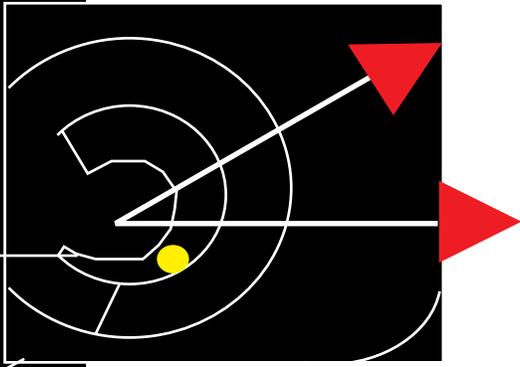


DOE Performance Indicators

***for
Environment,
Safety & Health***

Report Period Ending
March 1996



Office of Environment,
Safety and Health



Foreword

This is the second of our re-engineered performance indicator reports. It represents a continuing effort by the Office of Environment Safety and Health to provide tools and information that will help managers manage safety effectively and efficiently. The performance indicator report is a work in progress; we encourage your continued input and participation in improving it. Please use the survey form at the back of this document to suggest how we might better respond to your needs and concerns.

Like all works in progress, this effort is imperfect. To begin with, the data analyzed covers the period ending March 1996. This is not "real time" information, but the analyses should be useful in illuminating trends and highlighting areas that need attention. My previous commitment to shorten the reporting lag to 90 days over the next two quarters still stands. Secondly, these data present a composite picture of DOE – the safety performance of individual sites must be developed by "drilling down" to levels of greater detail. Our office is happy to assist sites in pursuing site-specific questions of interest.

The purpose of these reports is to raise questions and possibilities that will stimulate program and field office managers to analyze their own site-specific data in more detail and in "real time". Safety is no accident. Effective health and safety programs result when the many "upstream" factors that contribute to unsafe acts and dangerous conditions are well understood and well managed.



Tara O'Toole, M.D., M.P.H.
Assistant Secretary
Environment, Safety and Health

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Introduction

Vision

The ES&H Performance Indicator Report is primarily intended to serve as a high-level document aimed at measuring performance in achieving DOE's corporate strategic goals for environment, safety, and health. It is also aimed at answering senior DOE management and external stakeholder's critical questions of: "What is DOE's actual and potential impact on its workers, the public, and the environment?" and "Is DOE getting safer?" To satisfy this vision, we believe we need to track corporate measures in several areas or categories, such as:

- events or accidents that have already happened,
- near misses and precursors to accidents,
- safety management which includes training, manager and worker involvement, and regulatory compliance,
- level of hazard of operations and material at risk.

We also recognize that this report must not be a burden on the DOE field operations to collect the data. This second quarterly report is a further step in the direction of meeting this vision.

Assessment

Although the ES&H Performance Indicators included in this report do not yet constitute a complete picture of DOE's ES&H performance, some observations can be drawn from the standpoint of how DOE is doing in ES&H.

- Absolute numbers of injuries, illnesses, and exposures are going down. Many factors may be influencing these falling numbers including: improved safety, reduced or different activities, and fewer opportunities for mishaps.
- There is an increasing trend in electrical safety-related events.
- Half (3 of 6) of the fatalities in the past 2 years (1994-95) occurred in security force training exercises.
- Releases to the environment and exposure of the general public are going down.
- 85% of milestones in environmental agreements are being met.
- There is a recent decrease in the number of open recommendations from the Defense Nuclear Facilities Safety Board after a 5-year increasing trend.

Some of the factors that affect the data in the time frame concerned include: implementation of more aggressive ES&H policies; significant changes in the nature of the work as facilities are shutdown and transitioned from operation to stabilization or decommissioning and decontamination; changes in reporting criteria (i.e., whether an event is reportable and/or what is reported); reductions in the workforce. The reader is invited to refer to the previous report (April-June 1995) for a more detailed explanation.

New in this Report

This report contains data and analysis updated through March 1996. We have also added more "drill down" analyses. This allows a better understanding of the trends and serves as a catalyst for DOE sites to do further analysis, self-assessment, benchmarking, and improved work planning. The status of the Secretary's ES&H commitments to the President has been added to the report. New indicators under development are discussed for worker health (e.g., blood lead concentration, noise-induced hearing loss, carpal tunnel syndrome) and pollution prevention (e.g., waste generated, disposed, and

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- B Summary of Concept
- C Performance Indicator Definitions & Glossary

Feedback Survey Form

recycled). Lastly, the reporting lag time has improved; we are still pursuing a goal of issuing future reports within 90 days of the end of the quarter.

As discussed above, we recognize a need to refine performance measures to provide a more complete picture of DOE's ES&H performance. Under development are measures of:

- Level of operational hazards or material at risk. Working with the program offices and sites, we hope to be able to show how DOE is reducing hazards and vulnerabilities. A pilot measure of vulnerability reductions associated with plutonium stabilization is currently being developed. This effort will assist field managers in better risk management and risk prioritization of safety issues at their facilities to save scarce resources.
- Safety management. Concepts under consideration include completeness of training and qualification, management and worker involvement in safety, regulatory compliance, and adequate work planning.

We recognize that this report must be part of a living program, changing performance measures as DOE and our understanding of the data change. Obviously, as a better or more complete set of measures is developed, others will be dropped to permit a continued focus on a manageable number of indicators.

To produce this report and other analytical products, we depend on corporate reporting systems such as the Occurrence Reporting and Processing System (ORPS) and the Computerized Accident/Incident Reporting System (CAIRS). However, we recognize the cost and burden these and similar systems place on field activities that collect the data and are in the midst of a broad effort to re-engineer these systems. Many across the complex have participated in this re-engineering at our customer focus workshops or by serving on the Re-engineering Task Team. Please contact us if you or your organization would like to participate.

Although the Office of Environment, Safety and Health publishes this report, we consider it a DOE corporate document. We not only encourage but need feedback from our readers (a form is included on the last page). More than feedback, however, we need participation in developing pilot measures, improving data quality, and performing analysis. We welcome opportunities to team on specific projects and for individuals to be detailed to our office.



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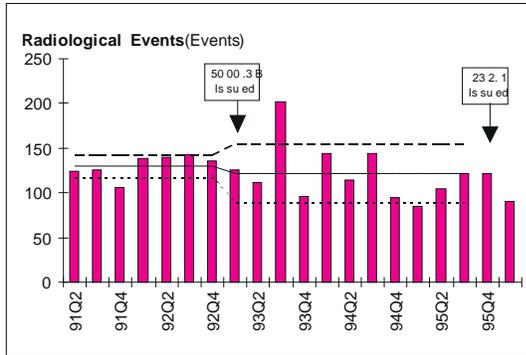
Future Plans

How You Can Participate

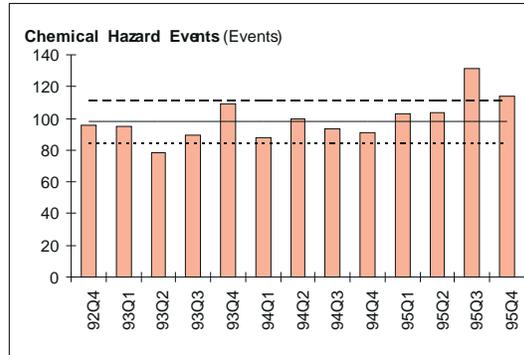
Contact for Additional Information

Management Summary

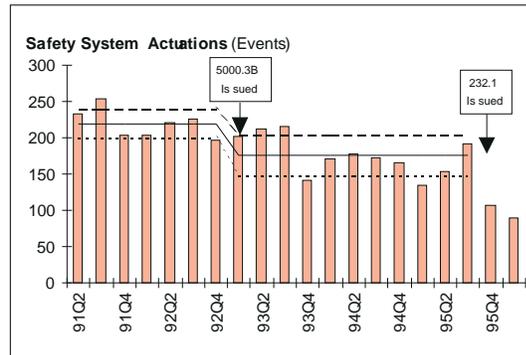
Six of the DOE Environment, Safety and Health Performance Indicators were selected this quarter to highlight below. Lost Workday Case Rate and Reportable Occurrences of Releases to the Environment are included in the Secretary of Energy's Key Indicators. DOE workers, contractors, and subcontractors are included in data obtained from Occurrence Reports. Federal workers have been excluded from the data obtained from the Computerized Accident/Incident Reporting System for Indicators 9 - 12. The horizontal lines on the graphs represent the historical baseline ± 1 standard deviation. Quarterly data is presented as calendar quarters. Trends are identified based on a statistical analysis of the data. A detailed discussion of the method (multinomial likelihood ratio test) is provided in the Glossary section of this report.



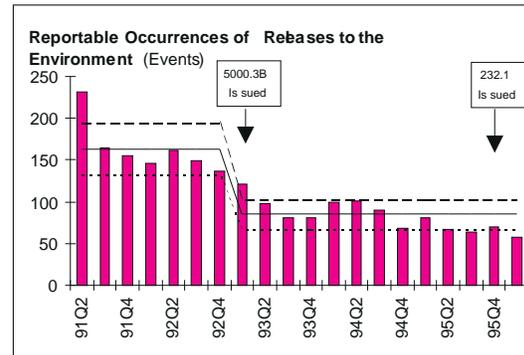
Number of reportable radiological events as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*. These events are made up of both personnel contaminations and radiation exposures.



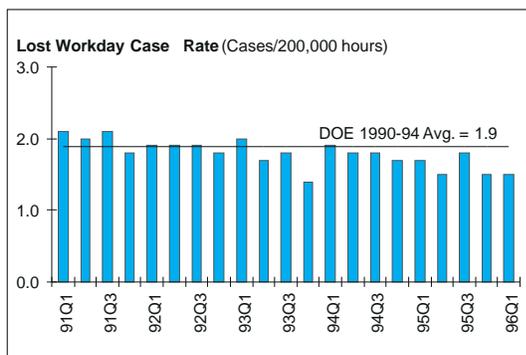
Number of events reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, that are gathered by a word search for specific chemical names.



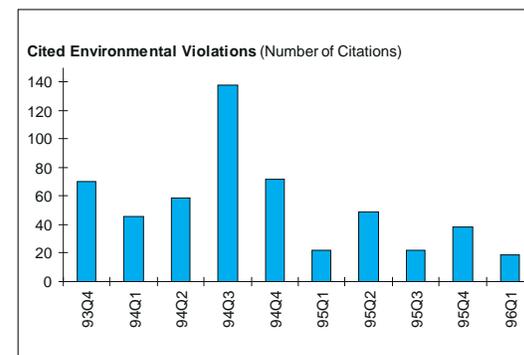
Number of operations-related events determined to be safety system actuations reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*.



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



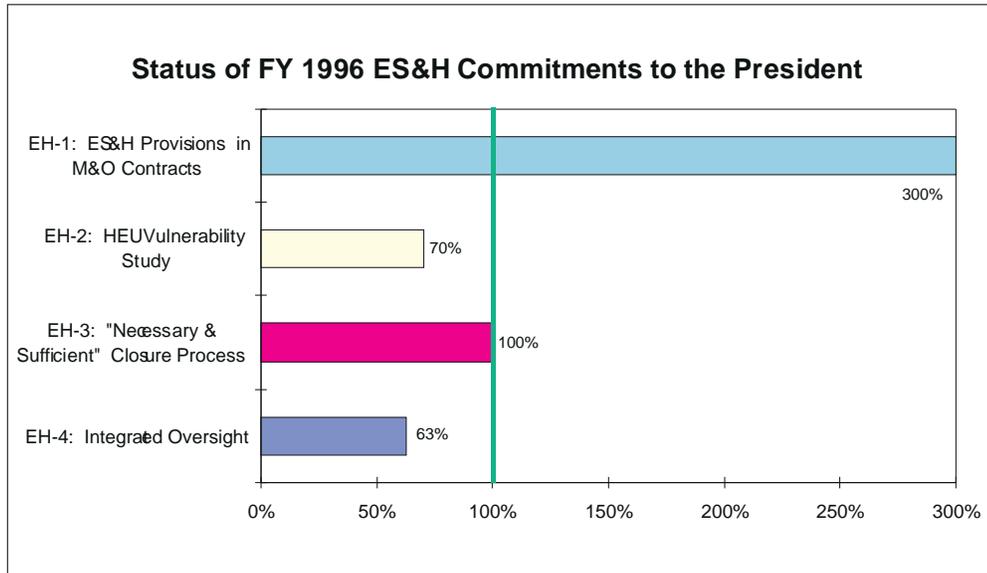
A lost workday case is a work related injury or illness that involves days away from work or days of restricted work activity, or both. Lost Workday case (LWC) rate is the number of lost workday cases per 200,000 hours worked.



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

The Secretary's Commitments to the President in ES&H

ES&H commitments as part of the Secretary of Energy's Performance Agreement with the President for Fiscal Year 1996 are summarized below. More information related to the status of these commitments can be obtained from DOE's Office of Policy.



Commitment	Measure of Success	Status
Incorporate the risk-based ES&H planning and budgeting process into all new or renewed major Management and Operation (M&O) contracts.	6 M&O contracts by 9/96	18 as of 3/96
Complete Highly Enriched Uranium (HEU) Vulnerability Study to identify ES&H vulnerabilities.	0 unaddressed serious HEU vulnerabilities by 9/96	8 of 10 milestones completed as of 8/96
Implement the "Necessary and Sufficient Closure Process" (now called "Work Smart Standards") to ensure safe operations in a streamlined environment.	9 pilot projects in FY95. Begin full implementation by 2/96	9 completed as of 3/96, 19 applications completed or underway as of 8/96
Institutionalize a multi-disciplinary fully integrated oversight process for evaluating ES&H and safeguards and security programs.	Value-added, comprehensive oversight evaluations at 8 DOE sites by 9/96	5 of 8 completed as of 8/96

EH-1: ES&H Provisions in M&O Contracts

EH-2: HEU Vulnerability Study

EH-3: "Necessary & Sufficient" Closure Process

EH-4: Integrated Oversight

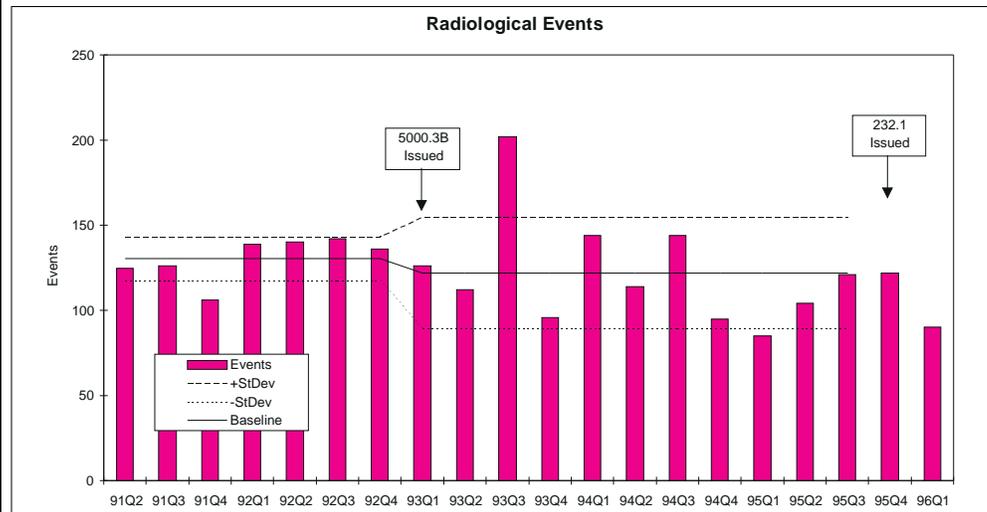
Worker and Facility Safety

Indicator

1. Radiological Events

Definition

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



Source: Engineer Review of Occurrence Reports.

Key Observations

- A highly probable decreasing trend exists over the last 13 quarters since Order 5000.3B was issued.
- 111 individuals were involved in the 90 reported radiological events during 1st quarter 1996. (Seven of the 90 events reported involved more than one individual.)

Additional Analysis

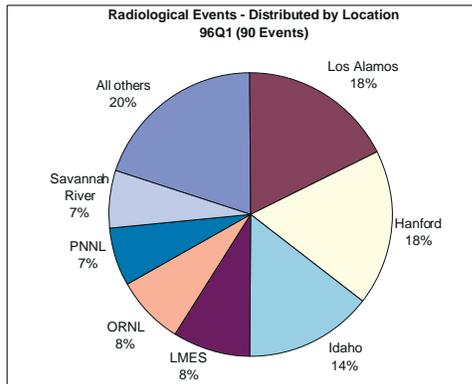
- The decreasing trend may be attributable to changes in reporting criteria that accompanied the implementation of the occurrence reporting Order 232.1. Reporting thresholds for occupational workers were raised by Order 232.1 (i.e., fewer reports) to account for expected exposures based on pre-job estimates.
- During the time period displayed above, significantly reduced levels of DOE operations occurred coupled with a shift away from production work, and the Radiological Control Manual was implemented. These events may have had an impact on the number of reported radiation events.
- Most (95%) of the radiological events reported in 1st quarter of 1996 involved personnel contamination, while the remaining few (5%) involved radiation exposures.

Distribution by Location

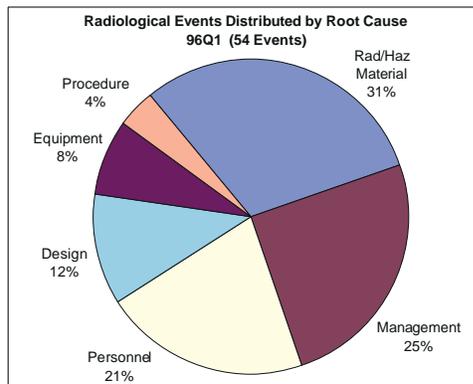
- One event reported during the first quarter 1996 involved 12 people. The event occurred over a 30-hour period at Savannah River when the Hot Canyon Air Tunnel Catch Tank overflowed due to leakage and an incorrectly positioned valve. The overflow leached contamination from a 1984 spill into the door frame and shaft of

an area elevator. Contaminations were limited to the employees' shoes in all but one case where a skin contamination was involved.

- During 1st quarter 1996, the two locations with the highest contribution were Los Alamos and Hanford. Both contractors show a probable increasing trend over the last 12 quarters. One fourth of all occurrence reports submitted by Los Alamos during the 1st quarter involved a radiological event. 11 of the Los Alamos events involved glovebox contamination events at the TA-55 plutonium processing plant. Hanford indicated that an increased sensitivity to radiological events following a Notice of Violation from the state of Washington. Decreasing trends in radiological events at the Oak Ridge site and at the Savannah River site moved the overall performance measure downward. The Oak Ridge trend is driven by a recent lengthy shutdown at Y-12 and extensive operational reviews at the other sites.

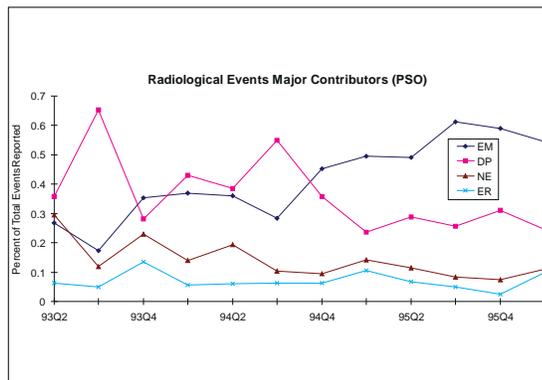


Root Causes: The most commonly cited root cause for the radiological events reported during 1st quarter 1996 was radiological or hazardous material problems (16 events), with material problems from an unknown source (12) the dominant subcategory. Management deficiencies (15) were also frequently cited, with planning deficiencies (6) the dominant subcategory.



Distribution by Facility Type

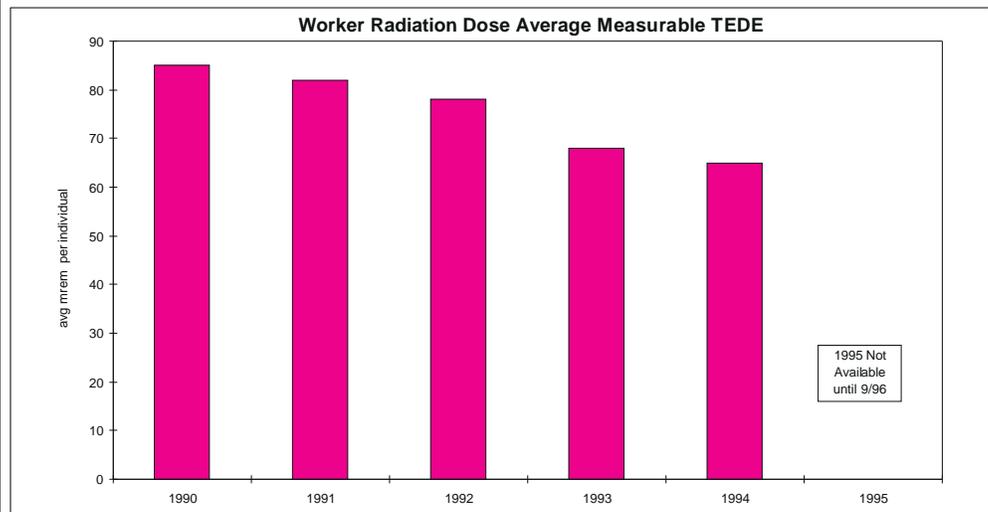
- Plutonium processing facilities accounted for 22% of the radiological events reported 1st quarter 1996. Nuclear waste operations and disposal account for an additional 18% of the total events.
- Work done at Environmental Management (EM) facilities account for over half (49) of the radiological events reported during 1st quarter 1996. There is a highly probable increasing trend over the last 12 quarters in radiological events reported by EM facilities. Defense Programs (DP) facilities account for an additional one fourth (22) of the radiological events reported during the first quarter. There is a highly probable decreasing trend for DP facilities over the last 12 quarters. The trends for EM and DP may be attributable to the transition of facilities from DP to EM.



Indicator 2. Worker Radiation Dose

Definition The 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 workforce size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.



Source: DOE Occupational Radiation Exposure Report 1992-1994, DOE/EH-52, U.S. Department of Energy, June 1996 draft.

Key Observations

- The average TEDE per individual with measurable exposure decreased from 85 mrem in 1990 to 65 mrem in 1994. For comparison, the average exposure for the U.S. population medical diagnostic x-rays is about 40 mrem.^a
- Nearly 80% of the collective TEDE is accrued at just six of the highest-dose DOE sites: Savannah River, Rocky Flats, Hanford, Los Alamos, Idaho, and Oak Ridge. Weapons fabrication and testing facilities account for the highest collective dose. Technicians receive the highest collective dose of any labor category.
- Occupational radiation dose at DOE has been impacted over the past 5 years by changes in:
 - operational status of DOE facilities,
 - reporting requirements,
 - radiation protection standards and practices.

Additional Analysis

Additional information concerning exposure received by individuals associated with DOE activities can be found in the DOE Occupational Radiation Exposure Report 1992-1994 (June 1996).

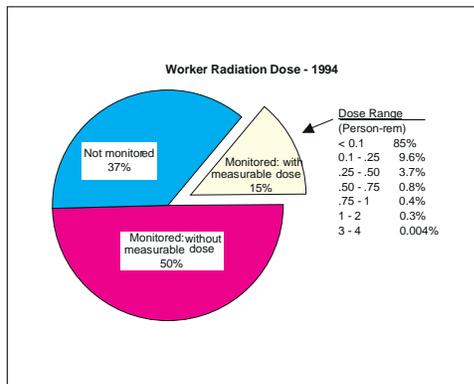
Changes Impacting DOE Occupational Radiation Dose

- Change in operational status of facilities is the predominant driver behind changes in the collective dose. Significant reductions in the opportunities for individuals to be exposed occur as facilities are shut down and transitioned from operation to stabilization or decommissioning and decontamination.
- Changes to reporting requirements have significantly impacted the collective dose at DOE. The change in internal dose methodology from annual effective dose equivalent (AEDE) to committed effective dose equivalent (CEDE) between 1992 and 1993 resulted in a reduction of the collective TEDE by 28%, because the dose from prior intakes is no longer reported.
- Radiation protection practices have changed because of the implementation of the Radiological Control Manual (RadCon Manual). The RadCon Manual changed the methodology to determine internal dose, established Administrative Control Levels (ACL), standardized radiation protection programs, and formalized “As Low As Reasonably Achievable” (ALARA) practices.

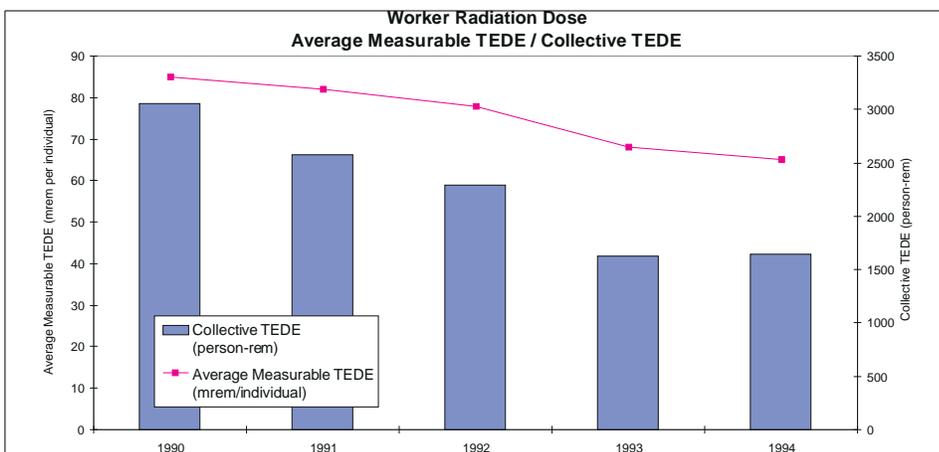
DOE Doses

- In 1994, 63% of the 184,073 DOE workers and contractors were monitored; 18.5% of those monitored received a measurable dose.

- No individuals exceeded the DOE limit of 5 rem in 1994, the latest year for which data is available; one individual exceeded the administrative control level (ACL) of 2 rem. 95% of the workers with a measurable dose received a dose of less than 0.25 rem. Doses in excess of the ACL and the DOE TEDE dose limit have decreased over the past 5 years. Most of this decrease is because of the change in methodology for determining internal dose discussed above.



- The collective TEDE (the sum of the TEDE received by all monitored individuals) for 1994 was 1643 person-rem. The graph below indicates the decline in both average dose and collective dose.



Comparison to Other Sources

- As a basis of comparison, the average Occupational Radiation Exposure received by shipyard personnel associated with the Naval nuclear propulsion program was 98 mrem per individuals with measurable doses for 1994 versus 65 mrem for DOE.^b Table 1 provides 1994 average occupational exposures for workers with measurable doses for Nuclear Regulatory Commission licensees.

TABLE 1
Comparison to 1994 Average Occupational Exposures for Workers with Measurable Doses^c

License Category	Average Measurable TEDE per Worker (rem)
Industrial Radiography	0.60
Manufacturing and Distribution	0.46
Low-level Waste Disposal	0.27
Independent Spent Fuel Storage	0.47
Fuel Fabrication and Processing	0.40
Commercial Light Water Reactors	0.29

- The average radiation worker dose received from DOE operations in 1994 was 65 mrem per individual. This should be contrasted to background radiation levels of 27 mrem per individual from cosmic radiation, 28 mrem per individual from terrestrial sources, and 200 mrem from naturally occurring radon sources.^d

References

^a *Exposure of the U.S. Population from Diagnostic Medical Radiation*, National Council on Radiation Protection and Measurements, NCRP Report No. 100, Bethesda, MD, May 1989.

^b *Occupational Radiation Exposure from U.S. Naval Nuclear Plants and Their Support Facilities*, Naval Nuclear Propulsion Program, Department of the Navy, Washington, DC, Report NT-95-2, March 1995.

^c M.L. Thomas, D. Hagemeyer, *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities*, NUREG-0713, Vol. 16, Government Printing Office, January 1996.

^d Merrill Eisenbud, *Environmental Radioactivity from Natural, Industrial and Military Sources*, 3rd Edition, by Academic Press, Inc., 1987.

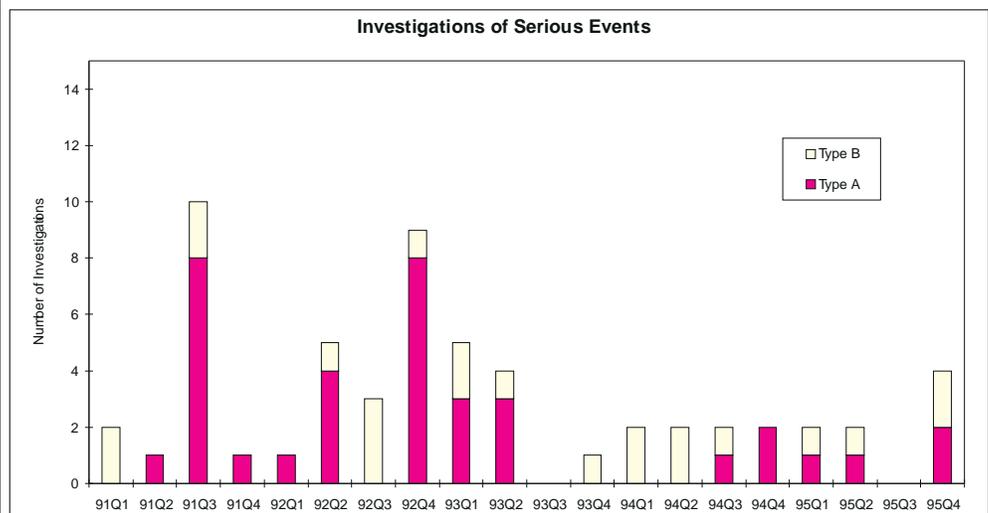
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Indicator 3. Investigations of Serious Events

Definition Investigation of accidents with significant human effects, environmental effects, or property damage.

Type A and B investigations are defined in DOE Order 225.1, *Accident Investigations*. Type A investigations include accidents which involve: a fatality, hospitalization or permanent disability of at least 3 people, significant radiation dose (>25 rem), releases more than 5 times that reportable under 40 CFR 302, and property damage in excess of \$2.5 million.

Type B investigations include accidents which involve: at least 1 person hospitalized for more than 5 days, 5 related lost workday cases within 1 year, accidents involving 5 or more people, radiation exposures (10-25 rem), releases 2-5 times that reportable under 40 CFR 302, and property damage of \$1 million - 2.5 million.



Source: Computerized Accident/Incident Reporting System.

Key Observations

- One of the two Type A investigations in 95Q4 was a fatality (a heart attack suffered during training). The other Type A investigation involved a forklift accident that resulted in multiple injuries to an individual.
- The two Type B investigations were slips/falls (on stairs and while walking).
- Each of the four Type A or B investigations in 95Q4 occurred at different sites.
- The data spikes in 3rd quarter 1991 and 4th quarter 1992 are attributed to DOE aircraft accidents, both with multiple fatalities. A USAir crash in 3rd quarter 1994 that involved 9 DOE fatalities was not included in the data.

Additional Analysis

Data exceptions (outliers): Two data outliers have been identified for this performance indicator:

- 9 DOE fatalities (Type A investigations) from the USAir plane crash in 3rd quarter 1994 have been removed since DOE had no influence over the circumstances.
- 20 Type B investigations of cumulative trauma disorders at Oak Ridge (occurring between 1991 and 1995) have been removed from the data.

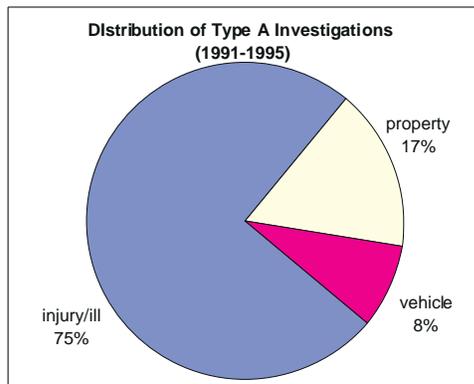
Although 270 cases of repeated trauma disorders (OSHA code 26) have been reported throughout DOE, only Oak Ridge identified them as potential Type B investigations. Oak Ridge discontinued this practice as of January 1996, with the implementation of DOE Order 225.1.

Many factors influencing the identification of Type B investigations must be considered when analyzing the data. Some of these factors are:

- Local interpretation of the requirements vary (e.g., the cumulative trauma disorders discussed above).
- Identification of the need for a Type B investigation may occur long after the initial illness/injury, because one of the criteria involves total days lost and these may accumulate over a long period of time (up to several years).
- Implementation of the revised DOE requirements document (DOE Order 225.1) varies from site to site, depending on implementation of the contractor requirements document.

1994 - 1995 Data Trends: Since Type A and B investigations tend to be infrequent events (5 or less per quarter), 1994 and 1995 investigations were examined as a group in an effort to identify trends in the data.

- 6 of the 7 were fatalities; 3 of the fatalities occurred during training. All of the 7 Type A investigations involved illness/injuries. This differs from the historical distribution shown at right.



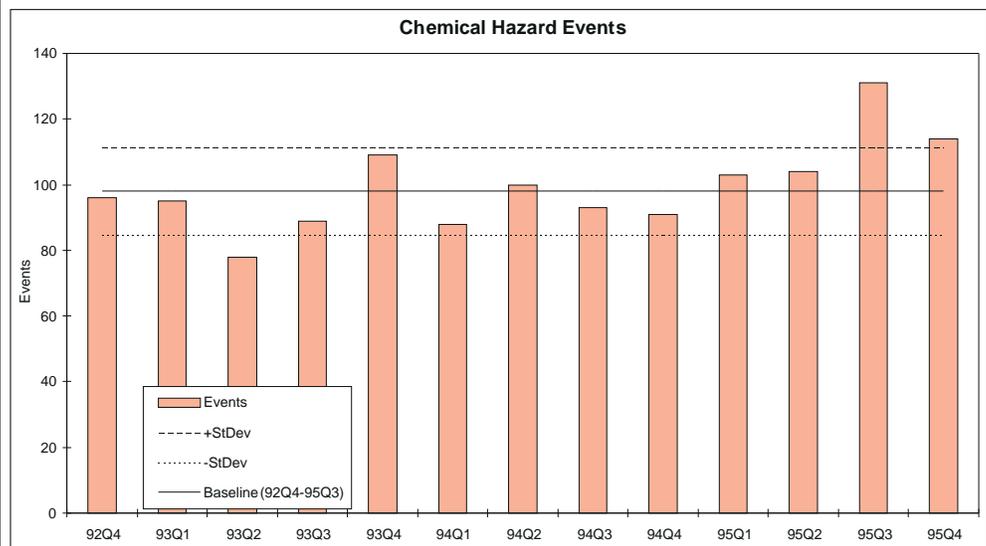
- No location dominates the investigations of serious events. Each of the 16 Type A or B investigations occurred at a different site.
- 5 of the 9 Type B investigations (56%) involved property damage (ranging from \$2,500 - 393,000). Historically, 40% of the Type B investigations have been related to property damage.

Indicator 4. Chemical Hazard Events

Definition

The number of events reportable under DOE Order 232.1, *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 which are significant by the frequency, but not by the consequences.



Source: *Chemical Safety Concerns: A Quarterly Review of ORPS October 1995–December 1995 and Annual Review 1995*. U.S. Department of Energy, Office of Field Support, EH-53.

Management Response Plan for the Chemical Safety Vulnerability Working Group Report, Volumes 1, 2, and 3, U.S. Department of Energy, DOE EH-0396P, 1994.

Key Observations

- Over the last 13 quarters, there is a highly probable increasing trend in the total number of chemical hazard events. The overall increasing trend is influenced by an increased number of events reported by United States Enrichment Corporation (USEC) facilities.
- Class 3 and 4 events comprise 87% of the chemical hazard events identified over the last 13 quarters. There is a highly probable increasing trend in the number of Class 3 and 4 events identified over this period.
- During the last 13 quarters, there is a highly probable decreasing trend in the number of Class 1 and 2 events, though the decreasing slope is slight.

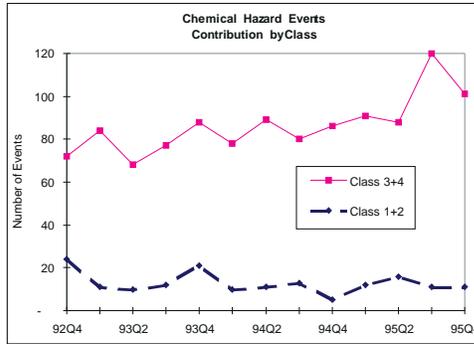
Additional Analysis

Characterization of Chemical Hazard Events

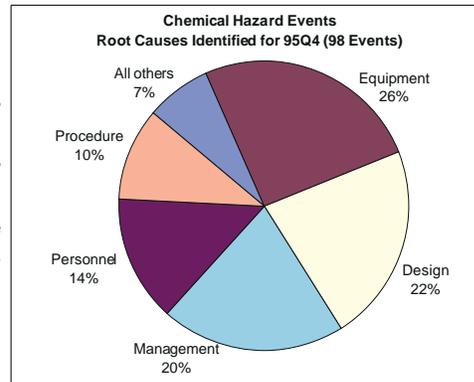
- During 4th quarter 1995, there were 11 Class 2 events. No Class 1 events were identified. 6 of these events involved a worker chemical exposure and 1 event

involved an environmental release. The remaining Class 2 events involved chemical mixing, safety violations, and fires or explosions.

- There were 103 Class 3 and 4 events identified during 4th quarter 1995. 36% of these events involved a detector or analyzer degradation, and 25% of the Class 3 and 4 events involved spills, leaks, or releases.

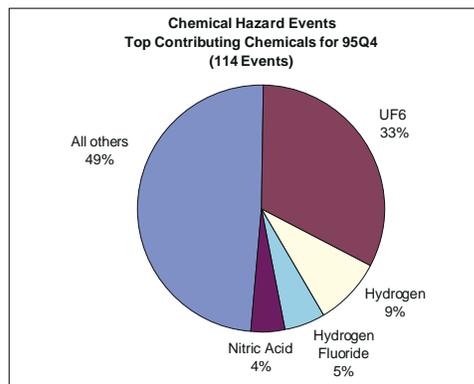


Root Causes: During 4th quarter 1995, the most frequently cited root cause was equipment/material problems (25 events), with defective or failed part (20) the dominant subcategory. Design problems (22) were also frequently cited, with inadequate or defective design (19) the dominant subcategory.



Distribution by Chemicals Involved

- Uranium hexafluoride (UF6) was involved in 33% of the total chemical hazard conditions identified during 4th quarter 1995. Hydrogen was also frequently involved in the chemical hazard events identified during 4th quarter 1995. The total number of chemical hazard conditions involving UF6 and hydrogen has increased during each quarter of 1995.
- UF6 and hydrogen have been the leading contributors to the chemical hazard total for the last 8 quarters.



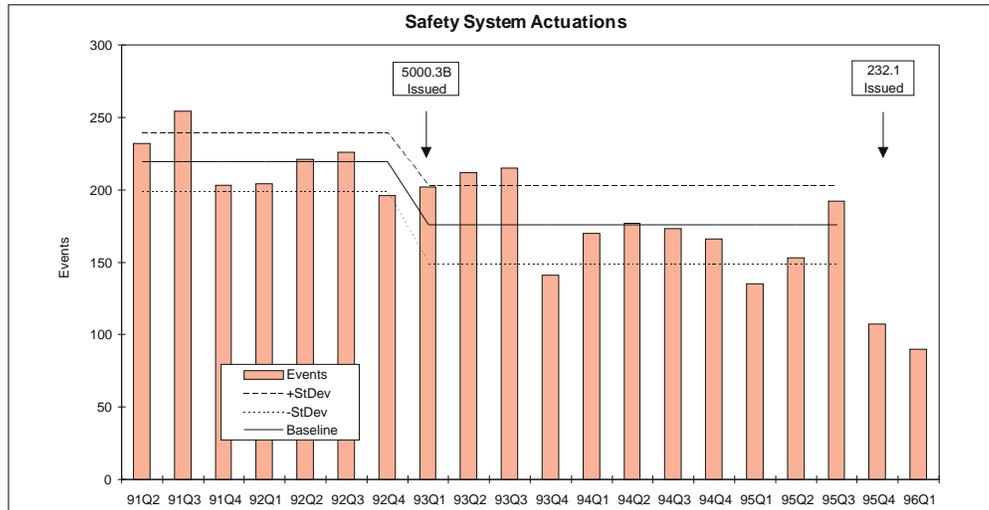
- During 4th quarter 1995, only 2 Class 2 events involved UF6 and hydrogen.

Distribution by Location: USEC was responsible for almost 40% of the reported occurrences identified as chemical hazard events during 4th quarter 1995. This coincides with the number of events involving UF6. Savannah River was responsible for an additional 23% of the occurrences reported during 4th quarter 1995. No specific chemical hazard was identified with the Savannah River events.

Distribution by Program Secretarial Office (PSO): During 4th quarter 1995, facilities operated by Environmental Management (EM) accounted for 46% of the hazardous chemical event total. 8 of 11 Class 2 events identified during this quarter occurred at EM facilities. Nuclear Energy (NE) facilities were responsible for an additional 39% of the 4th quarter 1995 total. All but 1 of the NE events occurred at USEC facilities. Defense Programs facilities accounted for 11% of the total events identified during the quarter.

Indicator 5. Safety System Actuations

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



Source: Engineer Review of Occurrence Reports.

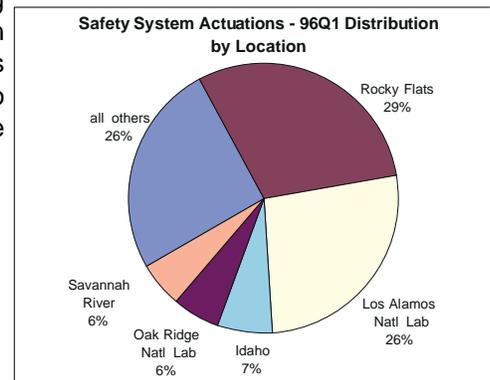
Key Observations

- The decrease in the number of safety system actuations reported for 4th quarter 1995 and 1st quarter 1996 can be attributed to implementation of changes in the occurrence reporting Order from 5000.3B to 232.1. This was confirmed through discussions with field personnel. The primary changes to reporting criteria, which impact this indicator, involve deleting the requirements to report:
 - inadvertent/false alarms, unless they are considered by the site to be significant and
 - precautionary facility evacuations.

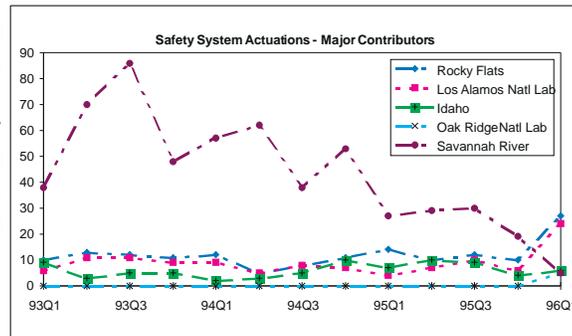
Additional Analysis

Distribution by Location

- For 1st quarter 1996, the leading contributors for safety system actuation events were Rocky Flats (29%) and Los Alamos (26%). Historically, these two locations have been among the top five contributors complex-wide.

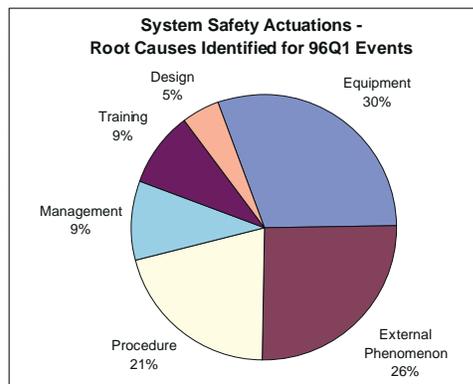


- Five locations experienced significant changes from 4th quarter 1995 to 1st quarter 1996. The increases at Rocky Flats (from 10 to 27 events) and Los Alamos (from 6 to 24 events) were offset by the decreases at Savannah River (from 19 to 5 events), Richland (from 14 to 4 events), and U.S. Enrichment Corporation (from 16 to 2 events).



- Of the 27 actuations at Rocky Flats in 1st quarter 1996:
 - 7 involved freeze protection, primarily related to pipe cracking.
 - 10 were considered false alarms due mostly to power outages or surges.
 - 10 were safety system actuations primarily requiring facility evacuation. Rocky Flats field representatives indicated that a significant number of these involved electrical distribution problems. Efforts are underway to address this issue site-wide.
- 15 of the 24 events at Los Alamos in 1st quarter 1996 were related to glovebox contamination problems experienced at TA-55 plutonium processing facility. Discussions with DOE personnel at LANL indicate that the problems are being addressed.
- DOE field personnel attributed the decrease at Savannah River primarily to early implementation of reporting changes per DOE Order 232.1 (discussed above).

Root Causes: The leading root causes for 1st quarter 1996 events with root causes identified (48% of the events) are shown in the graph. Since DOE Order 5000.3B was issued in February 1993, Equipment/Material problems, Management and Design problems have been the top 3 root causes for safety system actuations. Equipment/Material problems have consistently been the leading root cause for the last seven quarters.

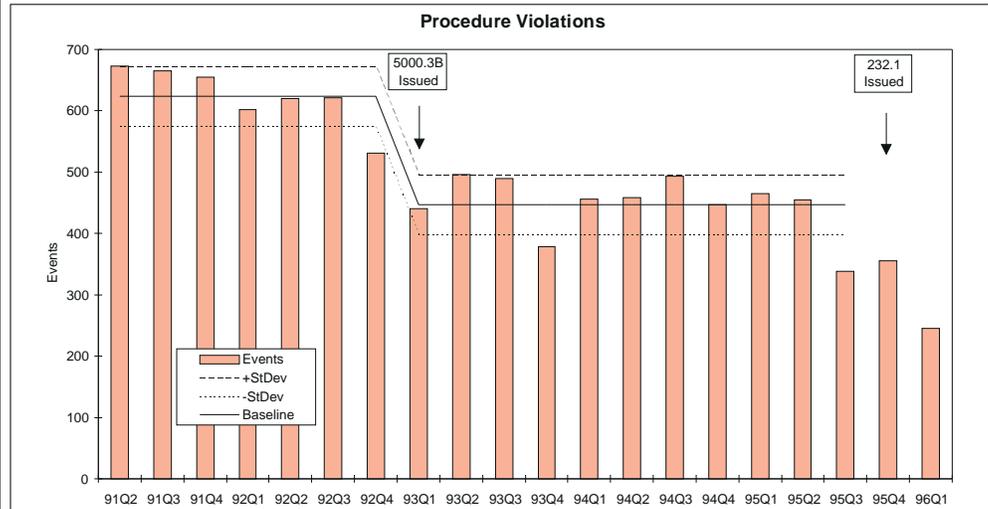


Distribution by Program Secretarial Office (PSO): The distribution of system safety actuations by PSO for 1st quarter 1996 was:

- Environmental Management (49%),
- Defense Programs (37%),
- Nuclear Energy (8%),
- Energy Research (7%).

Indicator 6. Procedure Violations

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



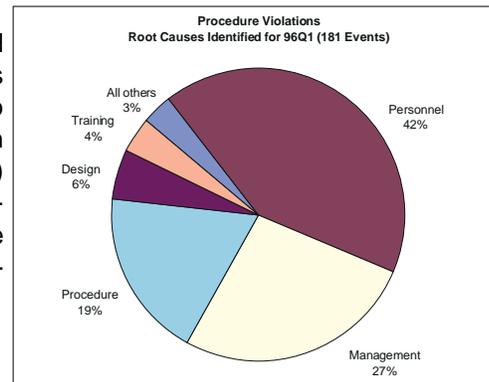
Source: Engineer Review of Occurrence Reports

Key Observations

- Procedure violations continue to show a decreasing trend. The last 3 quarters shown are more than one standard deviation below the 1993-1995 baseline. Prominent reductions in the average number of procedure problems reported appear to accompany each change in the governing reporting Order. No specific change or group of changes in reporting thresholds can be associated with the downward trend. However, since procedure violations can be identified with any reported event as a cause, the general raising of event reporting thresholds (effected through Order 5000.3B and, subsequently, Order 232.1) appears to be the most significant influencing factor.

Additional Analysis

Root Causes: The most frequently cited root cause during 1st quarter 1996 was personnel errors (76 events), with failure to use the procedure (42) the most common subcategory. Management problems (48) were also frequently noted, with inadequate administrative controls (17) the dominant subcategory. Inadequate procedures were noted for 34 events.



Distribution by Facility Type

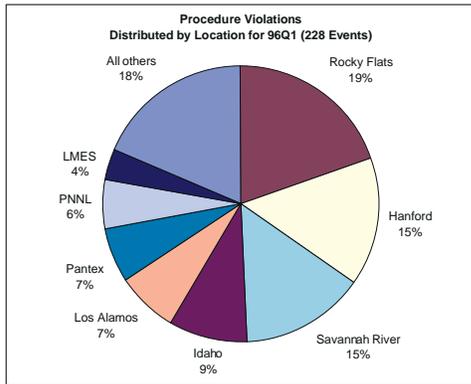
- The three largest contributors (45%) by facility type for 1st quarter 1996 are plutonium processing (21%), nuclear waste operations/disposal (13%), and

environmental restoration facilities (11%). Balance of Plant (BOP) activities contributed 40% of the total during 1st quarter of 1996.

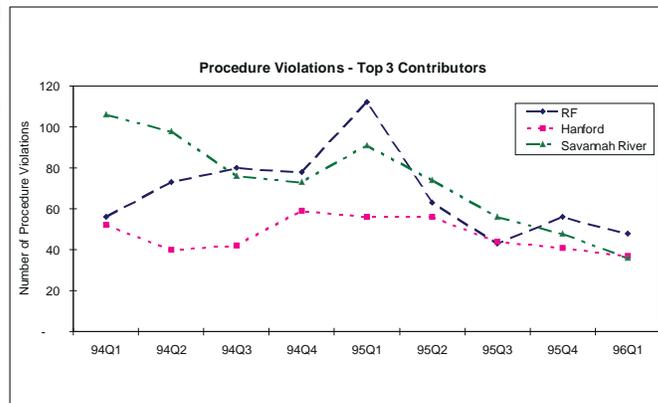
- During 1st quarter 1996, facilities managed by Environmental Management accounted for 67% of the procedure-related event total. Facilities managed by Defense Programs were responsible for an additional 22% of the total.

Distribution by Location

- The adjacent graph indicates the relative contribution to the total number of procedure violations for 1st quarter 1996 by location.
- At the time of the last report (2nd quarter 1995), Savannah River was the largest contributor with 74 events. This number dropped to 35 for 1st quarter 1996 and constitutes the largest decrease in reported events of any site in the complex over this one year period. Discussions with DOE Savannah River personnel responsible for tracking occurrence reporting related that this drop is a direct result of the site's early implementation of the changes to DOE Order 232.1.



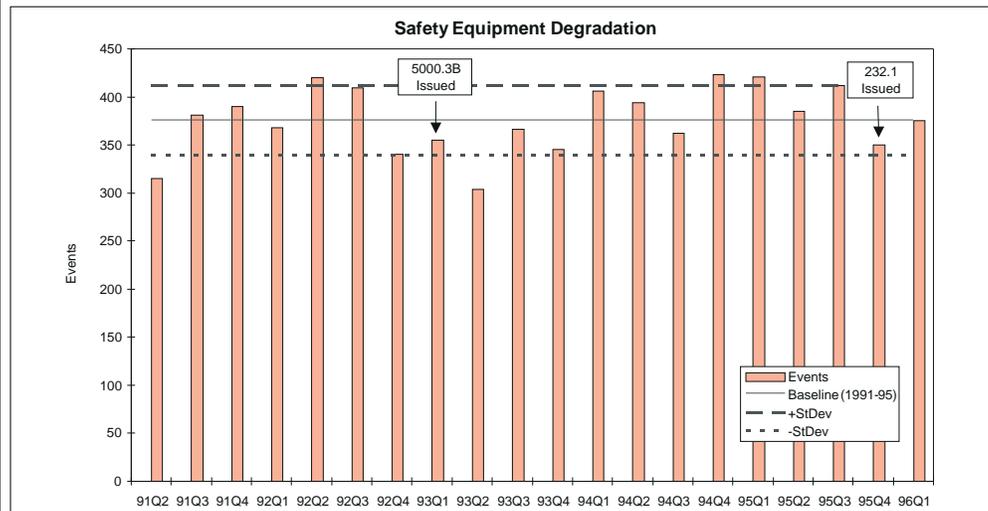
- The top three contributing sites during 1st quarter 1996 have all experienced a decreasing trend in reported procedure violations since 1st quarter 1995. Savannah River and Rocky Flats both had significant decreases in the number of procedure-related incidents during this time period.



Indicator 7. Safety Equipment Degradation

Definition Number of reportable events categorized as “vital system/component degradation” as defined in DOE Order 232.1, *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 surveillance/inspections and appraisal findings of any safety class SSC.



Source: Engineer Review of Occurrence Reports.

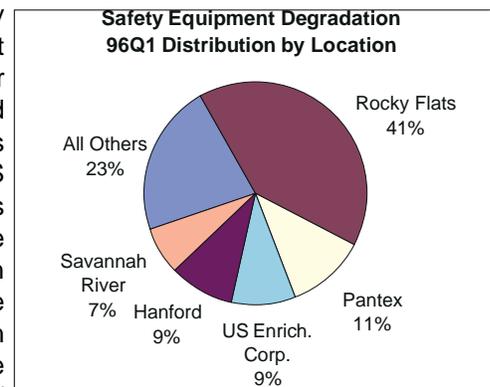
Key Observations

- The frequency of safety equipment degradation events shows a highly probable increasing trend since 1st quarter 1993.

Additional Analysis

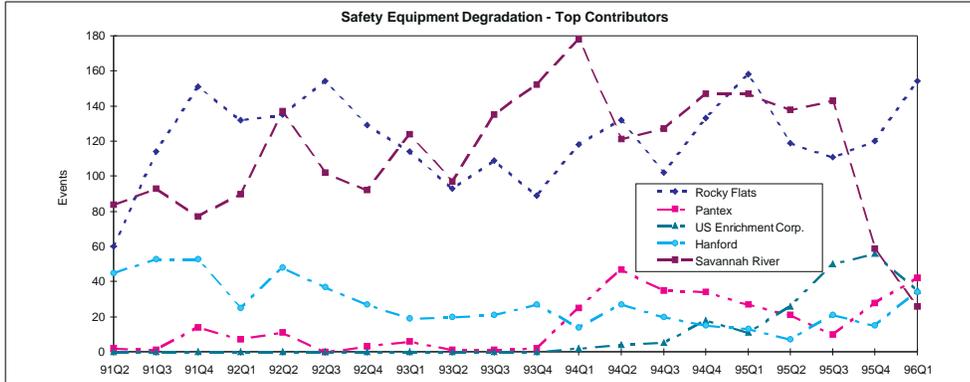
Distribution by Location

• The graph shows a distribution by location of safety equipment degradation events for the 1st quarter 1996. Rocky Flats, Pantex, and Hanford show highly probable increasing trends since 1st quarter 1993. The US Enrichment Corporation (USEC) shows a highly probable increasing trend since 1st quarter 1994, the first quarter in which they started reporting under the “USEC” name. Increasing trends in safety equipment degradation at these sites may be because the majority of these events are caused by defective or failed parts, which can be expected to increase with facility age.

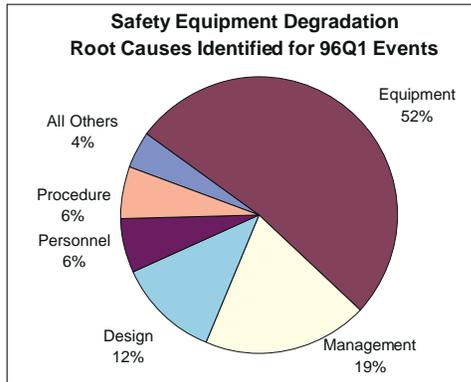


- Safety equipment degradation events at Savannah River dropped by 41% from 3rd quarter 1995 to 4th quarter 1995. Based on discussions with DOE field

personnel, the reason for this dramatic drop is Savannah River's early implementation of the change in occurrence reporting as established in DOE Order 232.1. These changes, as interpreted by that site, have the effect of raising the local reporting thresholds with respect to the definitions of safety significant systems, thereby lowering the number of events reported.



Root Causes: The graph shows the distribution of root causes of safety equipment degradation events for the 1st quarter 1996. Historically, the largest root cause category has been equipment/material problems, with the sub-category defective or failed parts averaging 86% of equipment/material problems.



Distribution by Facility Type: The distribution of safety equipment degradation by facility type for 1st quarter 1996 was:

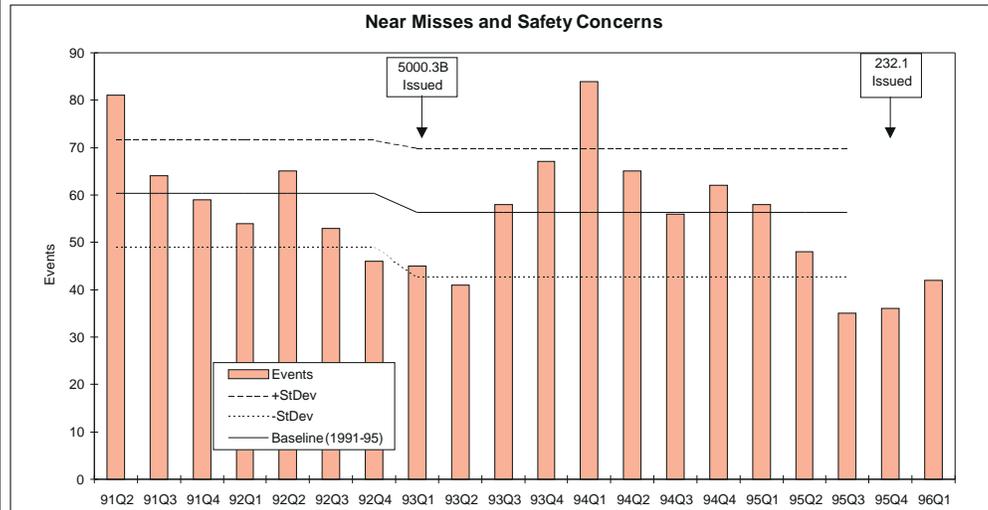
- Plutonium Processing and Handling Facilities (47%),
- Balance of Plant (25%),
- Uranium Enrichment (9%),
- Nuclear Waste Operations and Disposal (6%),
- All Others (13%).

Distribution by Program Secretarial Office (PSO): The distribution of safety equipment degradation by PSO for 1st quarter 1996 was:

- Environmental Management (59%),
- Defense Programs (26%),
- Nuclear Energy (13%),
- Energy Research (2%).

Indicator 8. Near Misses and Safety Concerns

Definition Number of events related to near misses or safety concerns reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*. A near miss occurs when all barriers to an event initiation are compromised, or if only one barrier remains to an event initiation after other barriers have been compromised. A safety concern exists if the unauthorized use of hazardous products or processes occurs, or if work is shutdown as the result of an Occupational Safety and Health Administration violation.



Source: Engineer Review of Occurrence Reports.

- Key Observations**
- A highly probable decreasing trend exists over the last 9 quarters. The totals for the most recent 3 quarters are more than one standard deviation below the baseline mean.
 - Electrical safety events are the most commonly reported near miss condition during 1st quarter 1996. Operating Experience Weekly Summary (OEWS) 96-17 indicates an increasing trend in events involving electrical shock over the last 6 quarters.
 - The reporting of fall protection issues increased dramatically in 1st quarter 1996 over previous reporting levels. The majority of these fall protection issues were identified and reported after a fatal fall that occurred at Idaho National Engineering Laboratory on February 20, 1996 (OEWS 96-08 details this fatal fall).

Additional Analysis Characterization of Events

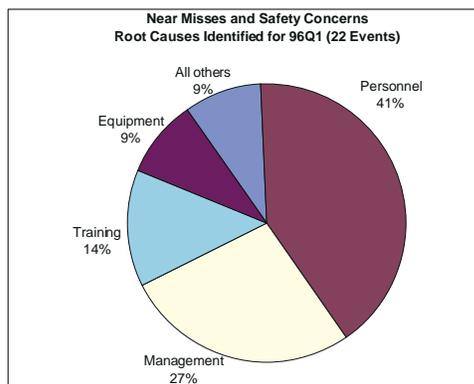
- The major types of events reported during 1st quarter 1996 were:
 - Electrical Safety Events-15 (36%)
 - Fall Protection Events-11 (26%)
 - Radiation Protection Events-3 (7%)
- An in-depth review of the 1995 occurrence reports included 177 near miss and safety concern events. Fall protection issues only accounted for 3% (6) of the 1995 total. There was only one rigging event reported as a near miss during 1st quarter

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of 1996 compared to 18 reported during all of 1995. The major contributors for calendar year 1995 were:

- Electrical Safety Events-45 (25%)
- Rigging Safety Events-18 (10%)
- Radiation Protection Events-16 (9%)
- Hazardous Material Safety Events-15 (8%)

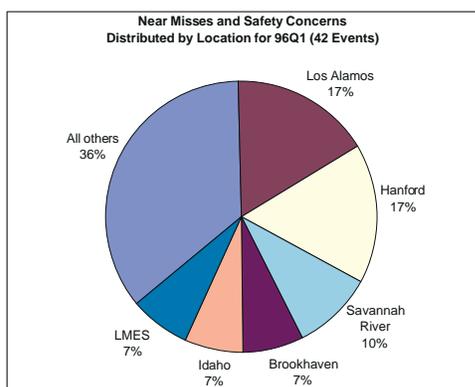
Root Causes: During 1st quarter 1996, the most frequently cited root cause was personnel problems (9 events), with failure to use the procedure (5) the dominant subcategory. Management problems (6) were also frequently cited, but there was no dominant subcategory. The adjacent graph shows the relative relationship among events with an assigned root cause. Only 52% of the reported events have been assigned a root cause.



Distribution by Facility Type

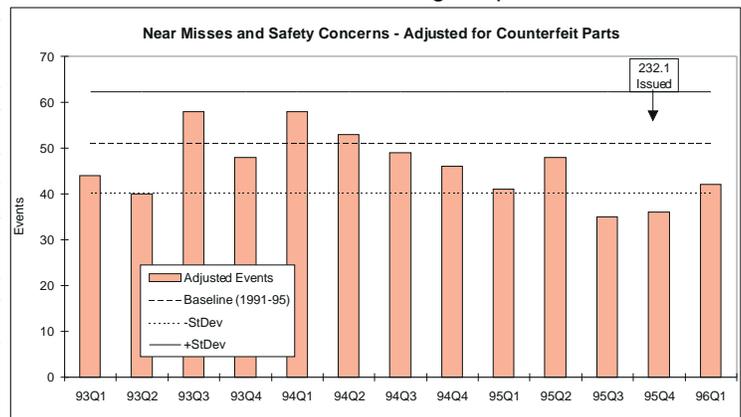
- During 1st quarter 1996, facilities involved in environmental restoration activities (5) and nuclear waste operations (4) contributed the most to the quarterly total by facility type after the Balance of Plant facilities (24). No single facility from any specific facility type was a dominant contributor to the quarterly total.
- During 1st quarter 1996, facilities managed by Environmental Management (EM) accounted for 43% of the event total. There is a highly probable increasing trend in reported events by EM facilities as a percentage of the total events reported for this category over the last 20 quarters. Facilities managed by Defense Programs (DP) were responsible for an additional 29% of the total. There is a highly probable decreasing trend in events at DP facilities over the last 20 quarters. These trends may be attributable to the transition of facilities from DP to EM.

Distribution by Location: The adjacent graph indicates the relative contribution to the total number of near misses and safety concerns for 1st quarter 1996 by location. The types of events were varied, and no single facility from any of these locations was a dominant contributor to the quarterly total. Only 18 contractors reported any near misses or safety concerns this quarter.



- During 1st quarter 1996, 59% of the reported events were classified as near miss events, and the remaining 41% were classified as safety concerns

- During 1st quarter 1996, 42 events were reported. The majority (38) were categorized as off-normal events. The remaining four events (described below) were classified as unusual events:
 - A construction worker cut an energized 13.2 kV cable with a jackhammer. He was hospitalized in serious condition.
 - Workers removing a lifeline after erecting scaffolding allowed the lifeline cable to contact an energized 480-volt bus bar causing an arc. There were no injuries.
 - A construction worker fell 12 feet from a roof and injured a shoulder.
 - A construction worker fell 15 feet into an open manhole and suffered a cracked bone beneath his right kneecap.
- The peak at 94Q1 includes 26 events involving suspicious or counterfeit parts reported as a safety concern. Most facilities report such events as potential concerns or issues worthy of reporting, which are not collected for this performance measure. No facility has reported a suspicious or counterfeit part as a near miss or a safety concern since 95Q1. If all events involving suspicious or counterfeit parts are removed from the near miss and safety concern data (103 events removed), a decreasing trend in near misses and safety concerns exists over the last 11 quarters.

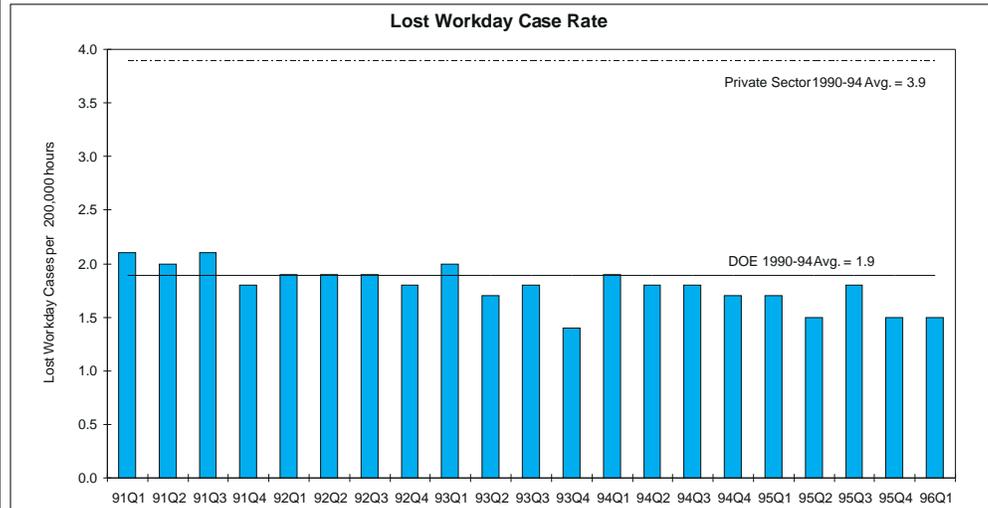


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Indicator 9. Lost Workday Case Rate

Definition 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.



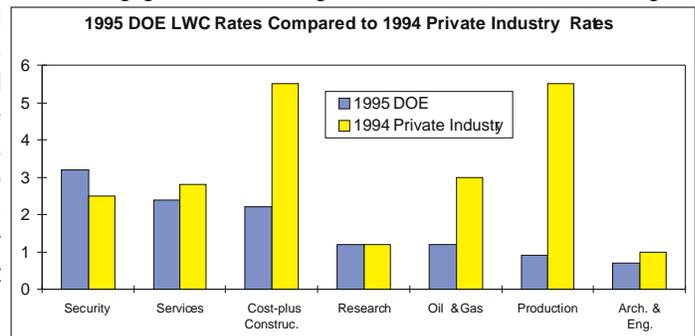
Source: Computerized Accident/Incident Reporting System; Department of Labor, Bureau of Labor Statistics.

Key Observations

- The 1995 LWC rate has been relatively constant. All four quarters of 1995 and the 1st quarter of 1996 fall below the 5-year average (1990-1994) LWC rate.

Additional Analysis

- Preliminary estimates of lost work time data indicate that in 1995, DOE contractors experienced 2360 lost workday cases, which resulted in 51,903 lost workdays. The average number of lost workdays per lost workday case was 22.0 in 1995.
- For DOE contractors in 1995, the average number of lost workdays per lost workday case were highest in security and cost-plus construction, where days lost per lost workday case were 29.6 and 27.5, respectively.
- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications, including general building construction, manufacturing of chemicals and allied products, oil and gas extraction, and sanitary services. The graph shows a comparison of 1995 DOE LWC rates with 1994 private industry rates (the most recent BLS survey).



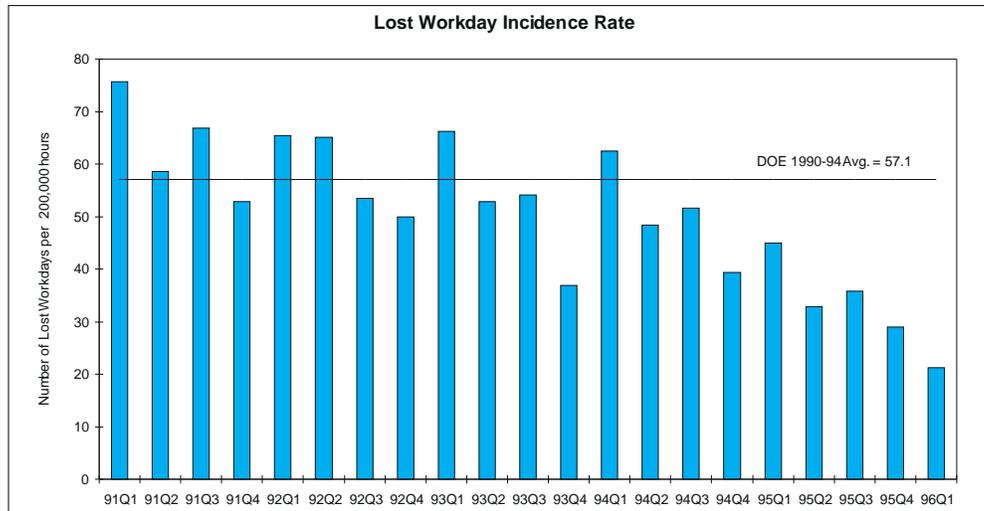
- In 1995, the DOE LWC rate was 1.6. As a comparison, the 1995 LWC rate for DuPont and its energy subsidiary, Conoco, was 0.035. In 1994, the chemical industry LWC rate was approximately 0.5^a.

Reference

^a *Safety, Health and the Environment 1995 Progress Report*, E.I. du Pont de Nemours and Company.

Indicator 10. Lost Workday Incidence Rate

Definition The Lost Workday (LWD) Incidence Rate is the number of lost workdays per 200,000 hours worked.



Source: Computerized Accident/Incident Reporting System

Key Observations

- The LWD Incidence Rate has declined since 1991. The highest percentage of lost workdays has shifted from workdays lost to restricted workdays, indicating a possible tendency to reassign injured workers rather than give them the time off. Revisions and late reporting are expected to result in increases in 1995 and 1996 estimates. Experience shows that this is to be expected with estimates of lost workdays, where some cases remain open and estimates continue to accumulate.

Additional Analysis

- The days lost are assigned to the quarter in which the case occurred regardless of the quarter in which the time is taken off. This results in frequent updates to the historical information, since the number of days associated with a case can increase as the individual remains off the job.
- The LWD Incidence Rate is generally highest in the 1st quarter of each year. An analysis of the data indicates that there are more weather related incidents, such as slips and falls, in the 1st quarter of the year and that weather is a contributor to increased injuries during the 1st quarter. Discussions with field personnel at Idaho National Engineering Laboratory and Los Alamos National Laboratory support this observation. As expected, a sample of DOE sites shows that those sites with harsh winters exhibit the largest fluctuations in the LWD Incidence Rate. Additional factors, such as a decrease in work activities during the holiday season at the end of each year and the subsequent increased activity to catch up, may also contribute to the fluctuation in the LWD Incidence Rate.

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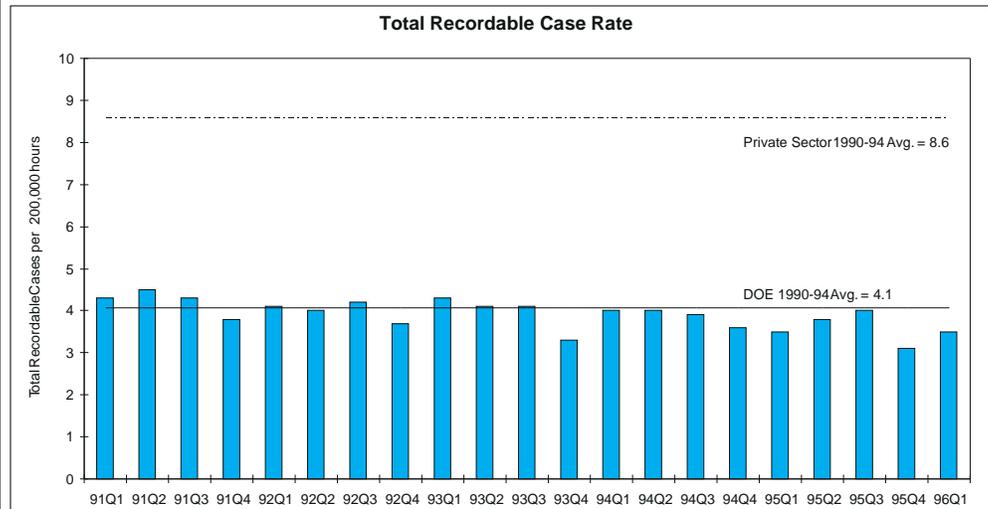
Indicator

11. Total Recordable Case Rate

Definition

Total recordable cases (TRC) are all work-related deaths and illnesses, and those work-related injuries which result in loss of consciousness, restriction of work or motion, transfer to another job, or require medical treatment beyond first aid.

Total recordable cases include all occupational injuries and illnesses that result in either death, a lost workday case, or a non-fatal case without lost workdays. Therefore, TRCs will always be either equal to or greater than the number of lost workday cases. Total recordable case rate is the number of TRCs per 200,000 hours worked.



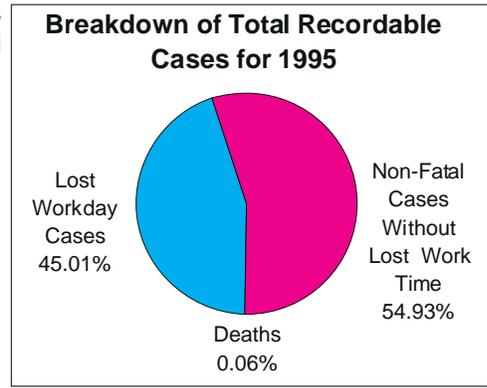
Source: Computerized Accident/Incident Reporting System; Department of Labor, Bureau of Labor Statistics.

Key Observations

- The 1995 TRC rate has been relatively constant. All four quarters of 1995 and 1st quarter 1996 fall below the 5-year average (1990-1994) TRC rate.

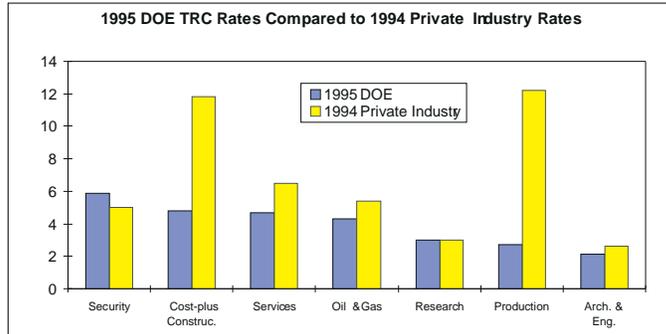
Additional Analysis

- A total of 5453 injury or illness cases have been reported by DOE contractors (as of July 1996) for the 1995 12-month period. 45% of these cases resulted in a lost workday case (a total of 51,903 lost workdays). In 1994, 47% of injury/illness cases resulted in a lost workday case (a total of 79,636 lost workdays).
- The largest percentage of TRCs are non-fatal cases without lost work time. In 1995, non-fatal TRCs without lost work time represented 54.93% of TRCs. During this same time period, lost workday cases and deaths accounted for 45.01% and 0.06%, respectively, of TRCs.



- In 1995, the highest rates for total recordable cases were experienced by DOE contractors engaged in construction and security activities. Construction operations report about 18% of total cases and engage about 10% of the DOE contractor workforce. Likewise, security operations report about 7% of total cases and engage about 4% of the workforce.
- Very general rate comparisons for some operation types can be made to the Department of Labor, Bureau of Labor Statistics (BLS) private industry classifications. The work performed by contractors for DOE falls into several industry classifications,

including general building construction, manufacturing of chemicals and allied products, oil and gas extraction, and sanitary services. The graph shows a comparison of 1995 DOE TRC rates with 1994 private industry rates (the most recent BLS survey).



- In 1995, the DOE TRC rate was 3.6. As a comparison, the 1995 TRC rate for DuPont and its energy subsidiary, Conoco, was 0.59. In 1994, the chemical industry TRC rate was approximately 3.0^a.

Reference

^a Safety, Health and the Environment 1995 Progress Report, E.I. du Pont de Nemours and Company.

Indicator 12. Occupational Safety and Health Cost Index

Definition In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total workforce. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The index is computed as follows:

$$\text{Cost Index} = 100[(1,000,000)D + (500,000)T + (2,000)LWC + (1,000)WDL + (400)WDLR + (2,000)NFC] / \text{HRS}$$

where

D = the number of deaths,

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

LWC = the number of lost workday cases,

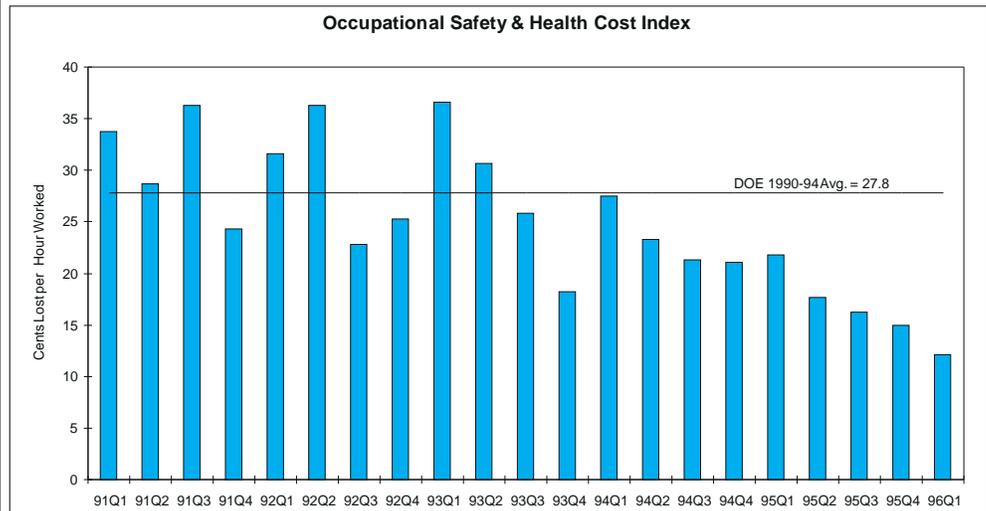
WDL = the number of days away from work,

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.

The coefficients are weighting factors which were derived from a study of the direct and indirect dollar costs of injuries.



Source: Computerized Accident/Incident Reporting System

Key Observations

- The Cost Index for each quarter in 1995 and the 1st quarter 1996 fall below the 5-year average (1990-1994) Cost Index. Revisions and late reporting are expected to result in increases in 1995 and 1996 estimates.

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- The Cost Index has turned downward since 1991. This is due to the overall decrease in lost workdays, with declines in both workdays lost (WDL) and workdays lost restricted (WDLR).
- The cost index data has been adjusted to exclude federal employees (which were included in the 2nd quarter 1995 report). This adjustment generally resulted in a decrease in the values for this indicator. 3rd quarter 1994 significantly decreased due to the exclusion of the 9 federal employee fatalities in a USAir crash.

Indicator 13. Worker Health

Performance measures focusing on worker health are under development. The following discussion provides a summary of these efforts to date.

Background

The need for performance measures for health is well recognized within the Department of Energy. Appropriate measurements of health-oriented programs and their impact on worker health facilitate the most effective use of limited resources and assist in focusing programs toward the core mission of protecting and enhancing worker health. The health of the individual reflects not only occupational factors but lifestyle choices, genetics, and other non-occupational factors as well. To assess worker health *to the extent that occupational factors affect it*, performance measurements should reflect occupational factors. The Office of Health Studies is focusing its initial development efforts on measurements that assess worker health rather than measuring program development and implementation.

To date, OSHA recordable injury and illness data are the only DOE complex-wide data addressing issues of worker safety. The Epidemiologic Surveillance Program of the Office of Epidemiologic Studies collects a broader array of health outcome data. The program now involves 10 sites. While this program is not yet complex-wide, it can contribute standardized health data for participating sites in a format that facilitates analysis. These data are collected on a nearly real time basis and are part of an established, ongoing system.

Future developments in the evolution of performance measurements for health will be facilitated by the implementation of medical (clinical) surveillance, which will provide additional, clinically oriented data helpful in detecting diseases and conditions that are not yet symptomatic, identifying occupational exposures, and in providing related data useful for measuring performance at the preventive or leading end of the performance measurement spectrum.

Current Activities

The concept of "sentinel health events," those believed to be strongly associated with occupational exposures, is being examined for the development of potentially useful measures of occupational health. A survey of occupational medicine clinics has been completed to determine the availability of data for three pilot performance indicators.

Potential Performance Measurements

Initially, the Office of Health Studies is considering the use of three performance measurements related to health.

Blood Lead concentration: The measurement of blood lead concentration is being considered because the potential for exposure is believed to be relatively common, monitoring of workers at potential risk for exposure to lead is prevalent at most sites, and reliable data are available to assess DOE workers' exposure.

Noise induced hearing loss: Noise induced hearing loss can exist in varying degree and can be detected in its early stages, providing a mechanism for prevention of further loss as well as a potential indication of workplace conditions that may require remediation to reduce or eliminate exposure. Again, the potential for exposure is relatively common, the capability to measure hearing loss is well developed and widely available, and many sites already have audiometry data available in automated form.

Carpal Tunnel Syndrome: Carpal tunnel syndrome is a repetitive motion injury of interest as a potential performance measurement because it is frequently diagnosed

among workers whose tasks involve sedentary work at desks or computer stations rather than more traditional tasks involving greater physical exertion. Rates of diagnosis or absence related to this syndrome would focus on a group of workers who are not commonly exposed to a variety of more traditional chemical, radiation, and other exposures. Data pertaining to carpal tunnel syndrome are readily available for epidemiologic surveillance sites, and the availability will expand further with the implementation of the Medical Surveillance Information System.

A survey of DOE Occupational Physicians conducted by the Office of Environment, Safety and Health identified performance measurement activities at the field level in various occupational medicine clinics throughout the complex. Thirty-two sites responded to the survey; their responses are summarized in the table below.

Availability of Data for Performance Indicators of Health

	Data Status	
	Sites Available	Site not Collecting
Blood lead test results available?	29	3
Audiometry test results available?	32	0
Cumulative trauma disorder data available?	32	0
Feasibility of computerized quarterly data transmissions?	16	16 nonautomated

Not all sites have all data in electronic form. Although most of the sites can provide data, half of the respondents reported that electronic data transmission would require additional computer programming or related system automation to provide this capability.

Initial data transmission from sites will involve the conversion of hard copy data to electronic form. Technical details for this data collection effort are being resolved at this time, and we anticipate requesting the initiation of data collection October 1, 1996, for the first quarterly data transmission to be completed in January 1997.

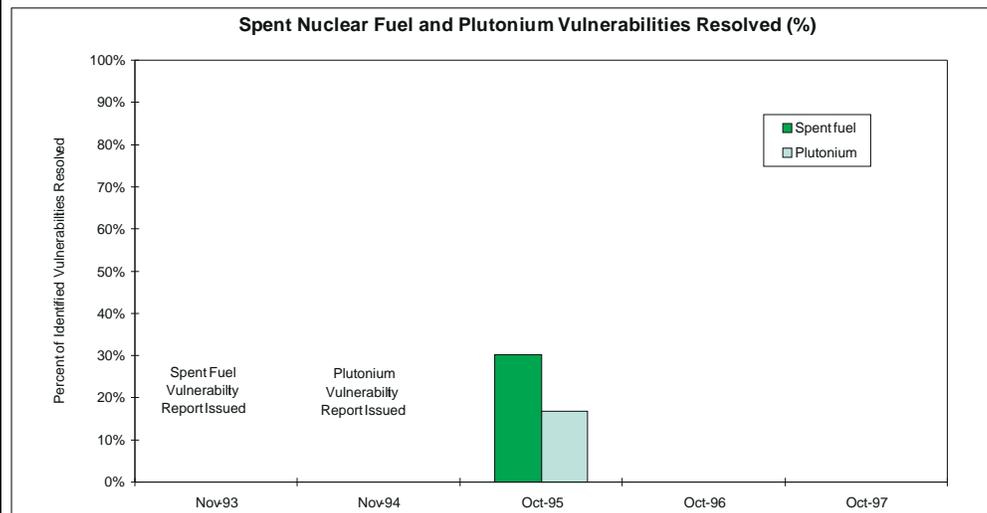
Our initial efforts have identified potential performance measurements outlined above and established their availability at the preponderance of DOE sites. Stakeholders have also suggested other potential measurements of use in assessing the health of the DOE workforce. These suggestions and alternative measurements are under consideration.

Other Potential Indicators

Indicator 14. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

Definition The 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 of the public." A resolved vulnerability implies that the cited condition no longer exists. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.



Source: Draft Plutonium Vulnerability Management Summary Report (EM-60), Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, 10/5/95 (EM-37) Plutonium Vulnerability Management Plan, DOE/EM-0199.

Key Observations

- There were 299 plutonium vulnerabilities identified at 13 sites and 106 spent nuclear fuel vulnerabilities identified at 11 sites based on reports issued in 1993 and 1994. As of 4th quarter 1995, 30% of the identified spent nuclear fuel vulnerabilities and 17% of the identified plutonium vulnerabilities have been resolved.

Additional Analysis

- The previous report (2nd quarter 1995) detailed several breakdowns by location for the spent fuel vulnerabilities and the plutonium vulnerabilities. No new data have been made available since the previous report was released.
- Research is ongoing for a proposed measure of the reduction in vulnerability to occupational workers, the environment, and the public as a result of Environmental

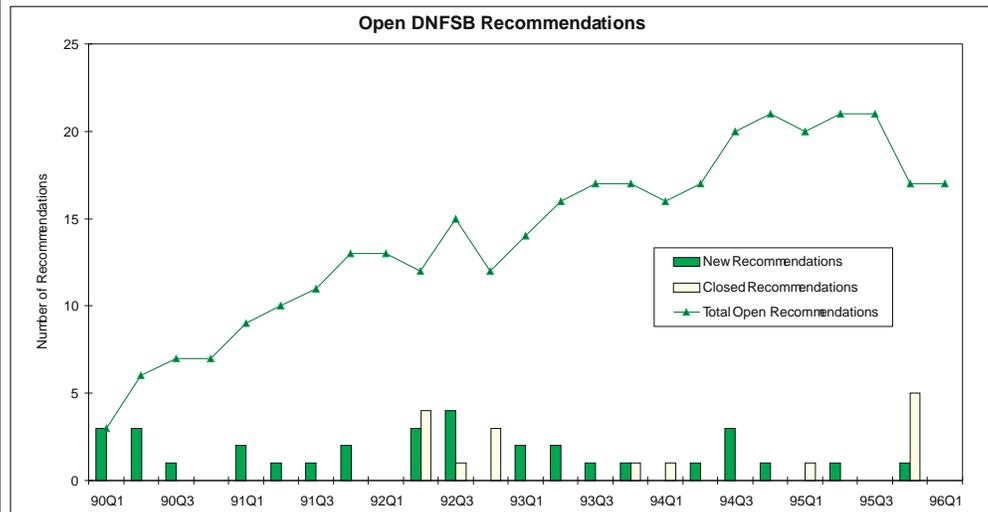
Management's (EM) plutonium stabilization efforts. It is expected that this measure, based on stabilization units, will be utilized for future DOE Performance Indicators reports.

- The planned effort will develop straightforward approaches for translating EM's critical few measures now being monitored into resulting vulnerability reductions. This will provide a more direct measure of vulnerability reduction associated with EM's plutonium stabilization efforts.
- Vulnerability scaling parameters will allow plutonium material in different states to be translated to associated vulnerabilities. Vulnerability reductions can then be tracked. Facilities and sites can be compared on a consistent basis in terms of the resulting vulnerability reductions.
- In the long term, cost estimates for various stabilization processes could allow for the determination of a "figure of merit", in the form of vulnerability reduction per unit cost, for various stabilization activities at various sites.

Indicator 15. Open DNFSB Recommendations

Definition The 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 involved in nuclear safety issues.

Each DNFSB recommendation leads to a set of commitments which, when fully implemented, will close a 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 Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.



Source: Safety Issues Management System.

Key Observations

- There were 17 open DNFSB recommendations representing 1009 DOE commitments. 52% of the commitments were considered to be satisfied or fulfilled. Potential commitments for Recommendation 95-2 were not included.
- 59% of the DNFSB recommendations were classified as “Heading to Closure” or making “Steady Progress” by S-3.1.

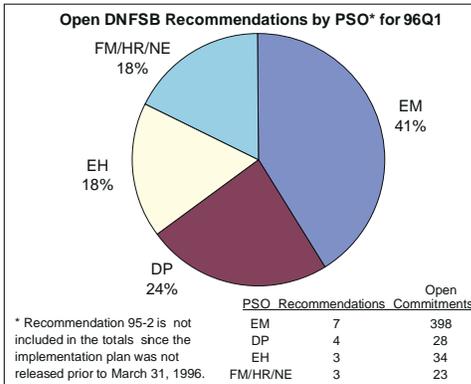
Additional Analysis

- Environmental Management (EM) and Defense Programs (DP) continue to be responsible for implementing most of the recommendations. The cumulative subtotals through 1st quarter 1996 are represented in the following table:

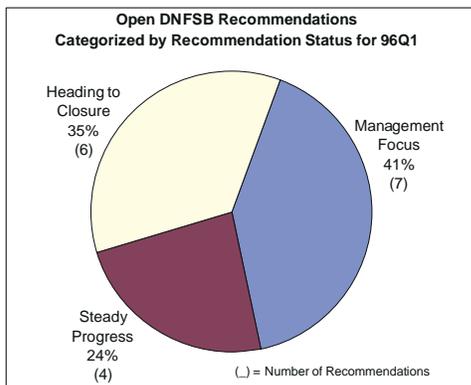
Office	DNFSB Recommendations	Commitments	Fulfilled	Not Yet Due	Overdue
EM	7	702	304 (43%)	176 (25%)	222 (32%)
DP	4	98	70 (71%)	24 (25%)	4 (4%)
EH	3	69	35 (51%)	16 (23%)	18 (26%)
FM/HR/NE	3	140	117 (84%)	8 (6%)	15 (10%)
Total	17	1009	526 (52%)	224 (22%)	259 (26%)

Distribution of Open Commitments

- There has been an improving trend in the number of open commitments (the sum of overdue commitments and not yet due commitments based on a projected schedule of completion incorporated within the implementation plans). There were 694 open commitments as of July 1995, while there were only 483 open commitments as of March 1996. However, the total number of overdue commitments has increased from 200 in September 1995 to 259 in March 1996. Of these 259 overdue commitments, 208 were overdue by 3 months or more.
- EM was responsible for 41% of the open recommendations for 1st quarter 1996; however, this represents over 80% of the open commitments.
- Potential commitments for Recommendation 95-2 were not included because the implementation plan was not issued before the end of 1st quarter 1996.



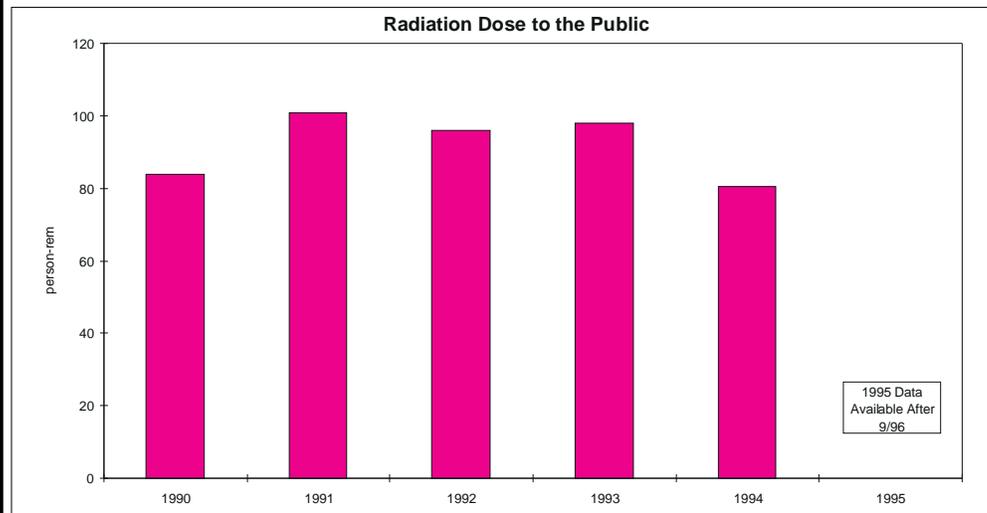
Characterization of Recommendation Status: The adjacent graph shows an evaluation by S-3.1 on the number of open DNFSB recommendations categorized by recommendation status. A status of "Heading to Closure" includes the existence of a clearly defined path to closure and the expectation that the remaining commitments/actions can be completed within the next year. "Steady Progress" implies the existence of an acceptable implementation plan with most commitments/deliverables generally being completed on schedule. However, some "Steady Progress" actions or commitments will require more than 1 year to complete. Recommendations classified as "Management Focus" involve difficulties with (or lack of) an implementation plan or a large number (10) of overdue commitments. 59% of the DNFSB recommendations were classified as "Heading to Closure" or making "Steady Progress".



Environment

Indicator 16. 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.)



Source: Annual reports to EPA, EH-41 data.

Key Observations

- Total collective radiation dose to the public from DOE sources is 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 is 0.00013 of the dose received by the same population from natural background radiation.
- Over the past five years, three sites [Oak Ridge Reservation, Argonne National Laboratory (ANL), and Savannah River Site] consistently account for about two-thirds of the estimated off-site collective radiation dose.
- The overall collective radiation dose decrease in 1994 is due to the lower off-site collective doses at these three sites. The decreases resulted primarily from the reduction in weapons production and development activities at Oak Ridge and Savannah River. ANL reductions resulted mostly from the decrease in Thorium-232 inventory in Building 200 which reduced Radon-220 emissions.

Additional Analysis

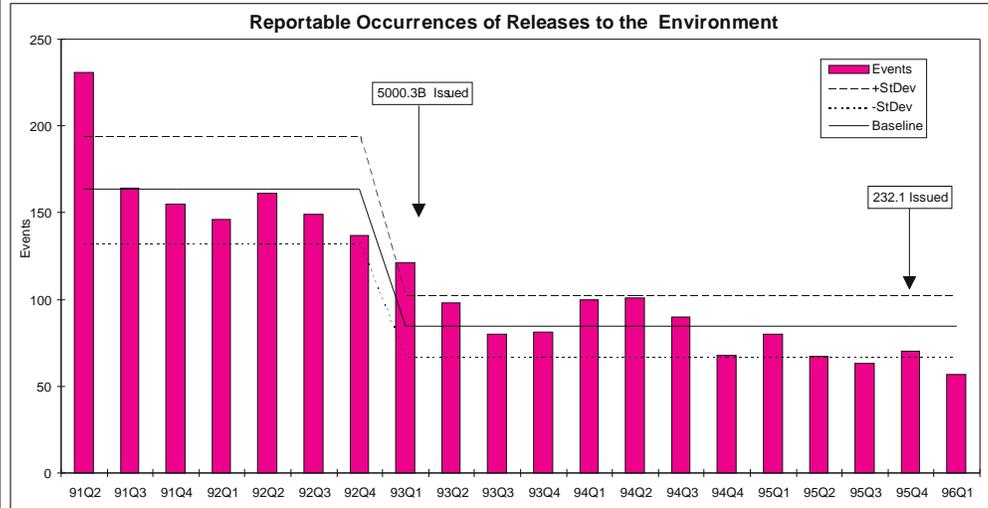
- In 1994, Oak Ridge and Savannah River reported the largest air releases and were significant contributors to the total collective radiation dose to the public from DOE sources. ANL and Lawrence Livermore Site 300 (LLNL-300) reported smaller air releases during 1994. However, these two sites are surrounded by higher population densities; therefore, their contributions to the total collective radiation dose to the public were also significant.
- Previously it was reported (*DOE Performance Indicators for Environment, Safety & Health, Report Period: April-June 1995*) that the increase in total collective radiation dose at LLNL-300 in 1994 resulted from more comprehensive estimates

of its diffuse emissions. After further analysis, it was determined that increased point source emissions (due to differences in the amounts of high explosives and depleted uranium used in explosives experiments) were responsible for the increase in total collective radiation dose at Site 300. The increase was due to variation in doses from firing-table experiments (point sources) and not diffuse sources.

- The increase in collective radiation dose from 1990 to 1991 results from a doubling of the reported collective dose at Savannah River. The results between 1991 and 1992 appear nearly unchanged or show a slight dip in emissions. A 30% increase in the collective dose at Oak Ridge is more than balanced by a 60% decrease in reported collective dose by Savannah River. Between 1992 and 1993, the situation is reversed where the Oak Ridge collective dose is reduced by nearly 50%, but is compensated for by a 60% increase at Savannah River along with a significant increased contribution from LLNL-300.

Indicator 17. 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: Engineer Review of Occurrence Reports.

Key Observations

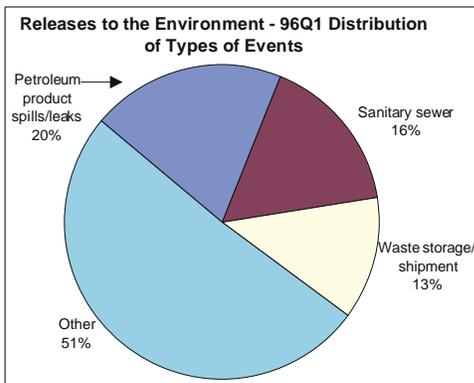
- Reportable release incidents have significantly decreased over the entire 20-quarter period displayed. There is also a significant decreasing trend since 93Q1, when the reporting criteria were changed by DOE Order 5000.3B, *Occurrence Reporting and Processing of Operations Information*.
- Implementation of Occurrence Reporting Order 232.1 in 95Q4 did not significantly impact this indicator.
- Most (84%) of 1st quarter 1996 reports involved hazardous materials; the remaining 16% involved radioactive material.

Additional Analysis

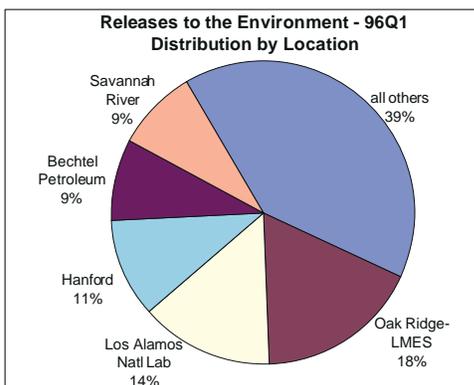
A portion of these events must be identified by analyzing the individual occurrence reports, and 96Q1 is the first quarter for which detailed distributions of the release data have become available. For this reason, information on possible historical trends for this indicator is limited.

- The primary change to reporting criteria introduced by DOE Order 232.1, which impacts this indicator, involves increasing the reportability threshold for oil spills from 10 to 42 gallons. A review of historical data indicates that this change represents less than 2% of the release events since 1st quarter 1993. Spills of less than 42 gallons were still being reported in 1st quarter 1996.
- Only 9% of 1st quarter 1996 release reports involved airborne releases.

- The types of events are shown in the graph at right. The category "other" includes events such as rain runoff, failed pumps, no permits for modifications, and failed samplings.

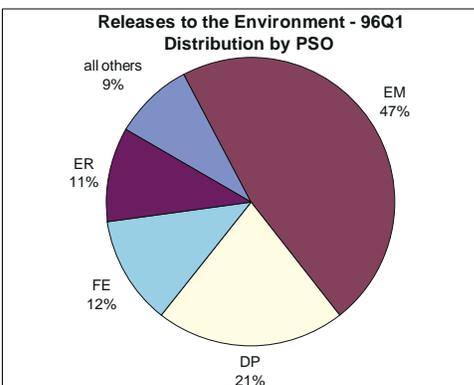


Distribution by Location: The top 5 contributing locations are shown at right. No one site dominates.



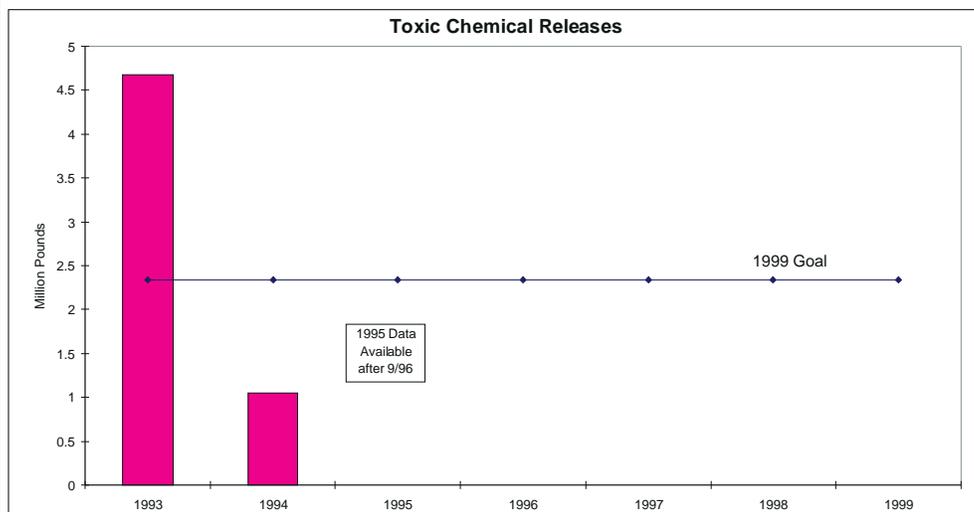
Root Causes: The leading root causes of release events tend to be attributed to equipment (35%), management (26%), or personnel (13%) issues. Root causes were identified for 40% of the for 1st quarter 1996 events.

Distribution by Program Secretarial Office (PSO): The distribution of release events by PSO is shown at right. The contributions by Environmental Management (EM) and Defense Programs (DP) are proportional to their contributions to the total number of people (FTEs), i.e., they represent about 44% and 25%, respectively, of the FTEs for organizations which submit occurrence reports.



Indicator 18. Toxic Chemical Releases

Definition Toxic Release Inventory (TRI) chemicals released or transferred off-site for treatment or disposal (pounds).



Source: EPA Toxnet database; individual site Section 313 Form R reports.

Key Observations

- Executive Order 12856 requires Federal agencies to reduce their toxic chemical releases and off-site transfers by 50% before December 31, 1999. Using a pre-established baseline year of 1993, DOE has already met this goal (decreasing from 4,678,000 in 1993 to 1,054,000 in 1994).
- DOE met its goal of reducing releases of 17 hazardous chemicals by 50% before 1995 through an earlier cooperative effort with the Environmental Protection Agency.

Additional Analysis**Reporting Requirements and Goals**

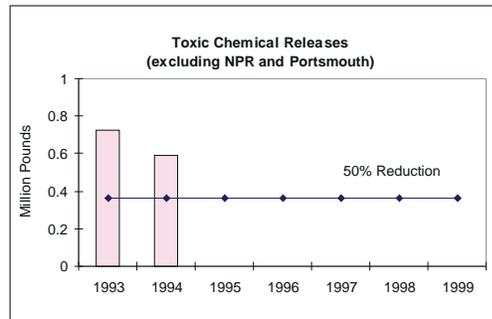
- Executive Order 12856^a directed all Federal agencies to reduce releases and off-site transfers of toxic chemicals by 50% before December 31, 1999 [as reported in the Emergency Planning and Community Right-to-Know Act's Toxic Chemical Release Inventory (TRI)].
- Prior to the executive order being issued, DOE had participated in the Environmental Protection Agency's 33/50 pollution prevention program, which included voluntary TRI reporting. Through this cooperative effort with EPA, DOE met its earlier goal of reducing inventories of 17 hazardous chemicals by 50% before 1995. Therefore, by establishing a 1993 baseline year, DOE effectively "jumped" one year ahead of other Federal agencies in working toward achieving the inventory/transfer reductions directed in Executive Order 12856.
- The new goal is for all TRI-reported chemicals. DOE's 1993 baseline total is 4,678,000 pounds. This is 0.1% of the 1993 industry-wide total.

DOE TRI

- Methanol accounted for 79% (3,666,000 pounds) of DOE's total TRI in 1993. Naval Petroleum Reserve #1 (NPR#1) reported 81% (3,783,000 pounds) of the DOE TRI baseline. In 1994, reported methanol releases at NPR#1 were reduced by more

than 90% below releases reported for 1993 by improving estimates based on sampling and monitoring.

- Portsmouth Gaseous Diffusion Plant also reported a major decrease (from 171,638 pounds in 1993 to 2,781 pounds in 1994). The decrease is entirely due to approximately 170,000 pounds of dichlorotetrafluoroethane reported in 1993 (and none in 1994). The decrease in the amount Portsmouth reported to DOE is due to the transfer of Portsmouth operations to the U.S. Enrichment Corporation in mid-1993; these releases continue and are now reported by USEC.
- When the reported releases are adjusted for these two anomalies, the modified data still indicate that DOE is achieving significant reduction in reported chemical releases.

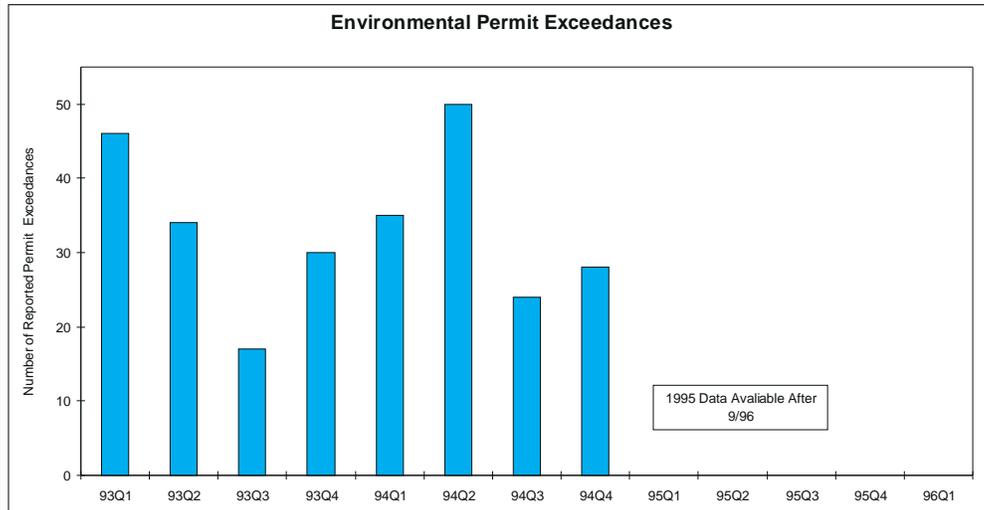


Reference

^a Executive Order 12856, Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, signed August 2, 1993.

Indicator 19. 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

- Seasonal effects (precipitation, temperature, sunlight) influence the number of exceedances, particularly in the first 2 quarters of each calendar year.
- Approximately 95% of exceedances over the two-year period displayed (1993-1994) were due to violations of water discharge permit conditions under the Clean Water Act; 5% were attributed to Clean Air Act permit violations.
- Four facilities (Argonne National Laboratory - East, Los Alamos, Portsmouth, and West Valley) consistently accounted for almost 70% of the total number of exceedances through 4th quarter 1994.

Additional Analysis

Characterization by Release Path

- Most exceedances (95%) occurred under National or State Pollutant Discharge Elimination System (NPDES/SPDES) permits mandated by the Clean Water Act to protect surface waters by limiting effluent discharges to receiving streams, reservoirs, ponds, etc. These permits specify discharge standards for various parameters and constituents as well as monitoring and reporting requirements. Industrial and sanitary wastewater discharges as well as stormwater runoff discharges are regulated under NPDES/SPDES permits.
- The other major type of permit violations (5%) occurred under Clean Air Act permits for on-site emission sources from industrial operations, chemical process systems, or waste processing systems that discharge to the ambient air through stacks, ventilators, air ducts, etc. (i.e., Air Quality Permits, etc.).

Distribution by Location

- The 4 major contributors (of the 54 DOE facilities from which the data were compiled) accounted for almost 70% of the total number of permit exceedances across the DOE complex through 4th quarter 1994. All 4 of the major contributors routinely discharged into receiving waters from significant ongoing on-site processes, industrial operations, and sanitary wastewater operations, and all were affected by variations in precipitation and storm events. The facilities were,

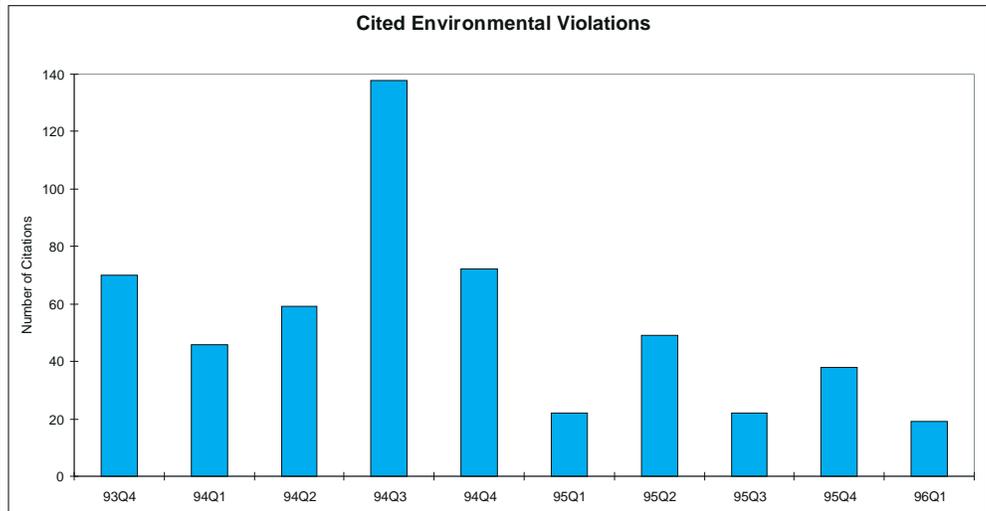
therefore, sensitive to stormwater runoff related exceedances. Some large sites such as Idaho, Hanford, and the Nevada Test Site contributed no permit exceedances because of low annual precipitation and less likelihood of stormwater runoff related exceedances.

Characterization of Permit Exceedances

- The number of exceedances is a function of the permit-specific parameters, number of outfalls, reporting frequency requirements, and the timing of the NPDES/SPDES permit renewal. In addition, changes in temperature, sunlight, and increased rainfall events all contribute to permit exceedances of non-toxic parameters such as Biological Oxygen Demand (BOD), pH, and Total Suspended Solids (TSS).
 - Exceedances were significantly more frequent during the first two quarters of the year. This was due primarily to increased precipitation, temperature, sunlight, and biological activity in on-site retention lagoons/ponds at the high-contributing sites, resulting in significant exceedances of the TSS, pH, BOD, and temperature permit parameters at these sites.
 - During 1st quarter 1994, West Valley renewed their SPDES permit which required additional chemical monitoring requirements and more stringent effluent limitations. This, along with the increased precipitation and temperature, resulted in a higher number of exceedances in the 2nd quarter 1994. This appears to be true of other sites as well.
 - Portsmouth contributed 13 exceedances in the 2nd quarter 1994 with most exceedances attributed to TSS, pH, and daily temperature violations due to precipitation and temperature influences.

Indicator 20. Cited Environmental Violations

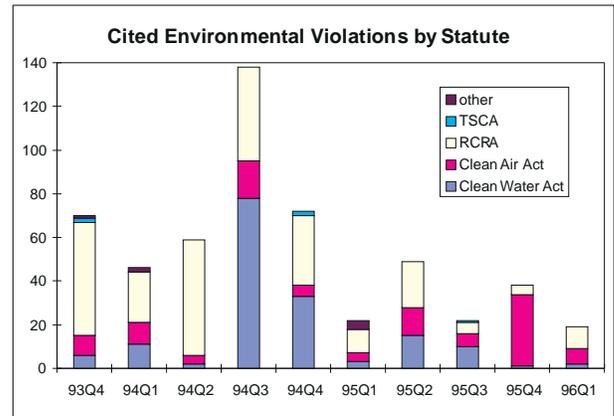
Definition Number of environmental violations cited by regulators in enforcement actions at DOE facilities.



Source: EH-41 Compliance Database.

Key Observations

- The number of violations cited decreased 58% from 1994 to 1995 (from 315 in 1994 to 131 in 1995).
- Between 1994 and 1995, cited violations related to the Resource Conservation and Recovery Act (RCRA) decreased 73% (from 151 to 41). Clean Water Act violations decreased 77% (from 124 to 29). Clean Air Act violations increased 56% (from 36 to 56).
- The data remain quite variable from one quarter to the next making it difficult to identify meaningful trends.



Additional Analysis

Distribution by Location

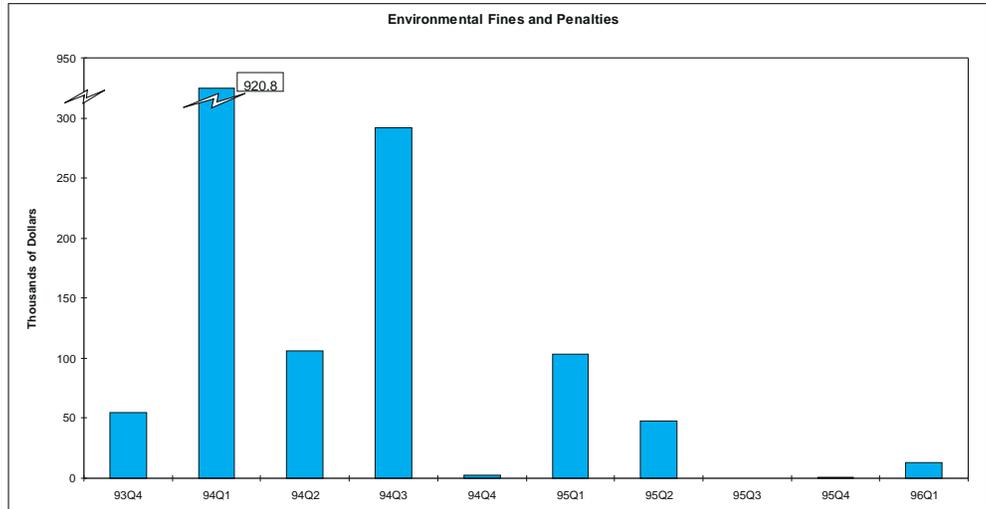
- In 3rd quarter 1994, two enforcement actions against Los Alamos National Laboratory accounted for 85% of the citations.
- Because no attempt has been made to normalize data among sites, no site-to-site comparison is appropriate, or attempted, using this indicator.
- The data have been reviewed and updated by the respective field offices. The Office of Environmental Policy and Assistance (EH-41) has performed additional review and quality assurance. Data from 3rd quarter 1993, reported in the first (2nd quarter 1995) ES&H Performance Indicators report, are no longer included because they are incomplete.

Factors That Can Influence the Number of Violations

- In addition to the “true” level of compliance, many factors may lead to increases or decreases in the number of violations cited.
 - Timing. Enforcement actions may lag the dates of the violations cited by weeks or months, depending on the enforcing agency. Violations may occur before the date of an inspection. Issuance of citations for a violation may lag an inspection by days, weeks, or months. For this reason, one must be cautious in drawing any conclusions regarding timing of the violations. The dates used are the dates when DOE received notification of the alleged violations, not the discovery or occurrence dates .
 - Enforcement philosophy. Regulatory agencies, whether they be states, EPA Regions, or local jurisdictions, vary in the vigor with which they enforce environmental requirements. While some regulators tend to cite only major violations, other regulators issue citations for many smaller violations.
 - Number of violations cited. This indicator is influenced by the number of violations cited from a single inspection, or in a single notice. An intensive multi-media inspection at a single site can either skew or obscure the “real” trend. For example, one such inspection resulted in an enforcement action citing 77 violations at one DOE site.
 - Number of inspections. Increases or decreases in the number of violations cited may be a direct result of increases and decreases in inspections performed, or increases and decreases in agency emphasis on certain types of violations. However, not all inspections yield a cited violation. The number of inspections could be used to normalize the number of citations. However, DOE sites are not required to keep a record of the data on the number of regulatory inspections. Although some sites do keep such records, it is unlikely that all sites would keep such records in an accessible form.

Indicator 21. Environmental Fines and Penalties

Definition Fines and penalties assessed by regulators at DOE facilities related to violations of environmental laws and regulations.



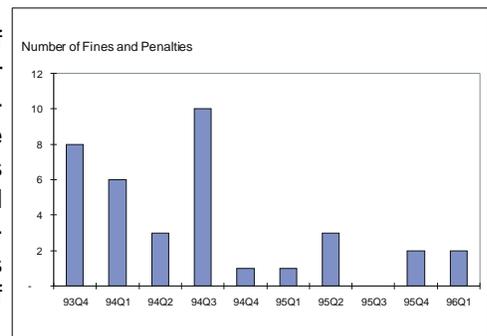
Source: EH-41 Compliance Database.

Key Observations

- Fines and penalties assessed by regulators against DOE facilities have significantly decreased since 1994. Fines of \$1,333,000 were assessed in 1994; the 1995 total was \$152,040. The number of fines and the average amount of fines have also decreased.
- 7 of the 9 largest fines (those \$10,000 or greater) since 4th quarter 1994 were violations of the Resource Conservation and Recovery Act (RCRA).
- Conclusions must be drawn with caution, however, since this performance indicator can be skewed or otherwise dominated by large assessments against a facility, either for a single violation or for multiple violations. For example, a \$900,000 fine was assessed for a single violation in 1st quarter 1994. \$247,000 in fines were assessed for 28 violations at a single site in 3rd quarter 1994.

Additional Analysis

Number of Fines: The dollar amount of fines and penalties assessed per quarter is highly variable. This volatility is demonstrated by the fact that the trend in the dollar amount of fines and penalties does not follow the trend shown for the "Cited Environmental Violations" performance indicator. The number of fines and penalties assessed is more similar to the number of cited violations.



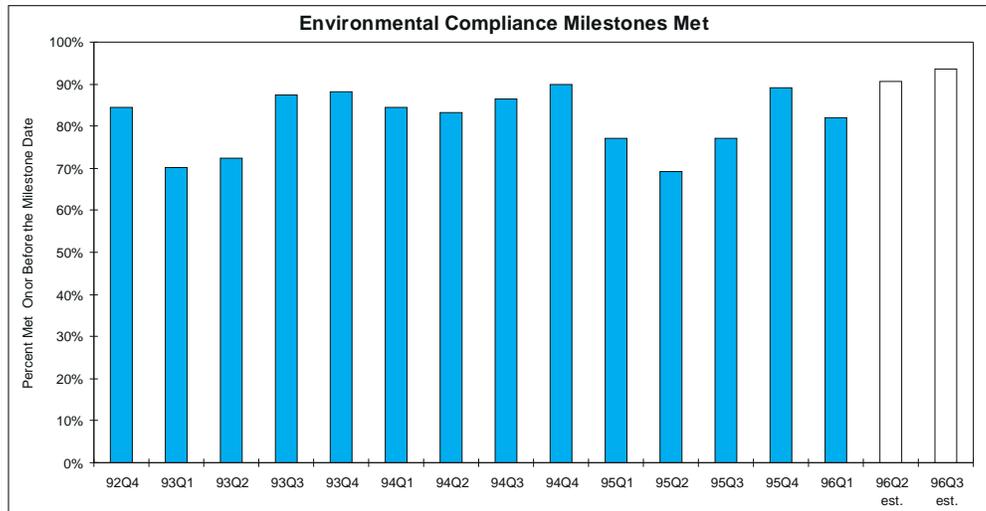
Large Fines (>\$10,000): 7 of the 9 large fines were for RCRA violations, ranging from \$15,500 to \$900,000 and accounted for more than 90% of the fines assessed. Also among the 9 largest fines was one under the Clean Water Act (\$40,000) and one under the Clean Air Act (\$10,000).

Quarters with Large Total Dollar Amounts (\geq \$40,000): All six quarters with large dollar amounts were dominated by large assessments at single sites.

- Only 2 of the 6 were large assessments for single violations: one was a \$900,000 fine assessed in 1st quarter 1994, and the other was a \$100,000 fine assessed in 2nd quarter 1994. Both fines were at Oak Ridge K-25 Plant.
- The remaining 4 of the 6 were for multiple violations addressed at a single site. For example, fines totaling \$247,000 for 28 hazardous waste violations were assessed at Los Alamos National Laboratory in 3rd quarter 1994. Fines totaling about \$104,000 for a different set of 28 violations were assessed at the same site in 1st quarter 1995.
- The dollar value of fines and penalties provides an indication of the degree of importance the regulators attach to a violation (i.e., the more serious the violation, the higher the assessed fine or penalty). The highest assessment for a single violation (\$900,000) was for failure to properly store drums of hazardous waste. The second highest assessment for a single violation (\$100,000) was for an administrative violation, i.e., failure to obey a Compliance Order for correcting violations dating from 1990.
- Increases or decreases in the amount of fines assessed may be a direct result of increases and decreases in inspections performed, or increases and decreases in agency emphasis on certain types of violations. However, not all inspections yield a cited violation or fine. The number of inspections could be used to normalize the number of citations. However, DOE sites are not required to keep a record of the data on the number of regulatory inspections. Although some sites do keep such records, it is unlikely that all sites would keep such records in an accessible form.

Indicator 22. Environmental Compliance Milestones Met

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



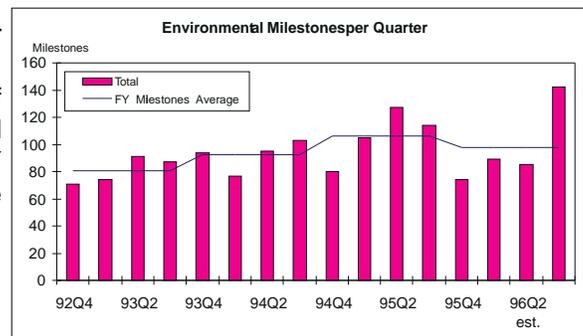
Source: Progress Tracking System Data, Office of Environmental Management.

Key Observations

- A significant number of enforceable milestones are not being met on time. Over 14 quarters, the fraction of milestones met early or on-time has ranged from 90% down to 69%.
- 77% of enforceable milestones were completed on time (including “early”) in FY 1995. In FY 1994, the rate was 86% and in FY 1993, the rate was 80%.

Additional Analysis

- In the most recent 3 quarters (3rd quarter 1995 through 1st quarter 1996), 82% of the milestones were completed by the due date. Over the entire 14 quarters of data, the average on-time completion rate was 85%.
- Rates are projected for 2nd and 3rd quarters 1996, based on milestones identified as “forecast delay” as of April 30, 1996. The usefulness of including such projections in subsequent performance indicator reports will be evaluated in the future.
- The number of milestones per quarter varies from 71 to 127. The average number of quarterly milestones increased from 81 in FY 1993 to 106 in FY 1995, with a modest decrease to 98 in FY 1996.



- These data do not capture all enforceable milestones; they reflect those milestones under the purview of the Office of Environmental Management. EM’s Progress Tracking System is believed to capture 85–90% of all DOE enforceable environmental milestones.

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Indicator**23. Pollution Prevention****Definition**

In May 1996, the Department set the following goals to be achieved by December 31, 1999, using calendar year 1993 as a baseline year.^a

- Reduce by 50% the generation of radioactive waste (for routine operations).
- Reduce by 50% the generation of low-level mixed waste (for routine operations).
- Reduce by 50% the generation of hazardous waste (for routine operations).
- Reduce by 33% the generation of sanitary waste (for routine operations).
- Reduce by 50% total releases and off-site transfers for treatment and disposal of toxic chemicals (for routine operations).
- Recycle 33% of sanitary waste (for all operations, including cleanup/stabilization activities).
- Increase procurement of Environmental Protection Agency-designated recycled products to 100%, except where they are not commercially available competitively at a reasonable price or do not meet performance standards.

Key Observations

- Current data are provided in this report for the fifth measure (see Performance Indicator 18, Toxic Chemical Releases). Work is ongoing to evaluate possible measures for these goals.

Reference

^a Memorandum "Departmental Pollution Prevention Goals" Hazel O'Leary to Heads of Departmental Elements, May 3, 1996, reprinted in *Pollution Prevention Program Plan 1996*, DOE/S-0118

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Relationship to DOE Strategic Plan Goals

Eliminate Hazards and Releases

DOE STRATEGIC PLAN (April 1994)	PERFORMANCE INDICATORS
<p><u>Environment, Safety, & Health Goal 1</u> <i>Empower workers and take other necessary actions to prevent all serious injuries and all fatalities, and to eliminate all worker exposures and environmental releases in excess of established limits. By eliminating these exposures and releases, reduce the incidence of illness among workers and the public, and prevent damage to the environment.</i></p>	<ol style="list-style-type: none"> 1. Radiological Events 2. Worker Radiation Dose 3. Investigations of Serious Events 5. Safety System Actuations 6. Procedure Violations 7. Safety Equipment Degradation 8. Near Misses and Safety Concerns 9-12. OSH (Lost Workday Case Rate, Total Recordable Cases, Cost Index, Lost Workday Incidence Rate) 15. Radiation Dose to the Public 16. Reportable Occurrences of Releases to the Environment 18. Environmental Permit Exceedances
<p><u>Environment, Safety, & Health Goal 2</u> <i>Ensure there are specific environmental, safety, and health performance requirements for DOE activities which are the basis for measuring progress toward continuous improvement.</i></p>	<ol style="list-style-type: none"> 1. Radiological Events 2. Worker Radiation Dose 9-12. OSH (Lost Workday Case Rate, Total Recordable Cases, Cost Index, Lost Workday Incident Rate) 17. Toxic Chemical Releases
<p><u>Environment, Safety, & Health Goal 3</u> <i>Establish clear environmental, safety, and health priorities and manage all activities in proactive ways that effectively and significantly increase protection to the environment and to public and worker safety and health.</i></p>	<ol style="list-style-type: none"> 13. Spent Nuclear Fuel and Plutonium Vulnerabilities
<p><u>Environment, Safety, & Health Goal 4</u> <i>Demonstrate respectable performance related to environmental protection and worker/public safety and health...</i></p>	<p>All</p>

Performance Requirements

Establish Priorities

Demonstrate Performance

(Numbers refer to corresponding Sections in this report.)

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Summary of Process

B1. Overview

One of the critical success factors identified in the Department of Energy (DOE) Strategic Plan for environment, safety and health is “ensuring the safety and health of workers and the public and the protection and restoration of 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. Subsequent reports may evolve to include incorporating the components into an index to represent the combined effect that the activities have on the envelope of safety that protects the worker and the environment, as experience is gained and data sources improve.

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 in Table B1.

<p><u>Summary of Process</u></p> <p>1. Overview</p> <p> 1.1 Initial Performance Measures</p> <p>2. Data Analysis</p> <p> 2.1 Analyses Performed</p> <p> 2.2 Determining Statistical Significance of Trends</p> <p>3. Future Plans</p>
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B1.1 Initial Performance Measures

The initial performance measures included in this report are identified in the table below. 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 1st quarter 1993 will be removed from the graphs and analysis (date of issuing DOE Order 5000.3B) in the next PI report.
- *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. Further, 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 (worker & facility safety and health and the environment in this case), 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
Worker and Facility Safety	
1 Radiological Events	Engineer Review of Occurrence Reports, EH-33
2 Worker Radiation Dose	Radiation Exposure Monitoring System (REMS), EH-52
3 Investigations of Serious Events	Computerized Accident/Incident Reporting System (CAIRS), EH-51
4 Chemical Hazard Events	Quarterly Review of Chemical Safety Concerns/Occurrence Reporting and Processing System, EH-52/EH-53
5 Safety System Actuations	Engineer Review of Occurrence Reports, EH-33
6 Procedure Violations	Engineer Review of Occurrence Reports, EH-33
7 Safety Equipment Degradation	Engineer Review of Occurrence Reports, EH-33
8 Near Misses & Safety Concerns	Engineer Review of Occurrence Reports, EH-33
9 Lost Workday Case Rate	Computerized Accident/Incident Reporting System, EH-51
10 Lost Workday Incidence Rate	Computerized Accident/Incident Reporting System, EH-51
11 Total Recordable Case Rate	Computerized Accident/Incident Reporting System, EH-51
12 Occupational Safety and Health Cost Index	Computerized Accident/Incident Reporting System, EH-51
13 Worker Health	TBD - Under Development
14 Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved	Plutonium Vulnerability Management Summary Report, EM-60; Reports on Status of Corrective Actions to Resolve Spent Nuclear Fuel Vulnerabilities, EM-37
15 Open DNFSB Recommendations	Safety Issues Management System (SIMS), S-3.1
Environment	
16 Radiation Dose to the Public	Annual Reports to Environmental Protection Agency (EPA) by Each Site, EH-41
17 Reportable Occurrences of Releases to the Environment	Engineer Review of Occurrence Reports, EH-33
18 Toxic Chemical Releases	Annual DOE 3350 Pollution Prevention Report to EPA
19 Environmental Permit Exceedances	Annual Site Environmental Reports
20 Cited Environmental Violations	Environmental Compliance Tracking Database, EH-41
21 Environmental Fines and Penalties	Environmental Compliance Tracking Database, EH-41
22 Environmental Compliance Milestones Met	EM Progress Tracking System (PTS)
23 Pollution Prevention	TBD - Under Development

B2. Data Analysis

B2.1 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. The two most recent quarters are excluded for data originating from CAIRS to account for the time lag in data reporting.

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.

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.

B2.2 Determining Statistical Significance of Trends

The Multinomial Likelihood Ratio Test (MLRT) is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events.

MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: "If the data are generated by a constant trend multinomial model, what is the probability of observing

a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

Significance Level	Conclusion
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

B3. Future Plans

This report is considered a "work in progress." Future activities are focused on obtaining feedback on the approach and improving the effectiveness of the product, including:

- Developing, in partnership with the field organizations, performance indicators that provide a measure of how well DOE is doing in (a) reducing hazards or vulnerabilities and (b) safety management including training, management involvement, and worker involvement. These new measures, combined with measures currently available, will more ably answer the critical questions of "what is DOE's actual and potential impact on people and the environment" and "is DOE getting safer."
- Providing more normalized or risk-based data that lends itself better to analysis and comparison.
- Establishment of Corporate goals for most indicators and comparison to average and best-in-class companies.
- Internet web-based tools to provide up-to-date data and charts of most performance indicators.

Future reports will be refined as data are gathered and customer input is received. Over time, new knowledge and changing missions will be reflected in the process.

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Performance Indicator Definitions

Worker & Facility Safety

1. Radiological Events

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

2. Worker Radiation Dose

The 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 workforce size. It includes any individual (federal employees, contractors, subcontractors, and visitors) with reported doses greater than the minimum detectable dose.

3. Investigations of Serious Events

Investigation of accidents with significant human effects, environmental effects, or property damage.

Type A investigations include accidents which involve: a fatality, hospitalization or permanent disability of at least 3 people, significant radiation dose (>25 rem), releases more than 5 times that reportable under 40 CFR 302, and property damage in excess of \$2.5 million.

Type B investigations include accidents which involve: at least 1 person hospitalized for more than 5 days, 5 related lost workday cases within 1 year, accidents involving 5 or more people, radiation exposures (10-25 rem), releases 2-5 times that reportable under 40 CFR 302, and property damage of \$1 million - 2.5 million.

4. Chemical Hazard Events

The number of events reportable under DOE Order 232.1, *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 events 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 which are significant by the frequency, but not by the consequences.

5. Safety System Actuations

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

6. Procedure Violations

Number of reportable events, as defined in DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*, which are either categorized as procedure

violations or problems or are reported as being caused by a procedure violation or problem.

7. Safety Equipment Degradation

Number of reportable events categorized as "vital system/component degradation" as defined in DOE Order 232.1, *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 surveillance/inspections and appraisal findings of any safety class SSC.

8. Near Misses and Safety Concerns

Number of events related to near misses or safety concerns reportable under DOE Order 232.1, *Occurrence Reporting and Processing of Operations Information*. A near miss occurs when all barriers to an event initiation are compromised or if only one barrier remains to an event initiation, after other barriers have been compromised. A safety concern exists if the unauthorized use of hazardous products or processes occurs, or if work is shut down as the result of an Occupational Safety and Health Administration violation.

9. Lost Workday Case Rate

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.

10. Lost Workday Incidence Rate

The Lost Workday (LWD) Incidence Rate is the number of lost workdays per 200,000 hours worked.

11. Total Recordable Case Rate

Total Recordable Cases (TRC) are all work-related deaths and illnesses, and those work-related injuries which result in loss of consciousness, restriction of work or motion, transfer to another job, or require medical treatment beyond first aid.

Total recordable cases include all occupational injuries and illnesses that result in either death, a lost workday case, or a non-fatal case without lost workdays. Therefore, TRCs will always be either equal to or greater than the number of lost workday cases. Total recordable case rate is the number of TRCs per 200,000 hours worked.

12. Occupational Safety and Health Cost Index

In general terms, the DOE Occupational Safety and Health Cost Index represents the amount of money lost to injuries/illnesses for every hour worked by the total workforce. The Index is a coefficient calculated from the direct and indirect dollar costs of injuries. It is not a direct dollar value and is not commonly used in private industry. DOE sites use this index to measure their progress in worker safety and health. The index is computed as follows:

$$\text{Cost Index} = 100[(1,000,000)D + (500,000)T + (2,000)LWC + (1,000)WDL + (400)WDLR + (2,000)NFC] / \text{HRS}$$

where

D = the number of deaths,

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.

The coefficients are weighting factors, which were derived from a study of the direct and indirect dollar costs of injuries. As a result, the index is approximately equal to cents lost per hour worked.

13. Worker Health (future indicators)

Performance measures focusing on worker health are under development.

14. Spent Nuclear Fuel and Plutonium Vulnerabilities Resolved

The 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 of the public." A resolved vulnerability implies that the cited condition no longer exists. Vulnerabilities can be characterized as material/packaging (e.g., storage of unstable and corrosive solutions), facility condition (e.g., facility weaknesses), or institutional vulnerabilities (e.g., loss of experienced personnel). The vulnerabilities were ranked by significance based on the likelihood of an accident and the perceived consequences.

15. Open DNFSB Recommendations

The 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 involved in nuclear safety issues.

Each DNFSB recommendation leads to a set of commitments which, when fully implemented, will close a 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 Departmental Representative to the DNFSB (S-3.1) as completed (fulfilled), not yet due, and overdue.

Environment

16. Radiation Dose to the Public

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.)

17. Reportable Occurrences of Releases to the Environment

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

18. Toxic Chemical Releases

Toxic Release Inventory (TRI) chemicals released or transferred off-site for treatment or disposal (pounds).

19. Environmental Permit Exceedances

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

20. Cited Environmental Violations

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

21. Environmental Fines and Penalties

Fines and penalties assessed by regulators at DOE facilities related to violations of environmental laws and regulations.

22. Environmental Compliance Milestones Met

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

23. Pollution Prevention (future indicators)

In May 1996, the Department set the following goals to be achieved by December 31, 1999, using calendar year 1993 as a baseline year.

- Reduce by 50% the generation of radioactive waste (for routine operations).
- Reduce by 50% the generation of low-level mixed waste (for routine operations).
- Reduce by 50% the generation of hazardous waste (for routine operations).
- Reduce by 33% the generation of sanitary waste (for routine operations).
- Reduce by 50% total releases and off-site transfers for treatment and disposal of toxic chemicals (for routine operations).
- Recycle 33% of sanitary waste (for all operations, including cleanup/stabilization activities).
- Increase procurement of Environmental Protection Agency-designated recycled products to 100%, except where they are not commercially available competitively at a reasonable price or do not meet performance standards.

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 which 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. In addition, the graphs show the historical baseline ± 1 standard deviation to give the reader a feel for the variation associated with the data. For Performance Indicators where there are insufficient data to calculate a meaningful baseline, no baseline is shown on the graph.

Multinomial Likelihood Ratio Test (MLRT)

MLRT is used to determine statistical significance of trends. MLRT performs separate tests for increasing and decreasing trends in a sequence of 2 to 30 counts of an event. The tests are based on a multinomial distribution assumption for the counts. Therefore, the sequence must be counting discrete events that are independent over time. An event is a physically indivisible quantity, such as an incident. These tests are also useful for performing trend analysis of rare events. MLRT computes a ratio of constant trend likelihood to increasing (or decreasing) trend likelihood from the observed sequence of counts. Therefore, small values of the ratio favor an increasing (or decreasing) trends. Consider the following question: "If the data are generated by a constant trend multinomial model, what is the probability of observing a smaller ratio than that computed from the observed sequence?" This probability is called the significance level of the test and is interpreted as follows:

<u>Significance Level</u>	<u>Conclusion</u>
> 0.1 to 1.0	no departures from constant trend detected
> 0.05 to 0.1	possible increasing (or decreasing) trend
> 0.01 to 0.05	probable increasing (or decreasing) trend
> 0.001 to 0.01	very probable increasing (or decreasing) trend
0 to 0.001	highly probable increasing (or decreasing) trend

The significance level is analogous to precision of measurement. As always, the importance of any precisely measured (i.e., statistically significant) quantity depends on the subject matter and context.

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.

The following terms are related to occurrence reporting, as required by DOE Order 232.1, 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

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

Severity of Occurrence

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.

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

Facility Function

- 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)

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

Causes of Occurrences

- Direct Cause: The cause that directly resulted in the occurrence.
- Contributing Causes: The cause(s) that contributed to the occurrence but, that 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, and other management problems.
7. External phenomenon: An event or condition caused by factors that are not under the control of the reporting organization or the suppliers of the failed equipment or service.
8. Radiation/hazardous material problem: An event related to radiological or hazardous material contamination that cannot be attributed to any other causes.

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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 its 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:
 - Quick pulse of the Department ES&H success
 - Light detail concerning the Department ES&H success
 - Moderate detail concerning the Department ES&H success
 - I have no need for this 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

	<i>Strongly Agree</i>	<i>Neutral</i>			<i>Strongly Disagree</i>		
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., successes 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. Based on your stated needs, does this report meet your expectations?							<input type="checkbox"/> Yes <input type="checkbox"/> No
13. Would you be willing to expend time/travel funds to participate in product improvement sessions?							<input type="checkbox"/> Yes <input type="checkbox"/> No

