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# Pacific Northwest Laboratory ALARA Report for CY 1992

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Pacific Northwest Laboratory
Richland, Washington 99352

## SUMMARY

This report provides summary results of the CY 1992 As Low As Reasonably Achievable (ALARA) Program at the Pacific Northwest Laboratory (PNL).[a] This report includes information regarding whole-body exposures to radiation, skin contaminations, and the nonradiological ALARA program.

The collective whole-body radiation dose to employees during 1992 was 0.58 person-sievert (58 person-rem).[b] This dose was 105% of the projected dose of 0.55 person-sievert (55 person-rem). The Radiation Protection Section's Field Dosimetry Services group projected that no PNL employee's dose would exceed 0.02 sievert (2 rem) based on dosimeters processed during the year; no worker actually exceeded the limit by the end of CY 1992.

There were 15 reported cases of skin contamination for PNL employees during 1992. This number is 60% of the projected total of 25 cases. There were an additional 15 cases of personal effects contamination to PNL staff. Thirteen of these contamination events (43%) occurred at the 324 Building.

Line management made progress during 1992 on the implementation and use of challenging and productive ALARA goals by the operational organizations. Line management completed all goals that could be completed through the efforts of the organizations involved. Appendix A describes the final status of the 1992 ALARA goals. Appendix B describes the radiological ALARA goals for 1993.

The Occupational and Radiological Safety and Radiation Protection Sections of the Laboratory Safety Department perform audits of radiological ALARA requirements routinely for specific facilities with significant potential for exposure. These ALARA audits are part of a comprehensive safety audit of the facility, designed to evaluate and improve total safety performance.

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(a) The Pacific Northwest Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy under Contract DE-AC06-76RLO 1830.

(b) The dosimetry records base the collective whole-body dose on dose to compliance dosimeter-wearing PNL staff on-site only. All other data, discussions, conclusions, etc. in this report include both on-site and off-site information.

The injury and accident rates for 1992 indicate that PNL protected staff members and the public from unacceptable exposure to nonradiological hazards. Motor vehicle accident and loss rates increased from two reportable accidents in 1991 to seven reportable motor vehicle accidents in 1992. There were no fires at PNL in 1992 that resulted in damage.

CONTENTS

## FIGURES



## TABLES

# I. INTRODUCTION

The concept of maintaining exposures to radiation as low as possible (ALAP) was first introduced formally in 1954 by the National Committee on Radiation Protection. DOE Order 5480.11, "Radiation Protection for Occupational Workers," establishes requirements for DOE contractor ALARA programs and references *Health Physics Manual of Good Practices for Reducing Radiation Exposures to Levels that are As Low As Reasonably Achievable (ALARA)*, which describes possible elements of ALARA programs.

ALARA is a factor considered in all PNL projects. Section 10.0 of PNL-MA-6, *Radiation Protection*, provides information on PNL's radiological ALARA program. PNL trains all radiation workers in ALARA ideas and techniques. The purpose of this report is to summarize and document activities, accomplishments and results of safety parameters involved in the ALARA Program during CY 1992.

At PNL, the ALARA philosophy is not limited to nuclear and radiological hazards; PNL applies the ALARA concept to a wide variety of hazards, including exposure to hazardous chemicals and physical hazards (lasers, noise, etc.). Line management makes exposures to chemicals ALARA by substituting less hazardous chemicals, using engineering controls such as ventilation or containment, and using administrative controls and personal protective equipment. Laboratory management reduces exposure to physical hazards such as lasers or rotating equipment by separating people from the hazard through the use of timing, distancing or shielding and/or guarding. PNL-MA-43, *Industrial Hygiene, Occupational Safety and Fire Protection Programs*, is the PNL document controlling such work.

The Occupational and Radiological Safety Section of the Laboratory Safety Department administers the ALARA Program; radiological through the PNL ALARA Coordinator, and non-radiological through the Industrial Hygiene Group. The research and operational organizations develop ALARA goals; the ALARA Coordinator reviews these goals and tracks their progress throughout the year. The ALARA report displays CY 1992 radiological goals and their status in Appendix A; the CY 1993 radiological goals are in Appendix B. Line management implements the ALARA programs and Laboratory Safety and other organizations provide training in many topics.

## II. RADIOLOGICAL ALARA

This section summarizes performance of PNL under the portion of the ALARA Program regarding radiological concerns. It includes information on radiation doses and skin contaminations and identifies the organizations with the highest doses.

### Radiation Exposure

In CY 1992 staff members at PNL facilities on the Hanford Site monitored for compliance with DOE Order 5480.11 (i.e., multipurpose dosimeter wearers) received a total of 0.58 person-sievert (58 person-rem) in CY 1992. At the beginning of the year, the ALARA Coordinator projected 0.55 person-sievert (55 person-rem), based on planned activities, primarily those in the 324 and 325 Buildings. The difference between projected and actual dose was + 5%.

### Exposure Trends

The ALARA Coordinator analyzed the distribution of doses among staff. Figure 1 shows the distribution of doses among the 1735 staff members monitored for compliance with DOE Order 5480.11 (multipurpose dosimeter wearers). The most frequently occurring dose for staff members during 1992 was 0 millisievert (0 millirem). The average dose for this group during 1992 was 0.34 millisievert (34 millirem), compared to 0.35 millisievert (35 millirem) in 1991.

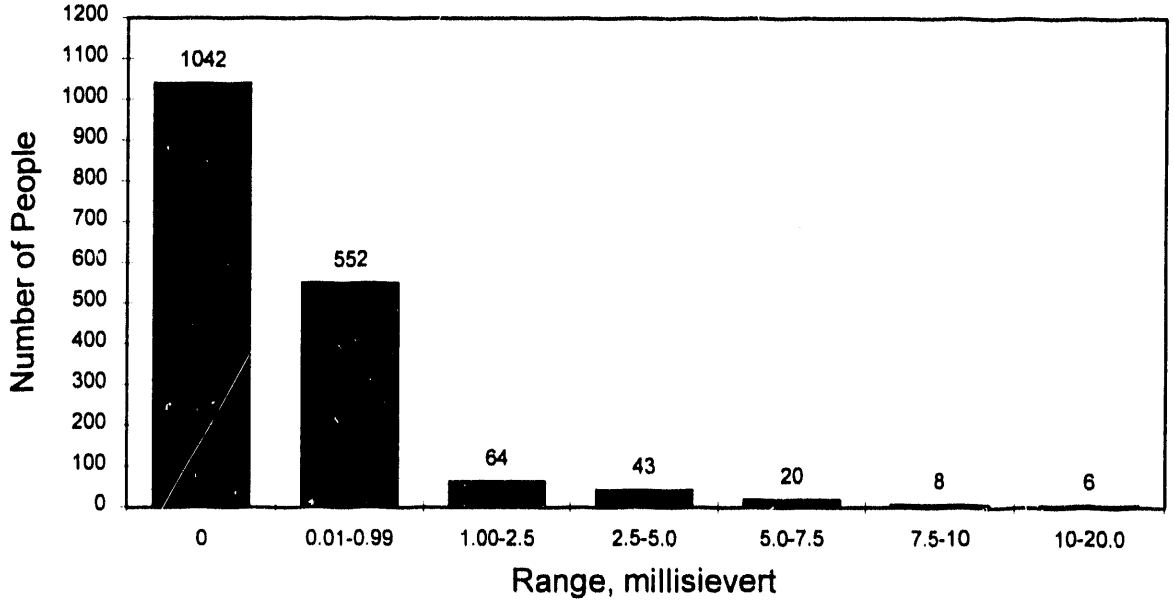


FIGURE 1. Dose Distribution for CY 1992

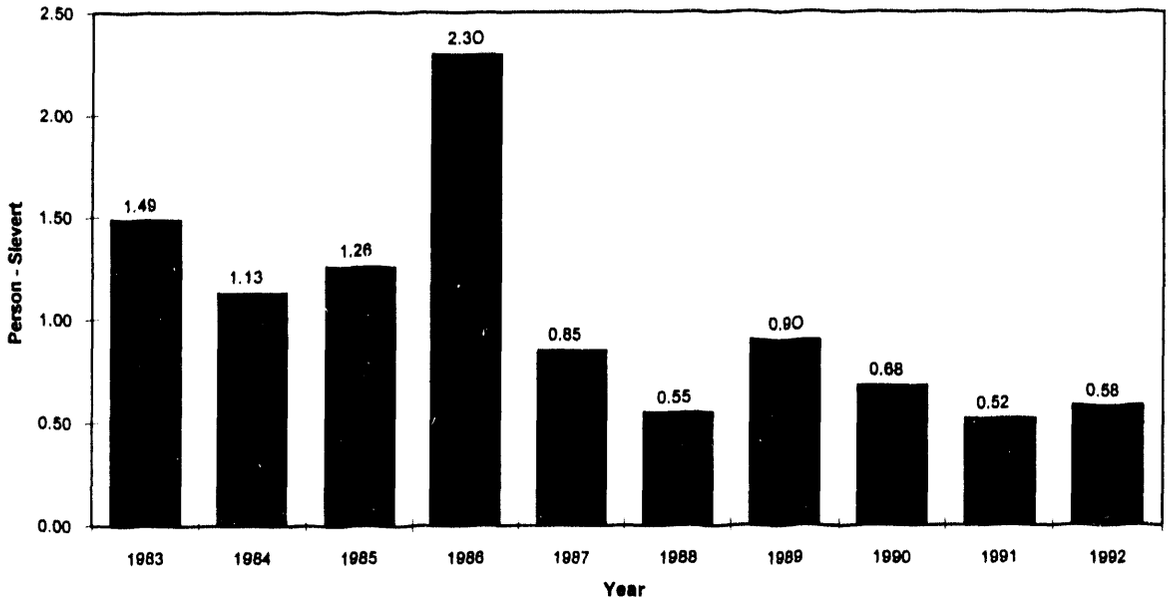


FIGURE 2. Annual Collective Whole-Body Dose for the Last 10 Years

Figure 2 shows the yearly trend in collective whole-body dose for PNL. The figure illustrates the correlation of collective dose to the major programs. The ALARA Coordinator relates the dose maximum in 1986 to the destructive examination phase of the steam generator project. The rise in collective dose in 1989-1990 was the result of the single-shell tank waste characterization. The majority of the increase in collective dose in 1992 is attributed to the 325 Building A-Annex clean-out, and increased activities in the 324 Building B Hot Cell clean-out activities. Figure 2 also shows the general trend toward lower doses at PNL, some of which is independent of major projects. The ALARA Coordinator expects the collective dose for PNL to remain below 1 person-sievert (100 person-rem) over the next several years, unless significant program changes occur.

Increases in the number of high-dose tasks, including large numbers of entries into high radiation areas, increased the overall dose for the Laboratory as a whole. The number of high individual doses increased, while the collective dose for many tasks decreased with growing experience and implementation of ALARA techniques. The decrease in dose-for-task was attributed to the accomplishment of many ALARA goals (see Appendix A, "Status of CY 1992 ALARA Goals"), conducting pre-job ALARA meetings as well as more active ALARA reviews and participation from Laboratory Safety. The Health Physics Department of the Life Sciences Center has remained at a

consistently low dose level over the past few years. Most of this dose is due to the unavoidable routine requirements of its primary job, radiation detector and dosimeter calibrations.

Figure 3 shows the yearly trend in total collective whole-body dose incurred by the five centers or directorates with the highest collective whole-body doses for the last three years. The Facilities and Operations Directorate accounted for approximately 40% of the total CY 1992 PNL collective whole-body dose. The Materials and Chemical Sciences and Waste Technology Centers accounted for the majority of the balance of the total dose, incurring approximately 26% each. Most centers incurred a collective dose slightly higher than their 1991 totals. The increases in the Facilities and Operations Directorate, the Waste Technology Center and the Material and Chemical Sciences Center are due to the activities described above.

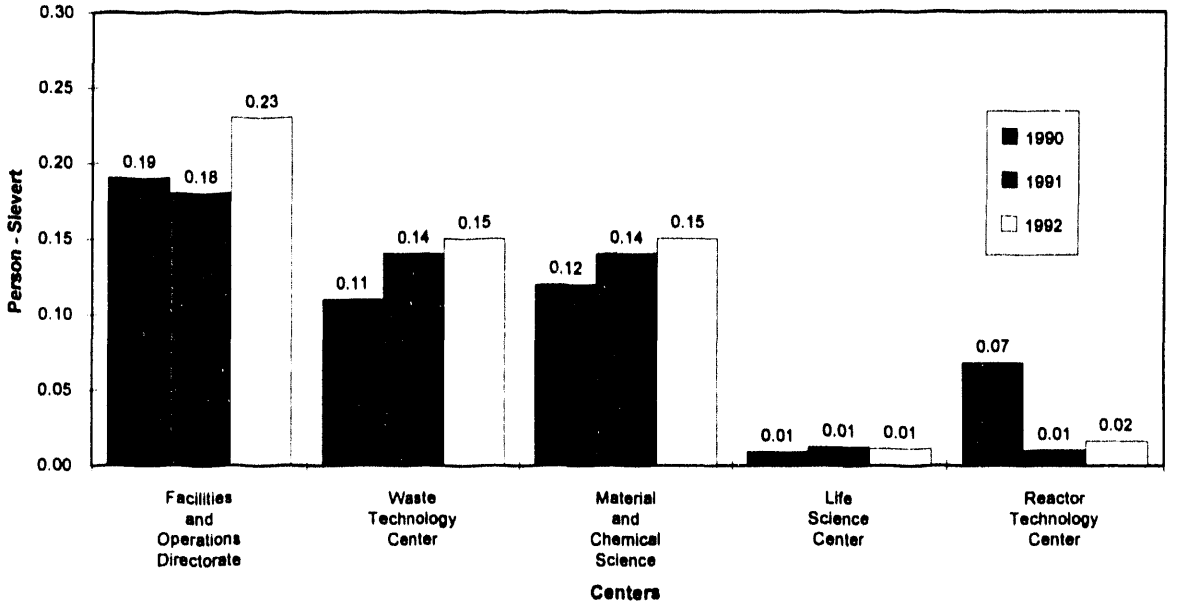


FIGURE 3. Collective Whole-Body Dose for 1990-1992 for the Five Highest Centers and Directorates

Figure 4 shows the distribution of dose among PNL high dose organizations for 1992. The department incurring the highest collective dose was the Process Technology Department of the Waste Technology Center, which operates the majority of PNL's hot cell facilities, incurring 25% of the PNL collective dose. The Technical Services Department, Facilities and Operations Directorate received 18% of the PNL

total. This dose results from support of the research and facility operations and maintenance. The Laboratory Safety Department, also of the Facilities and Operations Directorate received approximately 17% of the PNL collective dose, the majority of which is due to routine activities of the Radiation Protection Technologists in support of the hot cell cleanout activities in the 324 and 325 Buildings. The Chemical Sciences Department of the Materials and Chemical Sciences Center received 10% of the total. The Materials Science Department and Analytical Chemistry Laboratory of the Materials and Chemical Sciences Center had 8% of the total PNL dose each. The ALARA Coordinator attributes the majority of the dose for all of these departments to staff who work in the 324, 327 and 325 Buildings. The Health Physics Department of the Life Sciences Center contributed 5% of the PNL collective dose (see Figure 4).

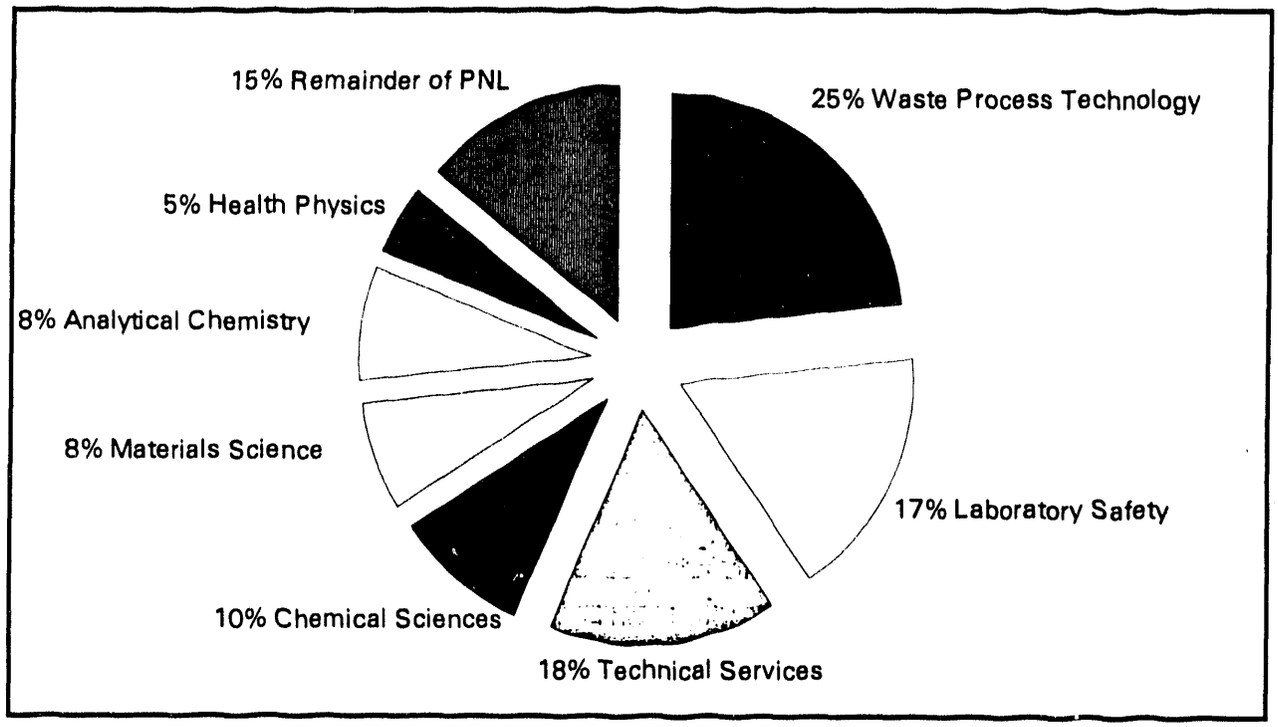


FIGURE 4. Distribution of Dose Among High-Dose Departments, 1992

Observing the centers' and departments' trends of collective dose totals over the years indicates that the level of the collective dose relates directly to the number of projects involving work with radioactive materials. The number of projects involving radiation work and the relative amount of this type of work load has been historically variable, making it somewhat difficult to adjust or weight the collective doses for comparison of different years. Line management may reassign personnel and

organizational groups to other jobs or organizational groups continuously throughout the year, making it relatively difficult to accurately assign doses to specific projects and work. Considering these obstacles involved in accurate trend analysis, a qualitative analysis of the 1992 overall collective dose totals for PNL has shown typical or expected values when compared with the recent years' totals (after 1986). The actual dose for 1992 was only 5% higher than projected, the best projection in recent years.

Quarterly Exposure Evaluations

Procedures for identification, tracking and evaluation of job tasks of staff members receiving potentially excessive whole-body and/or extremity doses remained in place in 1992. Supervisors of staff members with doses that indicate potential to exceed annual or quarterly limits receive an exposure evaluation request (and form) for each staff member with a high dose. The supervisor evaluates the tasks being performed by the individual(s), and records pertinent information on the exposure evaluation form so that line management can implement further ALARA practices wherever possible, and, if necessary, increase the administrative limit. Radiological Engineering reviews the supervisor's evaluation and initiates follow-up actions as appropriate. The whole-body and extremity quarterly doses used as criteria (in 1992) for evaluation were those values that extrapolate to year-end doses of 0.02 sievert (2 rem) for the whole-body and 0.30 sievert (30 rem) for the extremities. As shown in Table 1, three PNL staff members exceeded the criteria for evaluation during 1990. In 1991, one individual exceeded the limit in first quarter due to an off-site exposure; however, no one exceeded the limit for the year. In 1992, the dosimetry results projected that no individual would exceed the yearly limit, and no individual did. This decrease in the number of projected high dose individuals shows the attention to detail of the staff and their management, as well as the effectiveness of the ALARA program.

TABLE 1. Number of Staff Members Whose Extrapolated Year-End Dose Exceeded 0.02 Sievert

| Quarter | CY 1989 | CY 1990 | CY 1991 | CY 1992 |
|---|---|---|---|---|
| 1st | 6 | 3 | 1 | 0 |
| 2nd | 1 | 0 | 0 | 0 |
| 3rd | 1 | 0 | 0 | 0 |
| 4th | 0 | 0 | 0 | 0 |

Skin Contamination

In CY 1992, PNL staff had a total of 15 cases of skin contamination compared to an estimated number of 25 (Appendix D), up only two from 13 in 1991. The number of skin contaminations in 1991-1992 is a significant reduction from previous years. Figure 5 shows the historical trend of yearly skin contaminations for the period 1989-1991. The decline in the number of contaminations is mostly due to heightened staff awareness, attention to detail while removing protective clothing, and a decrease of the use of personal clothing in contaminated and potentially contaminated areas. Reduction of skin contaminations is also attributed to the survey for contamination of some protective clothing received from the laundry before use.

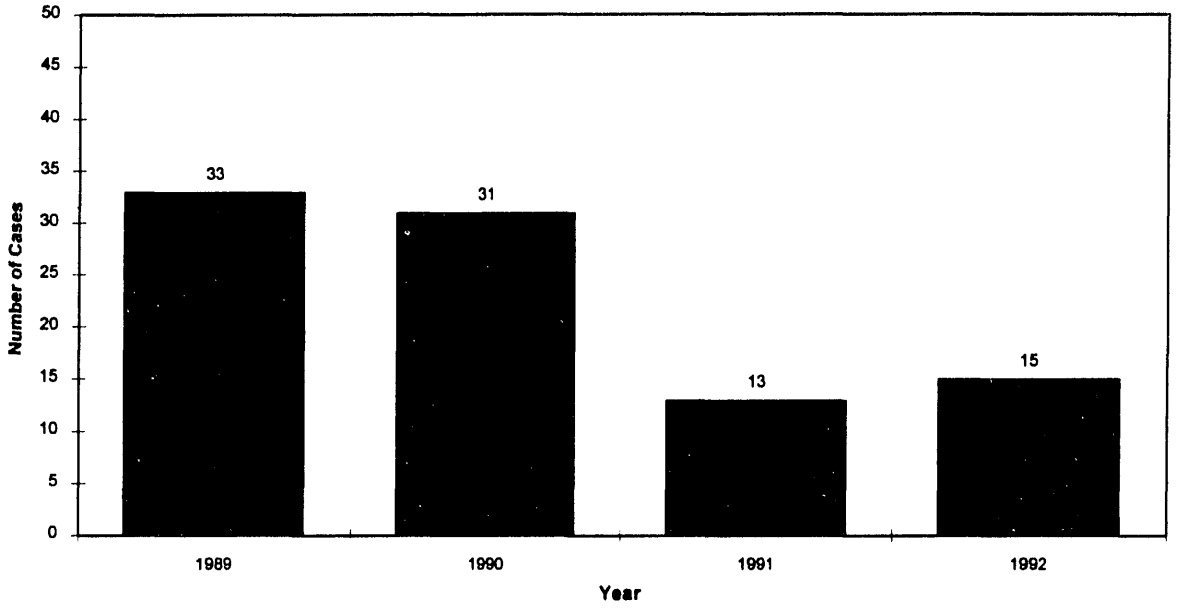


FIGURE 5. Annual Incidence of Skin Contaminations from 1989 through 1992

An analysis of the available data indicates that the rate of the skin contaminations, as well as number of the skin contaminations, remained essentially constant in 1992 as compared to 1991. In 1990, the rate of skin contaminations per entry into a Radiologically Controlled Area (RCA) was approximately 3-4 x $10^{-5}$ contaminations per entry, while in 1991 and 1992 the rate was only 1-2 x $10^{-5}$ per entry into an RCA. The number of entries into RCAs in all three years was approximately 500,000.

Figure 6 provides a breakdown of skin contamination cases by facility since 1986. Many of the 1992 cases (seven) occurred in the 324 Building. At the beginning

of the year, the ALARA Coordinator projected 25 cases based on planned activities and historical trends. The low number of contaminations in the 324 Building (compared to historical results) is despite continued work in the Shielded Materials Facility Hot Cell, the B Hot Cell clean-out, and work with materials that have historically caused many contaminations, such as cesium chloride and tritium.

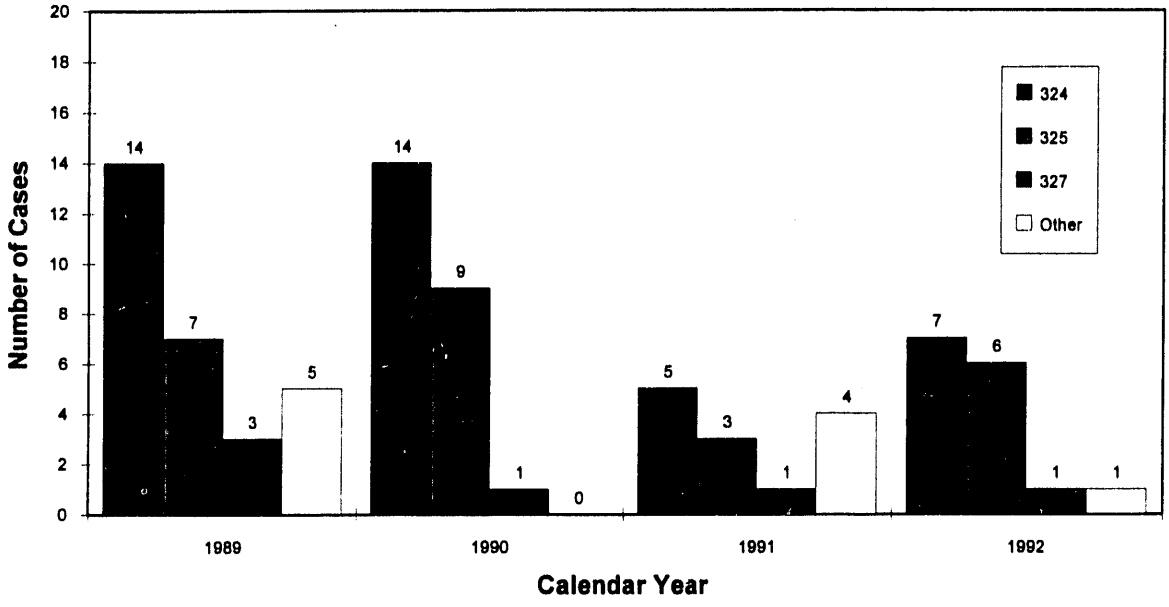


FIGURE 6. Annual Totals of Skin Contamination Cases by Year and Facility

## III. NONRADIOLOGICAL ALARA

During CY 1992, the Laboratory had an average of 3995 full-time staff members who worked 6.9 million hours on research and development programs. This section discusses the nonradiological safety performance of PNL for CY 1992.

### Accident Investigation

Laboratory Safety and line management investigate all accidents, injuries, illnesses, motor vehicle accidents, fires, and property damage with serious consequences and document them in detail. PNL policy requires line management involvement in the response and investigation of accidents and in the establishment and implementation of corrective action. These activities ensure that line management takes appropriate actions to prevent recurrence of the accident, and demonstrate PNL's commitment to providing a safe and healthy workplace.

### First Aid Cases

The Laboratory Safety Department investigated 153 first aid cases during CY 1992, an increase from 127 cases in 1991. Laboratory Safety investigated each reported occupational injury or illness and recommended appropriate corrective actions to line management to prevent recurrences.

### Recordable Injuries and Illnesses

Current criteria considers occupational injuries recordable if they are severe enough to require medical attention beyond first aid (e.g., prescription medication, sutures, treatment of broken bones, lost workday cases, etc.).

Before 1990, PNL used criteria defined by the U.S. Department of Energy (DOE) or the State of Washington to classify the injury or illness and to determine required documentation. In 1991, PNL fully implemented Bureau of Labor Statistics (BLS) criteria. Laboratory Safety classified all injuries during 1991 using the BLS criteria, which results in higher numbers of recordable injuries. Laboratory Safety re-examined the records from 1990 with partial use of the BLS criteria. These new criteria resulted in a higher number of recordable injuries than those in 1989. Laboratory Safety considers all occupational illnesses to be recordable illnesses. The data from 1991 has been re-examined, resulting in slightly different results than reported in the 1991 ALARA report for both PNL and the DOE Richland Operations Office (DOE-RL).

The Laboratory Safety Department and line management jointly investigate recordable injuries and illnesses. During CY 1992, staff members incurred 98 recordable injuries. This number resulted in a recordable injury incidence rate of 2.83 recordable injuries or illnesses per 200,000 work hours. Figure 7 compares this rate to past PNL rates and to DOE-RL. The ALARA Coordinator expects that the numbers of recordable injuries DOE-wide will rise when full implementation of the BLS criteria occurs.

Lost Workday Injuries

Laboratory Safety considers an injury or illness a lost workday case if the staff member misses an entire, regularly scheduled, work shift due to an occupational accident. These injuries are more serious than most other recordable injuries since the consequences include significant lost time. Staff members sustained 48 lost workday cases during 1992, which resulted in a lost workday case incidence rate of 1.39 lost workday cases per 200,000 work hours. Figure 8 compares this rate to past PNL rates and to DOE-RL averages.

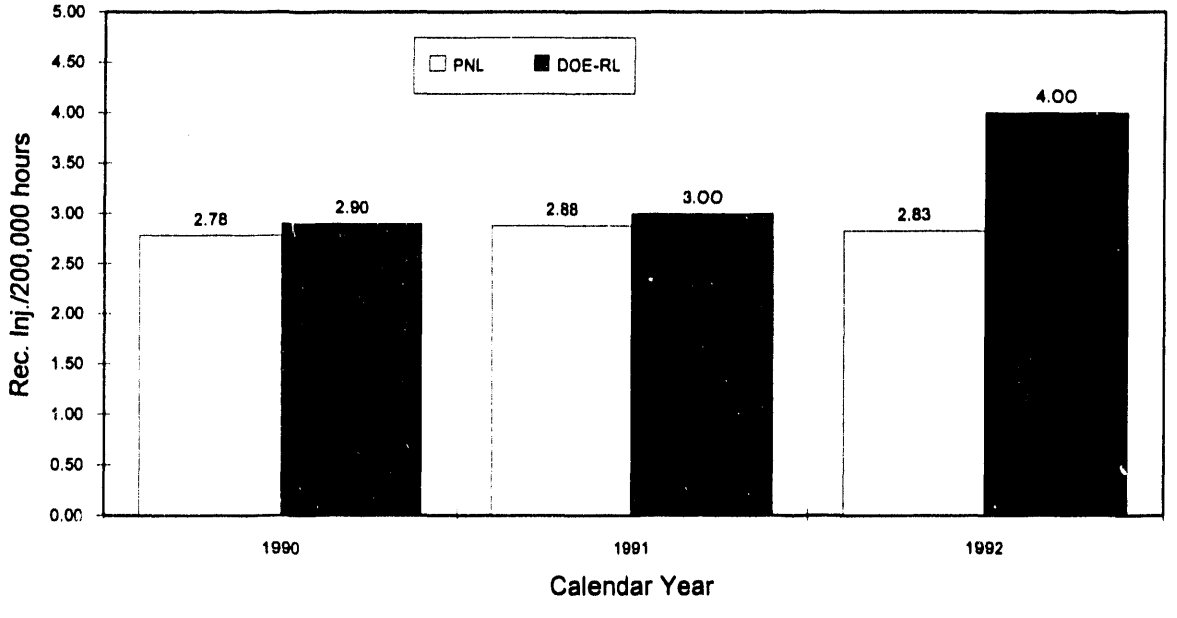


FIGURE 7. PNL Recordable Injury Incidence Rate

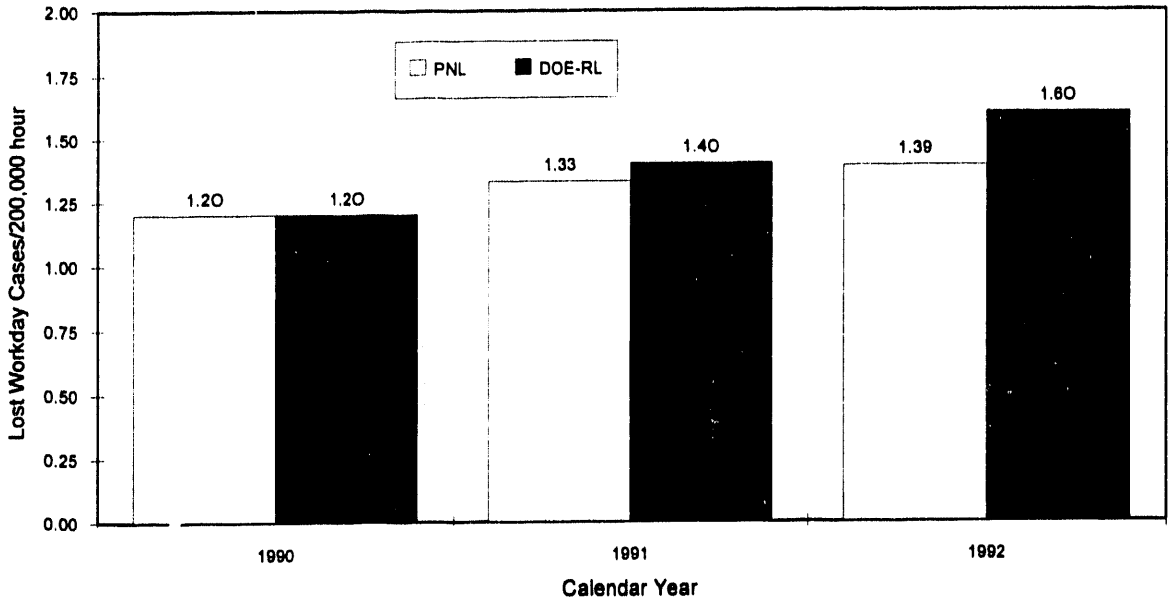


FIGURE 8. PNL Lost Workday Case Incidence Rate

The 48 lost workday cases resulted in 444 lost workdays and 175 days of work restriction. These lost and restricted workdays resulted in a lost workday incidence rate of 17.88 lost workdays per 200,000 work hours. Figure 9 compares this rate to past PNL rates and to DOE-RL averages.

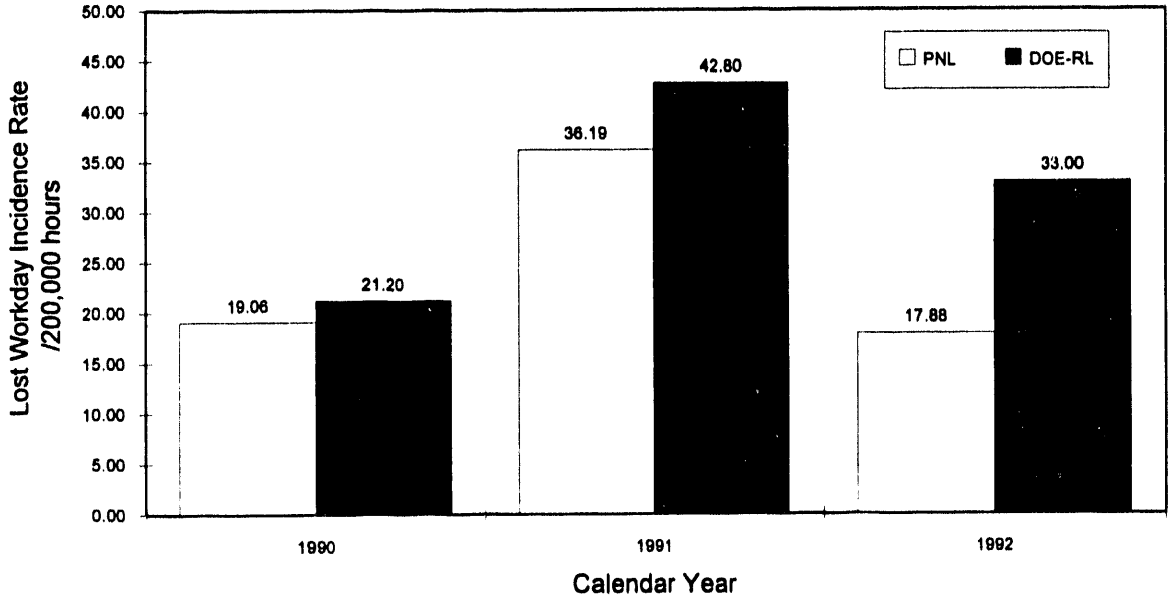


FIGURE 9. PNL Lost Workday Incidence Rate

Motor Vehicle Accidents

Staff members drove government vehicles approximately 0.83 million miles with seven reportable accidents during 1992. PNL's motor vehicle accident rate for 1992 was 8.46 accidents per million miles, as compared to 2.67 accidents per million miles in 1991, and none in 1990. Figure 10 compares these rates to past PNL rates and to DOE-RL averages.

The motor vehicle loss rate for 1992 of $8.71 per thousand miles compares to $2.47 per thousand miles in 1991, and none in 1990. Figure 11 compares this rate to past PNL and DOE-RL rates. Due to the relatively few miles PNL staff drive each year, a few accidents can significantly affect the PNL statistics.

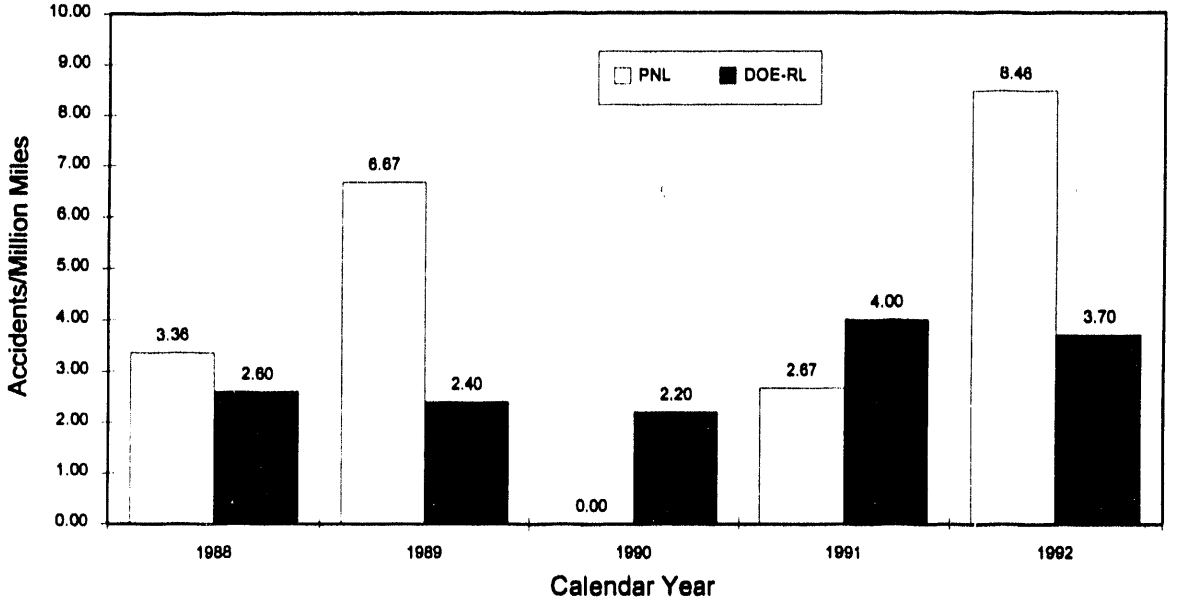


FIGURE 10. PNL Motor Vehicle Accidents Per Million Miles

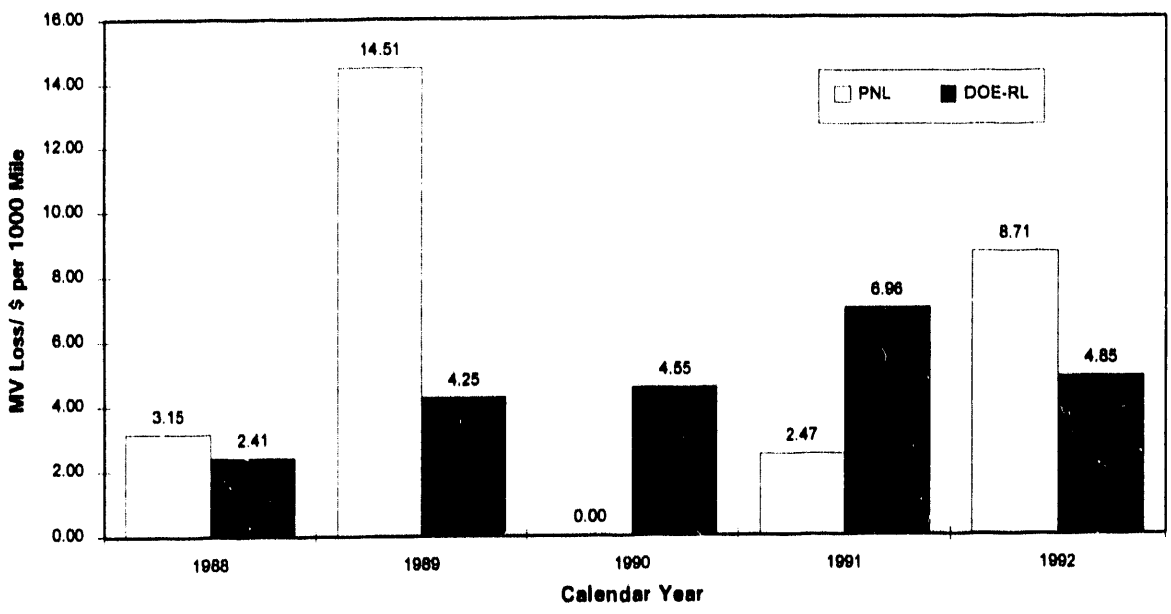


FIGURE 11. PNL Motor Vehicle Loss Rate

Property Damage and Fires

During CY 1992 seven non-fire property loss accidents occurred causing $91,558 in losses. Of the seven accidents, the two most expensive were due to the actions of Westinghouse Hanford Company personnel, which resulted in $73,400 (80% of the total) in damage. The most significant expense incurred due to an accident was a rigging crew dropping a 25,000 pound press brake machine ($39,900), and the second most costly was damage to an experimental lithium system ($33,500). This damage resulted in a property damage rate of 2.31 for CY 1992. Figure 12 compares this rate to other PNL property loss rates and to DOE-RL averages.

There were no fires that caused damage to PNL property in 1992. Figure 13 compares this rate with previous years rates.

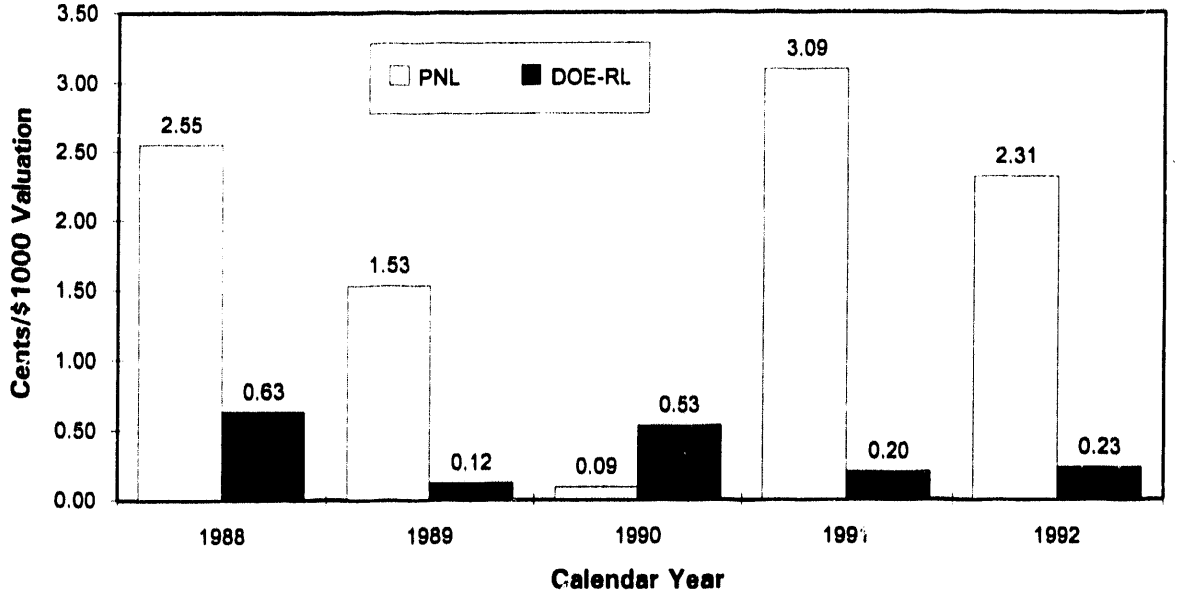


FIGURE 12. PNL Property Damage Loss Rate

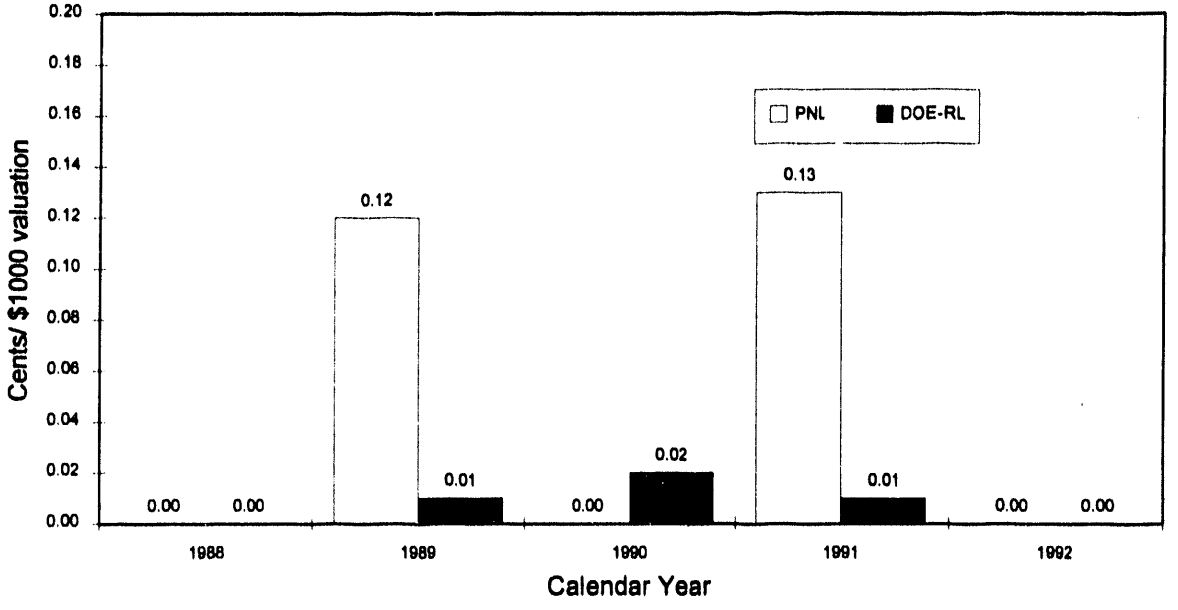


FIGURE 13. PNL Fire Loss Rate

## APPENDIX A

## STATUS OF CY 1992 ALARA GOALS

The majority of the CY 1992 ALARA goals were completed. Three goals were not completed due to circumstances beyond the control of the organization; these goals were canceled.

This appendix examines the goals individually, stating the goal number and a statement of the goal. The statement of the goal will be followed by a summary of final progress. The goals are numbered according to the organization working on the goal, the building where the work is being done and a sequential number.

The following organizations had ALARA goals for CY 1992: Waste Technology Center (WTC), Reactor Technology Center (RTC), Materials and Chemical Sciences Center (MCSC) and the Laboratory Safety Department (LS).

| Goal Number | Goal |
|---|---|
| WTC-324-1 | Decontaminate Room 147 to reduce exposure to operating staff and to reduce potential for skin contaminations.<br><br>This goal was completed ahead of schedule. |
| WTC-324-2 | Reduce personnel exposure by reducing the number of personnel entries into the Shielded Materials Facility (SMF) hot cell airlock in order to introduce materials into or retrieve materials from south cell. One to three shielded transfer mechanisms will be designed, fabricated, and installed into existing 4-inch diameter cell access ports.<br><br>This goal was canceled; the project was terminated by DOE. |
| WTC-324-3 | Reduce personnel exposure in the SMF airlock by developing a remotely operable system for removing radioactive wastes, created as a result of the Cesium Encapsulation Program (CEP), from south cell for disposal in the HN-200 liner.<br><br>This goal is considered completed. When the project was terminated by DOE only portions of the shielded mechanisms were completed. Those that were completed are in use. |

| | |
|---|---|
| WTC-327-1 | Remove radioactive contamination from the interior of the "D" and "F" cells' ventilation ducts in order to significantly reduce radiation dose rates in the 327 Building basement. It is estimated that the successful removal of this contamination will lower dose rates in the vicinity of these ducts by 75% or more.<br><br>This goal was completed on time, with the anticipated result. |
| WTC-327-2 | Further reduce personnel exposure to hazardous chemicals by identifying and obtaining alternate, nonhazardous materials for use in decontamination work and other operations which require the use of various reagents. Decreasing the potential for exposure to hazardous chemicals will enhance prevention of radiological mishaps. Minimizing the potential generation of radioactive mixed waste will be enhanced.<br><br>This goal was competed, with a reduction in use of hazardous chemicals to only one chemical. Further research is being done to find a substitute for the remaining chemical. |
| MCSC-306W-1 | Relocate or dispose of $ThO_2$ located in Room 141 to reduce dose rate in Laboratory 151.<br><br>This goal was canceled due to offsite problems. |
| MCSC-306W-2 | Reduce handling and transportation required for movements of depleted uranium bar stock within 306W Facility by the addition of supplemental in-process inspection equipment.<br><br>This goal was completed on time. |
| MCSC-306W-3 | Declassify depleted uranium cores that are being stored in Room 123, allowing inventory and potential exposure reduction.<br><br>This goal was completed on time. |
| MCSC-325-1 | Reduce exposure to potentially radioactive soil samples during analysis of cyanide through the acquisition and implementation of semi-automated instrumental analysis equipment.<br><br>This goal was completed on time. |

| | |
|---|---|
| MCSC-325-2 | Install pressure and moisture sensors in the 325 Building hot cells which will provide notifications of over-pressure and over-flow conditions in the cells for early response to these abnormal events.<br><br>This goal was completed on time. |
| MCSC-325-3 | Review and modify, as appropriate, the building routine radiological survey schedule and frequency to more accurately reflect current building operations and requirements.<br><br>This goal was completed ahead of schedule by Laboratory Safety staff. |
| MCSC-325-4 | Pursue the elimination of all Westinghouse Hanford Company (WHC) nuclear materials from the basement cage storage area, and relocate/consolidate building transuranic waste drum storage in this cage area.<br><br>This goal was completed. |
| RTC-306W-1 | Reduce inventories of enriched $UO_2$ materials within the 306W Facility.<br><br>This goal was canceled due to offsite problems. |
| LS-324-1 | Evaluate the benefit of the closed loop SWP laundry recycling system in use at the 324 Building, in preventing skin and personal effects contaminations.<br><br>This goal was completed on time. Varying amounts of contamination were found in the clean laundry, and the recycled laundry is now surveyed randomly for contamination. |

## APPENDIX B

## RADIOLOGICAL ALARA GOALS FOR CY 1993

The following organizations had radiological ALARA goals: Waste Technology Center (WTC), Material and Chemical Sciences Center (MCSC) and Reactor Technology Center (RTC).

| Goal Number | Synopsis of Goal |
|---|---|
| MCSC-306W-93-1 | Reduce the inventory of uranium, which will reduce the background radiation level as well as unnecessary dose to the staff. |
| MCSC-306W-93-2 | Reduce the amount of liquid radioactive waste stored in Lab 132, which will reduce unnecessary personnel dose. |
| MCSC-306W-93-3 | Reduce the probability of contamination from the cracked flooring by repairing or replacing the flooring (joint with RTC). |
| MCS-325-93-1 | Remove and dispose of the Pu-contaminated glovebox in Room 410, which will reduce the dose rate and contamination hazard. |
| MCS-325-93-2 | Remove radiation contamination hot spots from 325 A Annex floor, which will reduce the high dose rate hazard. |
| MCS-325-93-3 | Design and fabricate a shielded waste handling system for the Shielded Analytical Facility which will reduce personnel dose. |
| WTC-324-93-1 | Design and install a new track system for removal of waste from the 324 Building main hot cell complex airlock. Use of the new track system will reduce time in the airlock as well as industrial hazards. |
| WTC-324-93-2 | Design and fabricate a remote decontamination and viewing system for reduction of personnel dose and contamination. |
| WTC-324-93-3 | Reduce the volume of waste generated by use of analytical instrumentation. |
| WTC-327-93-1 | Identify and dispose of waste and unneeded radioactive materials from B and G hot cells. |
| WTC-327-93-2 | Reduce nonproductive personnel dose in the canyon room by removing painted-over contamination, changing filters, etc. |
| WTC-327-93-3 | Reduce the use of, or replace the hazardous solvent 1,1,1-trichloroethane with nonhazardous substitute. |

## APPENDIX C

## PROJECTIONS FOR CALENDAR YEAR 1993

The projections for CY 93 are based on several sources. The primary source is the individual organization's estimate of collective dose based on planned activities. The ALARA Coordinator reviews these estimates and makes an independent appraisal of high-dose organizations, then combines the estimates into a PNL-wide collective dose estimate. Other sources taken into account are historical and recent trends in dose and contamination, as well as the year to date. This estimate is usually relatively accurate, due to exposure rates for certain tasks being relatively well known and the extensive planning that occurs before a new task is undertaken. An increase in exposure is expected for 1993 as the pace of hot cell clean-out activities increases, as well as several repairs to hot cell facilities.

The estimate for the expected number of skin contaminations is based on planned work in contamination areas, past trends, planned training, and expected effectiveness of protective clothing. This projection is subject to wide variations from year to year due to the relatively small number of events that occur and to unexpected sources of contamination. As the majority of the high dose jobs are planned to occur in Very High Contamination Areas, the ALARA Coordinator projected the same number of skin contaminations as projected for 1992, despite the low number of actual skin contaminations.

Very few new or unexpected uptakes of radioactive materials have occurred at PNL in recent years; therefore, usually none are projected. The uptakes in past years have been either chronic uranium uptakes in the millirem range, or offsite uptakes of tritium. No new uptakes are projected for CY 1993.

**The Projections for CY 1993 are as follows:**

0.65 person-Sievert (65 person-rem) collective whole-body dose.

25 skin contaminations.

# APPENDIX D

## SKIN CONTAMINATION CASES IN CALENDAR YEAR 1992

There were 15 cases of skin contamination of PNL staff at the Hanford Site in 1992, 60% of the projected 25 cases. These cases do not include other contractor staff found to be contaminated at PNL facilities. Of these 15 cases, 7 were in the 324 Building, 6 in the 325 building, one in the 327 Building and one in the 329 Building. The table below lists the skin contaminations in chronological order, including the building where the contamination occurred, a brief description of the details of the event and a listed cause. An occurrence classifier determined the severity of the event and the cause of the event according to the guidance given by DOE Order 5000.3A. The occurrence classifiers determined that all skin contaminations in CY 1992 fit the category of "Off-Normal Occurrence." The Off-Normal Occurrence reports describe all skin contaminations in more detail and can be found in the Occurrence Reporting and Processing System (ORPS) database using the occurrence number listed (note: all occurrence numbers have the prefix RL-PNL).

In addition to the 15 skin contamination events, there were 15 events involving personal effects contamination. These events will be tracked in future reports.

| Date | Occurrence number | Building | Details | Cause/ Problem |
|---|---|---|---|---|
| 2/3/92 | 324-1992-0007 | 324 | Staff member's hand contaminated during shoe cover removal. | Equipment/ Material |
| 4/13/92 | 325-1992-0008 | 325 | During a sample transfer, a staff member was contaminated. Staff member assumed inside of bag was uncontaminated. Procedure did not detail the operation. | Defective/ Inadequate Procedure |
| 5/8/92 | 325-1992-0009 | 325 | Staff member contaminated while handling contaminated laundry without gloves. No procedure existed for handling contaminated laundry. | Lack of Procedure |
| 6/26/92 | 324-1992-0017 | 324 | Staff member found to be contaminated following entry into hot cell galleries. No work was performed, and no contamination was found. Contamination source assumed to be contaminated laundry. | Equipment/ Material |
| 7/1/92 | 325-1992-0016 | 325 | A caustic solution created holes in a staff member's gloves, which led to skin contamination. | Equipment/ Material |

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| 8/20/92 | 325-1992-0023 | 325 | Staff member found contaminated with alpha contamination following work with beta materials. Unknown source of contamination. | Unknown |
| 10/1/92 | PNLBOPER-1992-0059 | 329 | A NORCUS professor handled a technetium-99 contaminated instrument without gloves in violation of the RWP. | Personnel Error |
| 10/13/92 | 324-1992-0022 | 324 | A staff member's hand was contaminated after using a contaminated can of degreaser in violation of the RWP. | Personnel Error |
| 10/26/92 | 324-1992-0023 | 324 | Staff member's hand became contaminated while working in a glovebox. Source of contamination unknown. | Unknown |
| 10/28/92 | PNLBOPEM-1992-0012 | 327 | Staff member's hand contaminated by contamination inside canvas glove from laundry. | Equipment/ Material |
| 11/2/92 | 325-1992-0029 | 325 | Staff member used and removed an instrument from a contaminated area without a survey. | Personnel Error |
| 11/11/92 | 324-1992-0026 | 324 | Staff member removed and used a contaminated wrench from roped-off area without a survey. | Personnel Error |
| 11/18/92 | 325-1992-0031 | 325 | Staff member's hand contaminated while removing inner pair of gloves. Contamination came from changing outer pair of gloves. | Personnel Error |
| 12/23/92 | 324-1992-0028 | 324 | A broken remote manipulator tape contaminated two staff members. | Equipment/ Material |
| 12/28/92 | 324-1992-0029 | 324 | A control system component failed, which led to a staff member becoming contaminated on his head. | Equipment/ Material |

# END

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