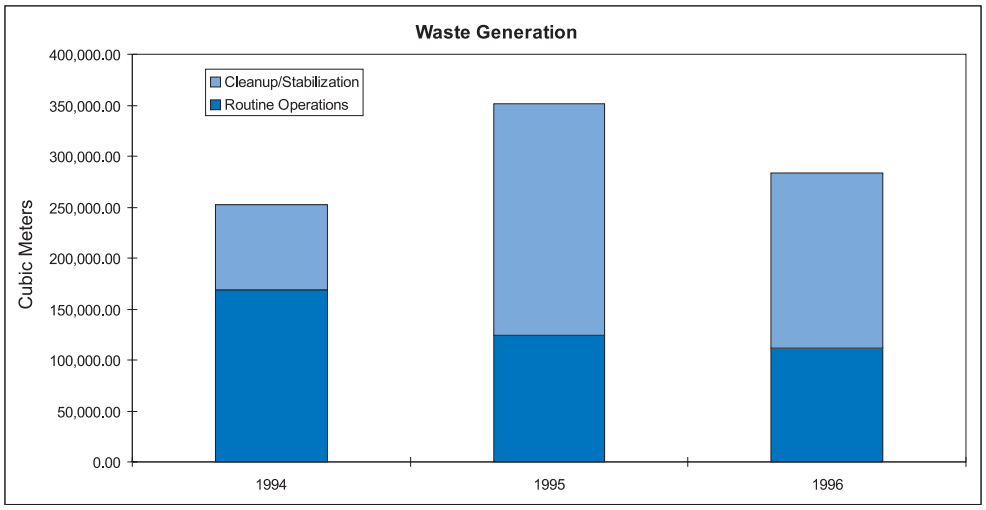
Definition

Total amount of waste generated, in cubic meters, for all DOE sites. Waste types generated include High-Level Radioactive, Transuranic, Low-Level Radioactive, Low-Level Mixed, Hazardous, and Sanitary. These waste types are generated during routine operations or cleanup/stabilization activities.

No change to this section since last report.

Routine operations waste consists of normal operation waste produced by any type of production operation; analytical and/or research and development laboratory operations, treatment, storage and disposal operations; "work for others"; or any other periodic or recurring work that is considered ongoing in nature.

Cleanup/stabilization waste, including primary and secondary waste, is generated by the environmental restoration of contaminated media (soil, groundwater, surface water, sediments, etc.), stabilization of nuclear and nonnuclear (chemical) materials, and deactivation and decommissioning of facilities.



Source: *Annual Report of Waste Generation and Pollution Prevention Progress 1996, August 1997, Office of Pollution Prevention, Office of Environmental Management.*

Key Observations

- The overall amount of waste generated decreased from 345,279 cubic meters to 283,948 cubic meters from 1995 to 1996. The amount of waste generated during routine operations (excluding sanitary) decreased 27 percent (from 30,164 cubic meters to 22,544 cubic meters), and the amount of waste generated during cleanup/stabilization operations (excluding sanitary) decreased 15 percent (from 114,201 cubic meters to 97,208 cubic meters). During the same period, the sanitary waste generated during routine operations decreased 9 percent (from 97,797 cubic meters to 89,038 cubic meters), and the amount of sanitary waste generated during cleanup/stabilization operations decreased 27 percent (from 103,117 cubic meters to 75,158 cubic meters).
- According to one of the authors of the *Annual Report of Waste Generation and Pollution Prevention Progress 1996*, the decrease in routine operations waste generated could be attributed to the rigorous pollution prevention programs put in place by programs and operations that reduced the generation of new waste, and the decrease in cleanup/stabilization waste generated for 1996 could be attributed to a peak in funding and phasing of those activities.

The tables below subcategorize waste generation based on production source: routine or cleanup/stabilization activities.

Waste Generated During Routine Activities (Cubic Meters)

Waste Type	1994	1995	1996
High-Level Radioactive	2,071	2,496	2,670
Transuranic	546	336	302
Low-Level Radioactive	31,868	21,894	15,048
Low-Level Mixed	2,834	1,335	1,371
Hazardous	12,497	4,103	3,153
Sanitary	110,208	97,797	89,038

- From 1995 to 1996, waste generated during routine activities decreased by 10 percent for Transuranic Waste, 27 percent for Low-Level Radioactive Waste, and 25 percent for Hazardous Waste.

Waste Generated During Cleanup/Stabilization Activities (Cubic Meters)

Waste Type	1994	1995	1996
Transuranic	214	156	202
Low-Level Radioactive	42,603	86,848	64,968
Low-Level Mixed	14,035	4,518	2,137
Hazardous	8,900	22,679	29,901
Sanitary	16,010	103,117	75,158

- From 1995 to 1996, waste generated during cleanup/stabilization activities decreased 26 percent for Low-Level Radioactive Waste and 52 percent for Low-Level Mixed Waste.
- Sanitary Waste accounted for 42 percent of all waste generated in both 1995 and 1996.

Additional Analysis

The Secretary's Commitments to the President in EQ and ES&H (for FY98)

Environmental Quality (EQ) and Environment, Safety, and Health (ES&H) commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1998 are summarized below.

More information related to the status of these commitments can be obtained from DOE's Office of Policy or via the World Wide Web at: http://www.doe.gov/policy/library/sol98/goals_eq.htm

Environmental Quality (FY98)

Aggressively clean up the environmental legacy of nuclear weapons and civilian nuclear research and development programs, minimize future waste generation, safely manage nuclear materials, and permanently dispose of the Nation's radioactive wastes.

Our Commitments

EQ1: *Reduce the most serious risks from the environmental legacy of the U.S. nuclear weapons complex first.*

EQ1-1 REDUCING WORKER, PUBLIC, AND ENVIRONMENTAL RISKS

Identify and fund projects to reduce the most serious risks first and prevent further increases in relative risk at all sites. **(EM)**

Success will be measured in FY 1998 by:

- *Stabilizing and safely storing about 3.7 metric tons of heavy metal of spent nuclear fuel (SNF). [Note: SNF data excludes information that is controlled or classified.]*
- *Stabilizing approximately 20,000 kilograms of bulk plutonium residue and approximately 7,000 liters of plutonium solution, and safely storing stabilized material.*
- *Closing one high-level waste storage tank at the Savannah River Site.*

EQ2: *Clean up as many as possible of the Department's 53 remaining contaminated geographic sites by 2006.*

EQ2-1 ACCELERATE AND COMPLETE GEOGRAPHIC SITE CLEANUP

Clean up as many as possible of the Department's 53 remaining contaminated geographic sites by 2006. Accelerate and complete cleanup of 9 large geographic sites by 2006, including the Fernald Environmental Management Project, Mound Plant, Rocky Flats Environmental Technology Site, Portsmouth Gaseous Diffusion Plant, West Valley Site, Weldon Spring Site, Brookhaven National Laboratory, and Lawrence Livermore National Laboratory (Main Site and Site 300).

Cleanup 34 of the remaining 36 smaller geographic sites by 2006, including the Uranium Mill Tailings Remedial Action (UMTRA) Project.

Accelerate cleanup at the remaining 7 large sites (Hanford, Savannah River, Idaho, Oak Ridge Reservation, Los Alamos National Laboratory, Nevada Test Site, and Paducah) where overall completion will not be achieved by 2006, and ramp up disposal operations at the Waste Isolation Pilot Plant (WIPP) to facilitate this accelerated clean-up.

Remediation progress will be measured by completion of release sites (i.e., discrete areas of contamination) and facilities (i.e., contaminated structures) that will ultimately lead to the completion of the entire geographic site. **(EM)**

Success will be measured in FY 1998 by:

- *Completing remediation at 6 geographic sites. This will bring the total number of completed geographic sites to 66 out of a total of 113 contaminated geographic sites.*
- *Making progress on release site completion:*
  - *Completing about 575 release site assessments.*
  - *Completing about 280 release site cleanups. This will bring the number of completed release site cleanups to approximately 4,130 out of a total inventory of about 9,300 release sites.*
- *Making progress on facility decommissionings:*
  - *Completing about 90 facility decommissioning assessments.*
  - *Completing about 70 facility decommissionings. This will bring the number of completed facility decommissionings to approximately 520 out of a total inventory of about 2,950 facilities.*

EQ3: *Safely and expeditiously dispose of waste generated by nuclear weapons and civilian nuclear research and development programs and make defense high-level radioactive wastes disposal-ready.*

EQ3-1 OPENING THE WASTE ISOLATION PILOT PLANT

Declare the Waste Isolation Pilot Plant (WIPP) geologic repository open for disposal of transuranic wastes in May 1998 (subject to regulatory approval) and maximize timely shipment of waste from DOE sites. **(EM)**

Success will be measured in FY 1998 by shipping between 388 and 592 cubic meters of transuranic (TRU) waste to WIPP for disposal from three DOE sites (Los Alamos National Laboratory, Rocky Flats Environmental Technology Site, and Idaho National Engineering and Environmental Laboratory).

EQ3-2 MAKING DISPOSAL READY AND DISPOSING OF WASTE GENERATED DURING PAST AND CURRENT DOE ACTIVITIES

Safely and expeditiously make disposal-ready and dispose of waste generated during past and current DOE activities. **(EM)**

Success will be measured in FY 1998 by:

- *Disposing of about 4,000 cubic meters of mixed low-level waste (MLLW).*
- *Disposing of about 30,000 cubic meters of low-level waste (LLW).*
- *Producing 200 canisters of high-level waste (HLW) at the Defense Waste Processing Facility (DWPF) at the Savannah River Site.*
- *Producing approximately 88 canisters of HLW at the West Valley Demonstration Project.*

EQ-4 *Prevent future pollution.*

EQ4-1 PREVENTING FUTURE POLLUTION

Incorporate pollution prevention, including waste minimization, recycling, and reuse of materials, into all DOE activities. **(EM, DP, NE, ER)**

Success will be measured in FY 1998 by:

- *Reducing routine waste generation by 40 percent compared with 1993 waste generation rates. [Data for reporting will be available at the end of calendar year 1998]* **(EM)**
- *Reducing/avoiding the generation of radioactive, mixed, and hazardous wastes by about 4,000 cubic meters. [Data for reporting will be available at the end of calendar year 1998]* **(EM)**

EQ5: *Dispose of high-level radioactive waste and spent nuclear fuel in accordance with the Nuclear Waste Policy Act as amended.*

EQ5-1 CONTINUING WITH YUCCA MOUNTAIN SITE CHARACTERIZATION

Complete the scientific and technical analyses of the Yucca Mountain site, and if it is determined to be suitable for a geologic repository, obtain a license from the Nuclear Regulatory Commission. **(RW)**

Success will be measured in FY 1998 by completing the viability assessment analyses for licensing and constructing a geologic repository at the Yucca Mountain site. The assessment will consist of four key components:

- *A design and operational concept of the repository;*
- *An assessment of the performance of that concept in the geologic setting;*
- *A plan and cost estimate to construct and operate the repository; and*
- *A plan and an estimate of the costs to complete a license application.*

EQ5-2 DEVELOPING WASTE ACCEPTANCE AND TRANSPORTATION CAPABILITY

Maintain the capability to respond to potential statutory direction that may include transportation of spent nuclear fuel and high-level waste to a designated interim storage facility. **(RW)**

Success will be measured in FY 1998 by:

- *Completing generic, non-site-specific interim storage facility work and addressing long lead-time issues related to storage of waste including design, engineering, and safety analyses.*
- *Developing a market-driven approach that uses private sector management and operational capabilities to provide waste acceptance and transportation services. Issuing a revised draft request for proposals.*
- *Completing a revised Policy and Procedure for implementation of Section 180(c) of the Nuclear Waste Policy Act.*

EQ-6 *Reduce the life-cycle costs of environmental cleanup.*

EQ6-1 REDUCING ENVIRONMENTAL CLEANUP COSTS THROUGH ENHANCED PERFORMANCE

Significantly enhance performance, increase efficiency, and reduce costs through increased use of fixed-price competitive contracting, optimized project sequencing, recycling, and other waste minimization techniques, privatization, systems engineering, and benchmarking. **(EM)**

Success will be measured in FY 1998 by

- *Achieving productivity enhancement targets (Targets to be established as part of the Accelerating Clean-up: Focus on 2006).*
- *Increasing the dollar value and/or number of competitively awarded fixed-price contracts, including privatization contracts. Continuing the development of the privatization strategy by:*
  - — *Awarding the Oak Ridge Transuranic Waste Treatment Privatization contract;*
  - — *Authorizing commencement of the Tank Waste Remediation System (TWRS) contract Phase 1B at Hanford Site in Washington; and*
  - — *Awarding the Carlsbad Area Office Contact-Handled Transuranic Waste Transportation Privatization Contract.*

EQ6-2 DEVELOPING AND DEPLOYING INNOVATIVE CLEANUP TECHNOLOGIES

Develop and deploy innovative environmental cleanup, nuclear waste, and spent fuel treatment technologies that reduce cost, resolve currently intractable problems, and/or are more protective of workers and the environment. **(EM)**

Success will be measured in FY 1998 by:

- *Accomplishing 49 innovative technology deployments.*
- *Demonstrating 35 alternative technology systems that meet the performance-specification based needs as identified by the Site Technology Coordinating Groups (STCGs).*
- *Making 40 alternative technology systems available for implementation with full cost and engineering performance data.*
- *Completing the final Programmatic Environmental Impact Statement for selecting the long-term management strategy for the depleted UF_6.* **(NE)**

EQ6-3 COMPLETING DEACTIVATION OF SURPLUS FACILITIES

Reduce operating costs by completing deactivation of surplus facilities and placing them in a safe and environmentally sound condition, requiring minimal surveillance and maintenance. **(EM)**

Success will be measured in FY 1998 by completing about 60 surplus facility deactivations.

EQ-7 *Maximize the beneficial reuse of land and effectively control risks from residual contamination.*

EQ7-1 MAKING DOE LANDS AND FACILITIES AVAILABLE FOR OTHER USES

In conjunction with stakeholders, develop comprehensive land use plans for DOE sites that provide information on alternative uses, ownership, environmental requirements, and implementation schedules. **(FM)**

Success will be measured in FY 1998 by:

- *Submitting to Congress a future use plan for DOE sites, and an analysis of related long-term stewardship issues by October 1998. The plan and analysis will include the Hanford Site, Savannah River Site, Rocky Flats Environmental Technology Site, and Idaho National Engineering and Environmental Laboratory.* **(EM)**
- *Initiating mission justification analysis and providing a schedule for reporting on the amount of excess land and facilities at each site by July 30, 1998.*

Environment, Safety, and Health

The mission of the Office of Environment, Safety, and Health is to develop innovative, unique, and cost-effective approaches for the protection of Department of Energy workers, the public, and the environment.

Our Commitments

CM1-1 INSTITUTING A SOUND ES&H CULTURE

Integrate and embed risk-based outcome oriented environment, safety, and health (ES&H) management practices into the performance of DOE's day-to-day work. **(EH)**

Success will be measured in FY 1998 by:

- *Preventing fatalities, serious accidents, and environmental releases at Departmental sites.*
- *Initiating Integrated Safety Management Systems at all 10 high priority facilities by April 1998.*
- *Completing documentation of ES&H roles and responsibilities for all appropriate DOE offices and sites by July 1998.*
- *Publishing guidance for incorporating environmental justice principles into the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) implementation process. (EH/ED)*

- *Through independent oversight, provide information and analysis of the effectiveness, vulnerabilities, and trends of the Department=s environment, safety, health, and .safeguards and security policies and programs to the Secretary and senior line management*
- *Completing an additional four needs assessments to continue building the basis for a more detailed program of medical surveillance, in order to address the health risks to former DOE workers.*

CM1-2 ENSURING DOE PROGRAMS APPROPRIATELY ADDRESS ES&H PRIORITIES

Clearly identify and fund ES&H priorities and ensure resources are appropriately spent on those priorities. **(EH)**

Success will be measured in FY 1998 by beginning to annually monitor and report on ES&H expenditures and improve related internal controls.

CM1-4 INVESTIGATING FEASIBILITY OF INDEPENDENT EXTERNAL OVERSIGHT OF SAFETY AND HEALTH AT DOE SITES

Work with the Nuclear Regulatory Commission and the Occupational Safety and Health Administration to evaluate the costs and benefits of independent external regulation of safety and health. **(EH)**

Success will be measured in FY 1998 by conducting three NRC/DOE pilot projects to assess the DOE facilities against the standards that NRC believes would be appropriate to ensure radiological safety.

Relationship to DOE Strategic Plan Goals

Establish Priorities & Eliminate Hazards

Performance Requirements

DOE STRATEGIC PLAN (September 1997)	PERFORMANCE INDICATORS
DOE's Four Businesses: Environmental Quality *How we will reduce the environmental, safety, and health risks and threats from DOE facilities and materials, safely and permanently dispose of civilian spent nuclear fuel and defense related radioactive waste, and develop the technologies and institutions required for solving domestic and international environmental problems.* **Environmental Quality: Objective 3** *Safely and expeditiously dispose of waste generated by nuclear weapons and civilian nuclear research and development programs and make defense high-level radioactive waste disposal-ready*	1. Lost Workday Case Rate 2. Occupational Safety and Health Cost Index 3. Electrical Safety 4. Industrial Operations Safety 5. Chemical Hazard Events 6. Reportable Occurrences of Releases to the Environment 7. Cited Environmental Violations 8. Environmental Permit Exceedances 9. Radiation Dose to the Public 10. Worker Radiation Dose 11. Radiological Events 18. Price-Anderson Amendments Act Enforcement 19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved 21. Waste Generation
Corporate Management: Environment, Safety, and Health *How we will ensure the safety and health of workers and the public, and protect and restore the environment.* **Corporate Management: Objective 1** *Ensure the safety and health of the DOE workforce and members of the public, and the protection of the environment in all Departmental activities.*	1. Lost Workday Case Rate 2. Occupational Safety and Health Cost Index 3. Electrical Safety 4. Industrial Operations Safety 7. Cited Environmental Violations 8. Environmental Violations 9. Radiation Dose to the Public 10. Worker Radiation Dose 11. Radiological Events 12. Near Misses and Safety Concerns 13. Inadequate Procedures/Procedures Not Followed 16. Environmental Compliance Milestones Met 17. Open DNFSB Recommendations

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy's (DOE) Strategic Plan for environment, safety and health is, "how will we ensure the safety and health of workers and the public, and protect and restore the environment." This report describes a new approach for measuring the performance of DOE operations in these areas and thereby supporting management decisions aimed at "ensuring the safety." The general concept is to focus on key factors with the most impact on worker and facility safety and the environment.

Data collection was limited to available data (e.g., ORPS, CAIRS, Site Environmental Reports). The process was non-intrusive and did not expend site resources. As such, the performance indicator components may not sufficiently measure all facets of environment, safety and health. Experience from this report, along with customer feedback from the attached survey form, will be evaluated.

This report was reviewed by a multi-disciplinary team with expertise in nuclear and facility safety, environment, worker safety and health, health studies, and planning/administration. The team is identified at the end of this appendix.

B1.1 Initial Performance Indicators

The performance indicators included in this report are identified in the following table. Selection of the indicators involved both evaluation of the overall safety significance as well as tests of availability. A process was established where all potential indicators were evaluated with respect to significance to the ultimate goal of measuring performance in environment, safety and health. With respect to availability, a decision was made to select indicators from existing data streams to avoid, for now, levying a burden on field activities for additional data. Primarily, indicators are derived from data within four data systems and one annual report:

- *Occurrence Reporting and Processing System (ORPS)*—A system originally designed for notification of nuclear as well as non-nuclear occurrences in the field. For all indicators based on occurrence reports, data prior to 93Q1 has been removed from the graphs and analysis.

- *Computerized Accident/Incident Reporting System (CAIRS)*—A system for collecting data associated with occupational injury and illness events and statistics.

- *Radiation Exposure Monitoring System (REMS)*—A system for collecting data on individual radiation doses received by DOE complex workers.

- *Environmental Compliance Database*—A system maintained by the Office of Environmental Policy and Assistance.

- *Annual Site Environmental Reports*

There are, of course, limitations resulting from using the data for other than the purpose for which it was collected. Furthermore, the availability of data should not be confused with relevance to measuring performance. Indicators should be selected based on their impact on the operations being examined, not solely because the data exist. Although some of the selected indicators may be of interest to other audiences, it is likely that other valid indicators exist that should be analyzed and trended to provide the appropriate perspective (e.g., facility, contractor, program management) on performance.

PI Component	Data Source
I. Accidents/Events	
1. Lost Workday Case Rate	Computerized Accident/Incident Reporting System/ EH-51
2. Occupational Safety and Health Cost Index	Computerized Accident/Incident Reporting System/ EH-51
3. Electrical Safety	Review of Occurrence Reports, EH-33 Field Office Contacts
4. Industrial Operations Safety	Review of Occurrence Reports, EH-33 Field Office Contacts
5. Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/ Occurrence Reporting and Processing System, EH-52/EH-53/BNL
6. Reportable Occurrences of Releases to the Environment	Review of Occurrence Reports, EH-33
7. Cited Environmental Violations	Environmental Compliance Tracking Database, EH-41
8. Environmental Permit Exceedances	Annual Site Environmental Reports, EH-41
9. Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
10. Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
11. Radiological Events	Review of Occurrence Reports, EH-33
II. Precursors	
12. Near Misses and Safety Concerns	Review of Occurrence Reports, EH-33
13. Inadequate Procedures/Procedures Not Followed	Review of Occurrence Reports, EH-33
14. Safety System Actuations	Review of Occurrence Reports, EH-33
15. Safety Equipment Degradation	Review of Occurrence Reports, EH-33, Field Office Contacts
III. ES&H Management	
16. Environmental Compliance Milestones Met	EM Progress Tracking System (PTS), EH-41
17. Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
18. Price-Anderson Amendments Act Enforcement	Office of Enforcement and Investigation Database, EH-10
IV. Hazards	
19. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-66; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-67
20. HEU Vulnerabilities Resolved	Office of Site Operations, DP-24 Highly Enriched Uranium ES&H Vulnerabilities Status Report, RFFO Field Office Contacts
21. Waste Generation	Waste Minimization Reporting System, EH-41

B2. Data Analysis–Analyses Performed

The data analysis results are summarized in the DOE Performance Indicator Report. They are intended to identify areas which should be further investigated (to identify areas that may require intervention as well as good practices to share across DOE); they do not provide absolute answers in themselves. Data analyses include:

- Looking for statistically significant trends over time,
- Comparison to historical averages or benchmarks (e.g., Bureau of Labor Statistics for similar industries),
- Normalization of events to opportunities (e.g., construction related events divided by construction hours worked or construction dollars spent),
- Examination for statistically significant trends in types of operations, severity or type of events, and causes.

Typically, the historical baseline is established using existing data excluding the most recent quarter. Where possible, data were analyzed by quarter. In some cases, data were also viewed monthly to reveal any interesting seasonal effects not evident in the quarterly data grouping. Where appropriate, sites were contacted to provide perspective for unusual data values or trends. Data sources for several of these measures are annual; the need for more frequent data must be evaluated for future reports.

The data can also be used to perform other special analyses and reports (such as trends in causes and types of events). These analyses and reports could support special needs, such as oversight preparation and programmatic reviews. Root cause data is analyzed based on information from the preceding quater as there is an inherent time lag between event notification and final identification of a root cause. To capture the maximum number of root causes for analysis purposes, the preceding quarter is examined.

The same approach can be used to perform more detailed functional or programmatic analyses by identifying subsets (peer groups) of DOE facilities for further examination. Examples of peer groups might include: reactors, accelerators, major clean-up sites, waste storage areas, defense chemical facilities, fossil energy sites, laboratories and spent fuel storage facilities.

B3 – Significance Analysis

The application of significance ranking in the context of performance indicators can be used to aid DOE and contractor management in determining where they need to apply resources to mitigate hazards or to improve safety. It is anticipated that as experience is gained, significance ranking will be applied to other performance indicators.

Significance of events is assigned in accordance with Table 1, EH-33 Performance Indicator Significance Criteria, in Appendix B-3 of this report. The table was developed for use with the PI report with input from various significance ranking models, including Savannah River's Significance Categories Matrix, Hanford's Priority Planning Grid, and from limits provided by various DOE Orders.

There are four significance rankings – Level 1 through 4 – with Level 1 being the most significant and Level 4 the least. Generic criteria for areas such as worker and public safety are combined with PI-specific criteria (i.e., Electrical Safety) to rank the significance of events. For example, a minor event that would be ranked as Level 4 (least significant) under the generic criteria would, in accordance with the PI-specific criteria for Electrical Safety, be ranked as Level 3 if an electrical shock was involved. For cases where there is no PI-specific criteria, the generic criteria are used.

It is expected that more PI-specific criteria will be developed as experience is gained with the current system and based on feedback from readers of this report.

Table 1 - EH-33 Performance Indicator Significance Criteria

Worker Safety	Level 1	Level 2	Level 3	Level 4
	Loss of life			
	Permanent disability			
	Injury with >30 days of lost work time	Injury with hospitalization or lost work time	Injury requiring medical treatment	Minor injury - no treatment, no lost work days
Public Safety	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	Offsite exposure near or above limits, moderate injuries	Low-level radiation or chemical exposure	Minor injury	Public inconvenience
Environmental	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	Major on-site environmental damange with cleanup costs >$5M	On-site environmental damage with cleanup costs >$500K	On-site environmental damage with cleanup costs >$250K	Reportable release with minor or no impact
	Off-site environmental damage with significant cleanup costs	On-site environmental damage with minor cleanup costs	Release to environment that exceed regulatory limits	
Facility Safety	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	Willful management disregard or direction to staff to disregard safety requirements, policies, or procedures	Widespread failure or lack of one or more facility safety programs	Findings indicating major deficiency or lack of compliance with safety documents	Administrative or isolated non-compliance
		Unreviewed Safety Question	OSR / Tech Spec violation	
		Major loss of configuration control in nuclear facility	Technical analysis cannot support conclusions needed for compliance document	
		DOE authorization required for startup or restart	Failure of corrective action to prevent recurrence	
External Compliance	**Level 1**	**Level 2**	**Level 3**	**Level 4**
	Willful violation of federal, state, or local laws or regulations	Several instances of non-compliance that indicate major deficiency or lack of a compliance program	Isolated or single noncompliance	Administrative or isolated non-compliance
Cost / Schedule	**Level 1**	**Level 2**	**Level 3**	**Level 4**
Cost	>$5M	>$1M	>$250K	>$100K
Schedule	Significant project delay		Minor project delay	Failure to meet milestone
Electrical Safety	**Level 1**	**Level 2**	**Level 3**	**Level 4**
			Electrical Shock, RF burn	
			Contact with energized equipment that should have been de-energized	

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Glossary

Baselines

Baselines provide an historical reference point used to show how the current period compares to past experience. Generally, historical baselines are established using existing data excluding the most recent reporting period. For the data that originates from CAIRS, the two most recent quarters are excluded to account for the lag in data reporting. Baselines established for data originating from occurrence reports are reevaluated each time the governing reporting order changes.

Causes of Occurrences

Causes of occurrences are determined by performing event investigations and may be identified as direct, contributing, or root causes.

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence, but by itself would not have caused the occurrence.
- Root Cause: The cause that, if corrected, would prevent recurrence of this and similar occurrences.

Cause categories are selected from the following:

1. Equipment/material problem: An event or condition resulting from the failure, malfunction, or deterioration of equipment or parts, including instruments or material.
2. Procedure problem: An event or condition that can be traced to the lack of a procedure, an error in a procedure, or procedural deficiency or inadequacy.
3. Personnel error: An event or condition due to an error, mistake or oversight. Personnel errors include inattention to details of the task, procedures not used or used incorrectly, communication problems, and other human errors.
4. Design problem: An event or condition that can be traced to a defect in design or other factors related to configuration, engineering, layout, tolerances, calculations, etc.
5. Training deficiency: An event or condition that can be traced to a lack of training or insufficient training to enable a person to perform a desired task adequately.
6. Management problem: An event or condition that can be directly traced to managerial actions or methods. Management problems include inadequate administrative control, work organization/planning deficiency, inadequate supervision, improper resource allocation, policies not adequately defined, disseminated or enforced,

Facility Function

Facility function identifies the type of facility or the activity/function performed by the facility. Possible facility functions are listed below.

- Plutonium Processing and Handling
- Special Nuclear Materials Storage
- Explosive
- Uranium Enrichment
- Uranium Conversion/Processing and Handling
- Irradiated Fissile Material Storage
- Reprocessing
- Nuclear Waste Operations
- Tritium Activities
- Fusion Activities
- Environmental Restoration Operations
- Category “A” Reactors
- Category “B” Reactors
- Solar Activities
- Fossil and Petroleum Reserves
- Accelerators
- Balance-of-Plant (e.g., offices, machine shops, site/outside utilities, safeguards/security, and transportation)

The following terms are related to occurrence reporting, as required by DOE Order 232.1A, *Occurrence Reporting and Processing of Operations Information*.

Occurrence Categories (Types of Occurrences)

Occurrence categories are arranged into 10 generic groups related to DOE operations and include the following:

1. Facility Condition
2. Environmental
3. Personnel Safety
4. Personnel Radiation Protection
5. Safeguards and Security
6. Transportation
7. Value Basis Reporting
8. Facility Status
9. Nuclear Explosive Safety
10. Cross-Category Items

Price-Anderson Amendments Act (PAAA)

Price-Anderson Amendments Act (PAAA). The 1988 Price-Anderson Amendments Act extended indemnification to DOE operating contractors for consequences of a nuclear incident. At the same time, Congress required DOE to begin undertaking enforcement actions against those contractors who violate nuclear safety rules. The regulatory basis for the enforcement program is published in 10CFR820, Procedural Rules for DOE Nuclear Activities. Enforcement actions may include the issuance of Notices of Violations and, where appropriate, civil monetary penalties of up to $100,000 per violation per day. The mechanism allows DOE to penalize a contractor for unsafe actions or conditions while providing positive incentives for contractors to strive for an enhanced nuclear safety culture through attention to compliance to standards and requirements, self-identification of problems, reporting noncompliance's to DOE and initiating timely and effective corrective actions.

Severity of Occurrence

Severity of occurrence indicates the degree of significance associated with the different types of occurrences.

- Unusual Occurrence: A non-emergency occurrence that exceeds the Off-Normal Occurrence threshold criteria; is related to safety, environment, health, security, or operations; and requires immediate notification to DOE.
- Off-Normal Occurrence: Abnormal or unplanned event or condition that adversely affects, potentially affects, or is indicative of degradation in the safety, safeguards and security, environmental or health protection, performance, or operation of a facility.

Statistical Process Control (SPC)

Statistical Process Control (SPC) is the application of statistical techniques to control a process.

Total Effective Dose Equivalent (TEDE)

TEDE = External Dose Contribution + Internal Dose Contribution. Prior to 1993, the method for calculating the internal dose contribution changed from an annual internal dose to a dose committed over 50 years. Although one may expect this change would result in higher reported doses, the elimination of the "legacy" doses from previous years' exposures resulted in lower reported doses.

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Product Improvement Survey Form

Purpose of the Product - The Office of Operating Experience Analysis and Feedback, EH-33, is developing a set of indicators for measuring the performance of DOE operations in the areas of Worker Safety and Health and the Environment. The indicators are intended to measure the Department's success in it strategic goal to manage and improve its environmental, safety, and health (ES&H) performance. The major customers for these indicators are expected to be the senior leadership of DOE.

In order to assess the effectiveness of this new performance indicator report, we would appreciate your assistance by providing responses to the following (check one):

1. Do you use indicators to measure performance? ☐ Yes ☐ No
2. Do you feel that improved methods for measuring performance are needed? ☐ Yes ☐ No
3. Would you make management decisions based on this kind of information? ☐ Yes ☐ No
4. Does DOE-wide ES&H performance matter to you? ☐ Yes ☐ No
5. What are your information needs with regard to measuring Department-wide ES&H success:

   ☐ Moderate detail concerning the Department ES&H success
   ☐ Light detail concerning the Department ES&H success
   ☐ Quickpulse of the Department ES&H success
   ☐ I have no need for the information on a regular basis

Report Evaluation - From your review of this report, ***and in consideration of the purpose stated above***, mark the number that most closely corresponds to your reaction to the following statements.

	Strongly Agree			***Neutral***			***Strongly Disagree***
6. The performance indicators are relevant to the measurement of overall DOE ES&H performance.	⑦	⑥	⑤	④	③	②	①
7. The report layout (text and graphics) is logical and easy to understand.	⑦	⑥	⑤	④	③	②	①
8. The data presented in this report are consistent with my impressions of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
9. The performance indicators provide a "balanced" view (e.g., successses and problems) of DOE's ES&H performance.	⑦	⑥	⑤	④	③	②	①
10. This report concept can help measure DOE's success in managing and improving its ES&H performance.	⑦	⑥	⑤	④	③	②	①
11. This report concept can be useful in communicating information on DOE's ES&H performance to external customers.	⑦	⑥	⑤	④	③	②	①

12. Would you be willing to expend time/travel funds to participate in product improvement sessions? ☐ Yes ☐ No
13. Based upon your stated needs, does this report meet your expectations? ☐ Yes ☐ No

Mail or FAX to:

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U.S. Department of Energy
Washington, DC 20585

FAX Number: (301) 903-2329

DOE Operating Experience Analysis
Safety Management Through Analysis

Page 1 of _____

From:

Name: _____

Organization: _____

Phone: _____

Comments: What additional parameter(s) should be monitored and where could the data be obtained? Consider changes required to make this report more useful for your needs and specify any general observations based on your review. Use additional pages as necessary.

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