

SUMMARY  
OF  
FIRE PROTECTION PROGRAMS  
OF THE  
UNITED STATES DEPARTMENT OF ENERGY  
CALENDAR YEAR 1994

OFFICE OF  
WORKER HEALTH AND SAFETY

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## FOREWORD

This edition of the Annual Fire Protection Program Summary for the Department of Energy (DOE) continues the series started in 1972.

Since May 1950, an annual summary has been submitted from each field organization under the requirements of two previous government agencies: the Atomic Energy Commission (AEC) and the Energy Research Development Administration (ERDA). Reports are currently promulgated through DOE Orders 5480.7, "Fire Protection," and 5484.1, "Environmental Protection, Safety and Health Reporting Requirements."

Beginning in 1981, all individual accident reports from DOE Order 5484.1 have been compiled by the Computerized Accident Incident Reporting System (CAIRS) administered by EG&G, Idaho. Each quarter year CAIRS issues the Occupational Injury and Property Damage Summary (CAIRS Summary), which statistically reports on DOE loss topics such as: injuries and illness, fatalities, non-fire, and fire losses. The Annual Fire Protection Program Summary (AFPR), tabulates a calendar year summary from field organizations which includes a more comprehensive look at the DOE fire protection program. Both fire and non-fire loss statistics are provided, as are reports on a broad range of fire protection activities including: descriptions of fire protection construction projects; suppression system performance; and actions of DOE that are of general fire protection interest. Loss statistics from the AFPR are also used to validate the CAIRS system, incorporating any necessary revisions to the official DOE database.

The report for calendar year (CY) 1994 was summarized from information sent to Headquarters by 23 out of 25 field organizations representing approximately 99.9 percent of DOE's holdings. For comparison purposes, field offices are arranged according to the CAIRS reporting format, with a total of 18 categories represented. Abbreviations are identified in the Glossary, as are the DOE site and Management and Operations (M&O) contractors and major definitions.

## GLOSSARY

### Field Organization abbreviations

ALAlbuquerque Operations  
CHChicago Operations  
ETCEnergy Technology Centers<sup>1</sup>  
FFO Fernald Field Office  
HQ Headquarters (DOE)  
IDIdaho Operations  
NPRNaval Petroleum Reserves<sup>2</sup>  
NVNevada Operations  
OKOakland Operations (San Francisco)  
OROak Ridge Operations  
PA Power Administrations<sup>3</sup>  
PNRPittsburgh Naval Reactors Office  
RFRocky Flats Operations  
RLRichland Operations  
SNRSchenectady Naval Reactors Office  
SPRStrategic Petroleum Reserves  
SRSavannah River Operations  
SSC Superconducting Super Collider Project

### Site or M&O Contractor abbreviations

ANL-W Argonne National Laboratory, West  
BM Bryan Mound Crude Oil Storage Site  
BNLBrookhaven National Laboratory  
EG&G-ID EG&G, Idaho Division  
EG&G-RF EG&G, Rocky Flats Division  
ETECEnergy Technology Engineering Center

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<sup>1</sup> Energy Technology Center organizations are comprised of: the Bartlesville Project Office (BPO); the Pittsburgh Energy Technology Center (PETC); and the Morgantown Energy Technology Center (METC).

<sup>2</sup> Naval Petroleum Reserve organizations are comprised of: the Naval Petroleum Reserves in California (NPR-1), and the Naval Petroleum & Oil Shale Reserves in CO, UT, and WY (NPR-2,3).

<sup>3</sup> Power Administration organizations are comprised of: the Alaska Power Administration (APA); the Bonneville Power Administration (BPA); Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA); and the Western Area Power Administration (WAPA).

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FAFermi National Accelerator Laboratory  
HANHanford Site  
INELIdaho National Engineering Laboratory  
ITRIInhalation Toxicology Research Institute  
K-25 Oak Ridge's K-25 Site  
KAPLKnolls Atomic Power Laboratory  
KCPKansas City Plant  
KSOKesserling Site  
LANLLos Alamos National Laboratories  
LLNLLawrence Livermore National Laboratories  
MMES Martin Marietta Energy Systems  
MPO Mound Site  
NDU Notre Dame University  
NRFNaval Reactor Facilities  
NTS Nevada Test Site  
ORNLOak Ridge National Laboratories  
PAN Pantex Site  
PGDP Paducah Gaseous Diffusion Plant<sup>4</sup>  
PI Pinnellas Site  
PNL Pacific Northwest Laboratory  
POR Portsmouth Gaseous Diffusion Plant<sup>4</sup>  
PPPLPrinceton Plasma Physics Laboratory  
REEC Reynolds Electrical and Engineering Company  
ROSS Ross Aviation Inc.  
SLACStanford Linear Accelerator Center  
SNLASandia National Laboratories, Albuquerque  
SNLLSandia National Laboratories, Livermore  
SRSSavannah River Site  
WHWest Hackenberry  
WHCWestinghouse Hanford Company  
WIWeeks Island Site  
WS Windsor Site  
WSRCWestinghouse Savannah River Company  
Y-12 Oak Ridge's Y-12 Plant

The below reference is used throughout the report to identify various DOE elements:

DOE Field Organization (abr.) / Site or M&O Contractor (abr.).

<sup>4</sup> On July 1, 1993 a lease agreement took effect between the DOE and The United States Enrichment Corporation (USEC) essentially transferring all ownership responsibilities to USEC.

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## DEFINITIONS

The following terms are defined in the text of DOE Order 5484.1, "Environmental Protection, Safety, and Health Protection Information Reporting Requirements." Section references are made at the end of the definition.

1. **Property Value:** The approximate replacement value of all DOE-owned buildings and equipment. Calculate this by applying to the original cost (or most recent appraised value) an appropriate cost index ratio (cost index published by "Engineering News Record" shall be used). Include the cost of all DOE-owned supplies and average inventory of all source and special nuclear materials. Exclude the cost of land, land improvements (such as sidewalks or roads), and below ground facilities not susceptible to damage by fire or explosion (such as major water mains and ponds). (CHAPTER 5.1)

2. **Estimated Loss:** Monetary loss determination based on all estimated or actual costs to restore DOE property and equipment to preoccurrence conditions irrespective of whether this is done in fact. Estimate includes: (1) any necessary nuclear decontamination; (2) restoration in areas that received water or smoke damage; and (3) any reductions for salvage value. Estimate excludes: (1) down time; and (2) any outside agency payments. Losses sustained on private property is not reportable, even if DOE is liable for damage and loss consequences resulting from the occurrence. Categorization of occurrences shall be by fire loss and non-fire loss events. (CHAPTER 5.2)

3. **Fire Loss:** All damage or loss sustained as a consequence of (and following the outbreak of) fire shall be classified as a fire loss. Exceptions are as follows: (1) burnout of electric motors and other electrical equipment through overheating from electrical causes shall be considered a fire loss only if self-sustained combustion exists after power is shut off; (2) vehicle losses (including aircraft, marine and railroad equipment) shall be included in the fire loss category only if determined that the loss was sustained as a direct consequence of fire (fire damage resulting from other consequences of the vehicle loss shall be classified within the respective vehicle loss category); and (3) fire losses involving cargo during transportation should be treated as a transportation loss. (CHAPTER 4.2.c.(1).c) (CHAPTER 5.2.c.(3))

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4. **Nonfire Loss:** All damage or loss sustained as a consequence of the following events: (1) explosions; (2) natural cause events (such as earthquakes and hurricanes); (3) electrical malfunctions; (4) transportation (cargo) losses; (5) mechanical malfunctions; (6) radiation releases or other nuclear accidents; and (7) miscellaneous accidents (such as thermal, chemical or corrosion related accidents). (CHAPTER 4.2.c)

5. **Loss Rate:** Unit of comparison in cents loss per \$100 of property value.



## EXECUTIVE SUMMARY

The DOE experienced no fatalities, injuries, or significant program delays caused by fire in CY 1994. There were however, 119 reported fire incidents producing a total fire loss of approximately \$781,269. This equates to an overall rate of approximately 0.06 cents of fire loss sustained for each \$100 of DOE controlled property value; a decrease of about 45 percent over last year's figure.

Recurring costs for fire protection activities exceeded 99 million for the year, an increase of 20 percent over last year's figure. Approximately 84 percent of the total was attributed to fire department and system maintenance activities, with the remaining amount spent on engineering fees.

Construction of fire protection features continued at a substantial rate in CY 1994. Most of these activities centered on the installation of automatic fire detection and suppression systems. These enhancements are indications of DOE's commitment towards maintaining its objectives stated in DOE 5480.7A by protecting high risk areas, and improving upon employee life safety considerations.

The performance of automatic suppression systems highlights the importance of installing and maintaining these systems. During the year, 3 fires were controlled by automatic suppression systems, thus minimizing significant damage and program interruption. Two of these fires were contained by wet pipe sprinkler systems, continuing the DOE track record on sprinkler effectiveness at a 99.1 percent rate. Control of the remaining fire was achieved with a dry-pipe automatic suppression system.

The above successes were however, offset by the inadvertent actuation of 110 suppression systems under a variety of nonfire circumstances. Particular concern remains on the inadvertent Halon discharge issue, which caused the release of approximately 11,000 pounds of agent to the environment in CY 1994. The DOE is committed to minimizing active quantities of this ozone depleting substance through implementation of its recently developed managed Halon phaseout guidelines.

Future activities of the fire protection community center on reducing the fire risk at DOE sites, optimizing costs associated with fire protection, and providing support for mission advances within the Department.

DOE FIRE LOSS STATISTICS

Property value estimates were taken from the CAIRS database since this information is more accurate to serve as a common denominator when comparing AFPR loss rates to the CAIRS Summary.

CAIRS data shows that DOE values rose by approximately 1.2 percent in CY 1994. Factors offsetting continued construction and inflation costs include decommissioning and decontamination operations.

DOE experienced no fatalities, injuries, or significant program delays resulting from fire in CY 1994. A total of 119 fire incidents were reported by field organizations accounting for total year end fire losses of \$781,269. The CY 1994 CAIRS Summary reports that 14 fire incidents caused losses totaling \$133,811; approximately \$647,500 less than field reports. Of this difference, approximately \$300,000 can be traced to business interruption costs from lost revenue at ETEC power production facilities. The remaining discrepancy relates to either pending reports (12 incidents), or fires that did not exceed the \$1,000 CAIRS reporting threshold (93 incidents).

Field organizations did not consistently report the number of nonfire events, but did identify loss amounts totaling \$3,193,534. The CAIRS Summary reports 68 nonfire incidents producing losses of \$2,359,443. Most of the \$834,091 difference relates to previously mentioned business interruption costs.

DOE's fire loss rate for CY 1994, as summarized from field organization reports, is approximately 0.06 cents loss per \$100 value; a decrease of about 45 percent over last year's 0.11 cent figure. This statistic is 70 percent lower than the 1987-1992 DOE average of 0.20, continuing the downward trend in fire loss rates over last year. In comparison, the loss rate average for the Highly Protected Risk insurance industry (HPR) was about 0.37 cents per \$100 value<sup>5</sup>.

The largest fire and nonfire losses for the year are noted below. Business interruption was excluded from consideration:

1. BPA experienced a \$190,000 fire loss (approximately 24 percent of the total fire loss) when a 500 kva transformer failed in service causing an explosion and subsequent oil fire.

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<sup>5</sup> Factory Mutual Research Corporation (FMRC) reports that the loss rate average is based on fire losses involving both sprinkler and nonsprinkler actuation within the HPR class of protection.

2.SPR experienced a \$500,000 nonfire loss (approximately 16 percent of the total nonfire loss) when a private grain vessel struck the dock while being turned around by two tugboats. The incident is currently under investigation as a Type B accident according to DOE 5484.1 guidelines. Investigation results may place responsibility outside the DOE, in which case, the loss will be deleted from the database.

Trending loss data indicates that a small number of incidents constitute the majority of losses reported to the DOE. For example, the 5 largest fire incidents (19 percent of the total above the CAIRS threshold) accounted for approximately 42 percent of the total loss category. The same percentage of nonfire events amounted to approximately 61 percent of the total loss category. Headquarters is therefore considering doubling the CAIRS reporting threshold to trim reporting costs generated by less significant events.

Monetary fire losses are however, influenced by a number of factors including: fire prevention activities, automatic suppression system performance and fire department response. These determine a fire's consequence and serve as an indicator of DOE's overall success rate within the fire protection program. For example, 78 percent of all DOE CY 1994 fires were considered insignificant due in part to the success of the program. Because of this, all fires will continue to be reported through annual field reports, with year-end summaries provided in this publication.

The following table characterizes DOE's loss history. Information includes a non-fire loss rate category along with a 5-year rate averaging category (numbers shown in parentheses) where applicable. The accompanying figures provide a graphical representation of the loss data, and a breakdown of year-end losses according to field organizations. Sites that are not identified reported either insignificant or zero losses for the year.

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**TABLE 1: DOE LOSS HISTORY FROM 1950 TO PRESENT**

YEARS	VALUE (Millions of Dollars)	FIRE LOSS (Dollars)	NON-FIRE LOSS (Dollars)	LOSS RATES		
				Fire	Non-Fire	Total
50	1,800.00	486,389	10,050	2.70	0.06	2.76
51	2,177.10	38,318	317,797	0.18	1.46	1.64
52	3,055.10	449,107	356,600	1.47	1.17	2.64
53	4,081.00	148,142	427,430	0.36	1.05	1.41
54	6,095.90	185,438	190,436	0.30	0.31	0.61
55	6,954.20	125,685	330,103	0.18(1.00)	0.47(0.81)	0.65(1.81)
56	7,364.10	2,206,478	940,945	3.00(0.50)	1.28(0.89)	4.28(1.39)
57	7,973.20	590,663	885,936	0.74(1.06)	1.11(0.86)	1.85(1.92)
58	8,102.50	275,560	476,265	0.34(0.92)	0.59(0.84)	0.93(1.76)
59	10,301.80	199,841	998,060	0.19(0.91)	0.97(0.75)	1.16(1.66)
60	10,708.60	636,228	764,823	0.59(0.89)	0.71(0.88)	1.30(1.77)
61	11,929.90	325,489	5,530,566	0.27(0.97)	4.64(0.93)	4.91(1.90)
62	12,108.80	3,020,023	293,341	2.49(0.43)	0.24(1.60)	2.73(2.03)
63	13,288.90	599,056	776,998	0.45(0.78)	0.58(1.43)	1.03(2.21)
64	14,582.80	480,519	870,516	0.33(0.80)	0.60(1.43)	0.93(2.23)
65	15,679.30	1,743,448	2,106,621	1.11(0.83)	1.34(1.35)	2.45(2.18)
66	16,669.00	158,220	698,753	0.09(0.93)	0.42(1.48)	0.51(2.41)
67	17,450.90	359,584	2,423,350	0.21(0.89)	1.39(0.64)	1.60(1.53)
68	18,611.90	155,986	713,097	0.08(0.44)	0.38(0.87)	0.46(1.31)
69	20,068.30	27,144,809	909,525	13.53(0.36)	0.45(0.83)	13.98(1.19)
70	22,004.30	89,456	1,611,336	0.04(3.00)	0.73(0.80)	0.77(3.80)
71	24,155.80	78,483	1,857,566	0.03(2.79)	0.77(0.67)	0.80(3.46)
72	26,383.50	222,590	698,061	0.08(2.78)	0.26(0.74)	0.34(3.52)
73	27,166.70	117,447	2,258,241	0.04(2.75)	0.83(0.52)	0.87(3.27)
74	28,255.50	249,111	930,766	0.09(2.74)	0.33(0.61)	0.42(3.35)
75	31,658.30	766,868	4,485,481	0.24(0.06)	1.42(0.58)	1.66(0.64)
76	35,512.70	251,849	2,040,727	0.07(0.10)	0.57(0.72)	0.64(0.82)
77	39,856.10	1,084,823	2,529,161	0.27(0.10)	0.63(0.68)	0.90(0.78)
78	47,027.10	12,976,036	4,501,943	2.76(0.14)	0.96(0.76)	3.72(0.90)
79	50,340.80	654,716	1,886,307	0.13(0.69)	0.37(0.78)	0.50(1.47)
80	54,654.70	1,385,686	7,160,249	0.25(0.69)	1.31(0.79)	1.56(1.48)
81	59,988.80	2,042,633	2,600,855	0.34(0.70)	0.43(0.77)	0.77(1.47)
82	65,360.40	948,691	3,252,277	0.15(0.75)	0.50(0.74)	0.65(1.49)
83	70,484.40	731,234	9,765,828	0.10(0.73)	1.39(0.71)	1.49(1.44)
84	82,166.90	1,549,807	4,917,513	0.19(0.19)	0.60(0.80)	0.79(0.99)
85	86,321.84	1,145,975	2,983,322	0.13(0.21)	0.35(0.85)	0.48(1.06)
86	82,787.52	805,030	4,490,262	0.10(0.18)	0.54(0.65)	0.64(0.83)
87	91,927.20	1,570,736	1,440,093	0.17(0.13)	0.16(0.68)	0.33(0.81)
88	92,998.00	466,120	7,837,000	0.05(0.14)	0.84(0.61)	0.89(0.75)
89	107,948.00	615,551	6,890,000	0.06(0.13)	0.64(0.50)	0.70(0.63)

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YEARS	VALUE	FIRE LOSS	NON-FIRE LOSS	LOSS RATES		
	(Millions of Dollars)	(Dollars)	(Dollars)			
90	115,076.00	8,392,746	9,078,000	0.73 (0.10)	0.79 (0.51)	1.52 (0.61)
91	119,236.00	623,940	2,019,000	0.05 (0.22)	0.17 (0.59)	0.22 (0.81)
92	119,294.00	1,260,950	3,647,805	0.11 (0.21)	0.31 (0.52)	0.42 (0.73)
93	120,733.88	781,269	3,193,534	0.06 (0.20)	0.26 (0.55)	0.32 (0.75)
94				?? (0.20)	?? (0.43)	0.00 (0.63)

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SIGNIFICANT FIRE LOSS DATA

The following is a brief review of the five largest DOE fire losses.

- 1.BPA - A Slatt Substation transformer (500 KV) failed while in service. The transformer ruptured, with hot oil igniting surrounding areas. Total property loss was estimated at \$190,000. Neither CAIRS nor ORPS has a record of this loss.
  
- 2.OK/LBL - An internal transformer fault caused an explosion and fire in building 58. Fire loss was estimated at \$50,000. CAIRS does not have a report on this incident. ORPS No.: SAN/LBL/Operation/1993-0001.
  
- 3.OK/ETEC - A three phase to ground fault occurred on the 4160 volt service to the Sodium Pump Test Facility. The incident caused a power outage and fire, which resulted in \$40,000 of property damage and \$60,000 in lost revenue. CAIRS reports this in the non-fire loss category. ORPS NO: SAN-ETEC-SPTF-1993-0001.
  
- 4.AL/MPO - Process temperature controller malfunctioned causing a fire which resulted in property damages totaling \$45,000 (CAIRS 93-0006).
  
- 5.AL/PAN - During security training at Big Boar Rifle Range No. 3, a tracer round ricocheted from the impact berm and started a grass fire. The ensuing fire burned approximately 700 acres, causing \$26,500 in property damage. CAIRS has reported this as a fire incident. ORPS No.: ALO-AO-MHSM-Pantex-1993-0050.

Other losses of interest are included in the following table:

LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS

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\* No CAIRS report; \*\* Amount represents lost revenue

WATER-BASED AUTOMATIC SUPPRESSION SYSTEM PERFORMANCE

A total of 86 incidents were reported where water-based suppression systems operated in CY 1994: 29 were wet-pipe systems, 12 dry-pipe, 41 deluge, 2 foam deluge systems and 2 dock oscillating monitor (deluge) systems. Of the 29 wet-pipe system activations, 2 were directly related to fire. A third fire was controlled by a dry-pipe system. All remaining system activations were caused by the following non-fire events: 14 were considered human error, 23 mechanical failure, 8 electrical failure, 33 acts of nature (15 freezing, 5 rainwater seepage, 4 wind, 9 electrical storms), and 5 miscellaneous events. Review of the CAIRS Summary shows that 6 of the above non-fire activations were reported for a cumulative damage estimate of \$106,079.

Water-based system activations of interest are shown in the following table. The designation NR indicates that this report was not included in the CAIRS Summary and mentioned (without a dollar loss report) in the field organization's annual fire protection report.

LOSS TYPE	LOC.	DESCRIPTION	DOLLAR LOSS

\* No CAIRS Report

There are now 220 incidents in DOE records where sprinkler systems operated in a fire. The satisfactory rate of performance is 99.1 percent, or 218 times out of 220 incidents. The two failures were a shut cold weather valve in 1958, controlling a single sprinkler in a wood dust collector, and a deluge system failure due to a hung-up trip weight in a 1963 transformer

explosion.

To date, the DOE has experienced 94 fires that were either controlled or extinguished by wet-pipe automatic sprinkler systems. As shown in the table below, approximately 92 percent of the fires were controlled with less than 4 sprinklers activating.

**DOE Wet-Pipe Automatic Sprinkler Performance  
1955 to 1992**

Sprinklers Cumulative of Total	No. of Operating Percent	Cumulative Fires	Percent Total
1	66	66	70
70	2	82	17
87	3	86	5
92	4	88	2
94	5	90	2
96	6	91	1
97	7	93	2
99	8	93	0
99	9+	94	1
100			

### HALON SUPPRESSION SYSTEM PERFORMANCE

Concerns regarding the effect of chlorinated fluorocarbons (CFCs) and Halons on the ozone layer have led to regulations conforming with the 1991 Clean Air Act. The Environmental Protection Agency has subsequently drafted rules on this regulation to include: prohibiting new halon production; establishing container labeling requirements; imposing Federal procurement restrictions, imposing significant Halon taxes; issuing requirements for the approval of alternative agents; and listing essential areas where Halon protection is considered acceptable.

DOE's current policy does not allow the installation of any new Halon systems. In addition, Field Organizations been requested to aggressively pursue alternative fire protection configurations for existing systems and to effectively manage expanding Halon inventories as a result of downsizing. Halon inventory will eventually be "banked" at a central location and utilized to replenish drawdown from existing systems determined essential to the mission of the Complex. The long term goal being the gradual replacement of these essential systems.

The following report updates the extent of Halon use throughout the DOE. This information was solicited from Field Organizations in the AFPS data request with additional information obtained from the results of EH's 1992 Essential Use Survey.

In CY-93, the DOE had 1,235 Halon 1301 systems in operation containing approximately 335,362 pounds of agent. About 330 of these systems were considered essential applications where alternative fire protection methods are considered unsuitable.

Halon 1301 inventory was reported at approximately 85,551 pounds. Operational and inventory amounts for the Halon 1211 were reported at 180,593 and 24,949 pounds respectively. Halon inventories are not yet banked at a central location; however, planning is underway for locating a Halon repository at SRS.

Field Organizations reported that 106 non-essential systems have been disconnected, increasing DOE's Halon inventory by approximately 20,000 pounds. This represents an approximate 7 percent reduction in last years operating volume. Actual reduction percentages may be higher since not all sites reported Halon volumes in the CY-92 AFPS.

The following table provides a breakdown of the 5 largest Halon utilizing field organizations. The bulk of Halon retained within the PA is shared between BPA (14,495 lbs. in 6 systems) and WAPA (11,419 lbs. in 22 systems). Drawdown amounts represent the amount of Halon that was released to the environment over the

calendar year.

LOCATION	HALON 1301		AGENT DRAWDOWN	HALON 1211	
	ACTIVE (LBS.)	INVENTORY (LBS.)		ACTIVE (LBS.)	INVENTORY (LBS.)
SR	80,000	1,400	1,268	6,000	6,500
AL	56,015	11,826	1,577	43,880	8,211
CH	51,002	11,752	1,109	28,743	150
PA	26,516	2,788	0	45,757	425
SPR	30,923	0	5,969	0	0
Total	245,757.00	29,067.00	9,923.00	125,591.00	16,497.00

A total of 24 incidents were reported where Halon 1301 suppression systems operated in CY 1994. No sites reported any Halon system failures during a fire event. System activations were the result of the following non-fire events: 8 were considered human error, 2 acts of nature, 10 electrical, and 4 miscellaneous (smoke, dust thermal) causal factors. Approximately 10,772<sup>6</sup> pounds of agent were discharged in these events.

The table on the following page lists all Halon 1301 system activations in CY 1992 of 100 pounds or more. The designation NR indicates that this report was not included in the CAIRS Summary and mentioned (without a dollar loss report) in the field organization's annual fire protection report. The CAIRS Summary classified the SPR/WI Halon discharge as a Type B incident with

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<sup>6</sup> The above figure does not consider system leakage. SR identified in the Fire Department's Annual Report that approximately 30 lbs. was used over the year for recharging systems due to leakage. Using SR's leakage rate (0.000375) to all of DOE, presumes that approximately 158 lbs. was lost due to system leaks.



protection program.

CY-93 saw approximately 313 fire protection systems completed in new or existing structures throughout the Complex. Sprinkler upgrades continue to be the predominate type of installation, with about 113 being installed. The majority of the other installations were either infrastructure oriented (water supplies, base fire alarms), or maintenance oriented (minor sprinkler installations or alarm panel replacements).

The following is a list of major fire protection projects. The list does not include current design projects, unless it was identified that the installation was completed within the calendar year. As with past reports, the summary is intended not only to indicate the number of projects that have occurred, but also to serve as a source of information to those planning similar upgrades.

AUTOMATIC SPRINKLER SYSTEMS COMPLETED IN CY 1992

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LocationInstallation

AL/SNLLInstalled an automatic sprinkler system in buildings 923 (Radiography Facility) and 965 (Welding Shop). Also added fire department connections to 15 automatic sprinkler systems and removed obsolete fire pumps. The total cost of construction (TCC) was \$124,620.

AL/KCPA new preaction sprinkler system was installed beneath a Waste Management canopy used for interim storage of waste materials.

AL/LANLThe Materials Science Laboratory, a fire resistive, two story facility was completed. Sprinklers are provided throughout. There are (635) 212°F and (23) 286°F heads provided on the wet-pipe hydraulically designed, ordinary hazard (Group II) system. A dock anti-freeze loop is included. System includes 2 block valves, 1 post indicator valve, 1 new hydrant, and 100 feet of ductile iron underground feed main.

CH/ANLESeven wet-pipe systems were installed in the Advanced Photon Source Project for a TCC of \$700,000.

AUTOMATIC SPRINKLER SYSTEMS (continued)

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LocationInstallation

CH/FA Existing wet-pipe systems in the Klystron Units and Linac Annex Headhouse were modified, and a new wet-pipe system was installed in the booster Area Trailer Complex. The TCC for this project was approximately \$60,000.

CH/BNLSprinkler protection was installed in Buildings 321, 339, 412, 526, 922, 923 and 926.

CH/PPPLSeven buildings were sprinklered at the lab for a TCC in excess of \$441,000.

ID/INELAutomatic sprinkler systems were installed in the following facilities: RWMC-653, PER-641, CPP-1647, CPP-1650, and CPP-1663.

NV/NTSThe following buildings were completed for a TEC of approximately 4 million dollars. These buildings included fire detection/alarm systems and automatic sprinkler system upgrades: Bldg. 6-901, Operators/Teamsters Office Building; Bldg. 6-902, Laboratory Office Building; Bldg. 6-903, Vehicle Maintenance Shop; Bldg. 6-906, Carpenters, Painters and Laborers Shop; Bldg. 23-111, DOE/NTSO Office Building (Upgrade); Bldg. 23-1010, Power Dispatch Center (Upgrade); Bldg. 23-1103, Security Training Center (Addition).

OR/Y-12Building 9723-33, a change house of noncombustible construction, was completed. A wet-pipe system supplies 137 sprinklers protecting most of the building. A small dry-pipe system supplies 9 sprinklers in the remaining, unheated, portions of the building.

OR/Y-12Approximately 500 sprinklers were replaced in Building 9712. The "old-style" sprinklers were 50 years old and required by code to either be tested or replaced. Replacement was determined to be the most cost effective measure.<sup>7</sup>

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<sup>7</sup> Section 2-3.1.1 of NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems requires that representative sprinkler samples be tested when these have been in service for 50 years or more. This sample consists of a minimum of two sprinklers per floor, or individual riser, and in any case not less than four, or 1 percent of the

AUTOMATIC SPRINKLER SYSTEMS (continued)

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LocationInstallation

OR/ORNLA total of 229 sprinkler heads were added in modified facilities. Associated equipment such as valves, hydrants, fire dampers, etc. were installed concurrent with facility modifications.

RFTwo wet-pipe automatic sprinkler systems were installed: Building 910 to replace existing smoke detection systems (change in occupancy). TCC was \$60K. Building 117 (new modular building). TCC was \$25K.

RL/HANBldg. 234-5Z, PFP Duct Level Sprinkler System Extension; Wet-pipe system, On/Off heads, 16,600 square feet. TCC was \$940,000.

RL/HANWet-pipe automatic sprinkler systems were installed in six modular office facilities (72,000 square feet) for a TCC of \$207,000.

RL/HANWet-pipe sprinkler system installed in Bldg. 2704-S, Laboratory Office Facility. TCC to sprinkler the 8,100 square foot facility was \$84,700.

RL/HANWet-pipe sprinkler system installed in Bldg. 243-Z, PFP Liquid Low Level Waste Treatment Facility. TCC to sprinkler the building was \$96,100.

SR/SRSAutomatic sprinkler systems were installed in the following facilities: 730-B, 192-K, 772-4F, 735-18A, 321-M and 234-H.

SF/LBLSprinkler system completed for the Cafeteria, Building No. 54.

SF/LLNLNew automatic suppression systems were installed in four buildings, with significant improvements made in five other buildings.

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number of sprinklers per individual sprinkler system, whichever is greater. Where representative samples fail to meet the test requirements, all sprinklers that the sample represents must be replaced. Systems that pass this test must also be retested at 10-year intervals.

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SNR/KSWet-Pipe automatic sprinkler systems were installed in the following facilities for a TCC of \$98,000: Q-9, Testing and Storage Facility; O-3, Engineering Offices; N-9, Engineering Offices; Q-10 Storage and Offices; and, M-10, Waste Storage Facility.

SSCAutomatic Sprinklers were completed in the Linac facility. This system protects the ground elevation equipment gallery and high bay style source area. Linac tunnel is not sprinklered.

SPECIAL EXTINGUISHING SYSTEMS COMPLETED IN CY 1992

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LocationInstallation

CH/ANL-EA carbon dioxide system was provided for a high voltage enclosure in the 369 bldg (TCC of \$50,000.). Also, two wet chemical systems were installed in the 213 bldg. at a TCC of \$25,000.

CH/ANL-WInstalled a carbon dioxide system in the WIPP Waste Characterization Chamber in the 785 bldg. (\$28,000 TCC).

OR/ORNLA unique open-spray sprinkler system was custom designed and constructed for remote installation in the Radiochemical Engineering Development Center (REDC) hot cells. After full scale testing was completed, DOE approved the system for installation.

ID/INELA Halon system was installed in the control room of building CPP-604 at the Chemical Processing Plant.

PNR/BAPLA carbon dioxide underfloor extinguishing system was installed in the control room in Hangar 2. TCC was \$15,000.

RL/HANTotal flooding carbon dioxide systems were installed in two portable instrument houses (600 square feet total area) at a TCC of \$38,400. Total flooding dry-chemical systems were installed in two hazardous material storage modules (352 square feet total area) at a TCC of \$7,000.

FIRE DETECTION AND ALARM SYSTEMS COMPLETED IN CY 1992

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LocationInstallation

AL/SNLLInstalled fire alarm and duct detection systems in the Integrated Manufacturing Technology Laboratory (IMTL), office and laboratory areas. Construction costs were a part of the new facility. Also, a new smoke detection system was installed in Bldg. 916, room 108 laser laboratory, and room 106 cleanroom. TCC for this work was \$12,283.84.

AL/MPOFire alarm systems were completed in the R and SW Buildings for a TCC of \$150,000.

CH/ANL-EAn addressable fire detection and alarm system was installed in the Bldg. 369 for a TCC of approximately \$100,000.

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FIRE DETECTION AND ALARM SYSTEMS (continued)

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LocationInstallation

CH/FA New addressable fire alarm systems were installed in 30 mechanical support Bldgs. of the Main Ring Accelerator for a TCC of \$220,000.

CH/NRELAlarm systems were added into the new CERF facility for a TCC of \$60,000. Also, existing alarm system in the FTLB facility was replaced for a TCC of \$40,000.

ID/INELThe ICPP fire protection line item project provided a new "Emergency Communication System", installing manual fire alarm systems in Bldgs. CPP-604/605, CPP-606, CPP-659, and CPP-1635. Detection systems were also installed in Bldgs. CPP-604/605, CPP- 630, CPP-659, CPP-1635, and CPP-1663.

PNR/NRFInstalled a system of spot type fire detectors for alarm purposes only in the S5G IDE Facility, Bldg. 634. Alarm signals transmit to the existing NRF signaling fire alarm system and to a new graphic annunciator panel located in the S5G Control area. TCC was \$11,085.

RF Upgraded 1 glovebox overheat detection system in Module C of Bldg. 707 for a TCC of \$880,000.

RL/PNFLFacility buildings 313, 331H, 3708, 3746, 3764, 3765, and 3767 were upgraded with new detection and alarm systems for a TCC of \$150,000.

RL/HANNew detection and alarm systems were installed in six modular office facilities for a TCC of \$135,000.

RL/HANBldg. 243Z, PFP Buildings Life Safety Upgrade; Upgraded evacuation alarm systems for a TCC of \$563,000.

SNR/KSAn Incipient Fire Detector (IFD) air sampling system was installed in a facility which contains high value computer equipment. The IFD is the second such system installed at KS.

SR Detection, alarm systems and autoterms were installed in the following facilities: 192-K, 241-102H, 772-4F, and 901-Z.

SSC Fire detection and alarm systems were completed for the

Linac facility. The system provides for life safety evacuation, tunnel smoke detection, and monitoring of automatic sprinkler systems. The system is arranged to transmit alarm, supervisory and trouble signals to the SACL dispatch center.

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WATER DISTRIBUTION SYSTEMS COMPLETED IN CY 1992

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LocationInstallation

- AL/SNLL Interconnected 2 dead end water mains with the site distribution system. Also replaced 4 fire hydrants. The TCC for this work was \$18,077.
- AL/LANLA new 250,000 gallon water storage tank was installed at TA-15, along with 6,000 feet of 10-inch PVC pipe and three hydrants. Project cost was \$650,000 in GPP funds, with a construction cost of \$450,000.
- CH/NREL Completed the fire main loop around the new SERF facility for a TCC of \$110,000.
- ETC/METC Installed a secondary fire main tie-in at B-19 to the city of Morgantown's water supply for a TCC of \$29,000.
- ID/INELICPP Water System Upgrade project was completed. This work included the installation of a water loop around the east side of the facility and the installation of a new fire water line to Bldg. CPP-603.
- PNR/BAPL Installed approximately 1,200 feet of 8 inch underground to provide an additional loop to the fire main system. Also, 2,000 feet of 6 inch mains were replaced with 8 inch piping and three new hydrants were added to the site. TCC for the project was \$202,000.
- PNR/NRF Installed a Surge Suppression and Fire Pump test Header in Plant Services, Bldg. 602, and in the S5G Pumphouse, Building 635. TCC was \$85,000. Installed three additional fire hydrants outside the Site perimeter for a TCC of \$96,000.
- SR 52,472 feet of new fire line was installed in various areas throughout the SRS, along with 43 fire hydrants, 74 curb boxes, and 150 post indicator valves.
- SSC Primary and secondary potable water mains were extended around the Linac site. These mains provide a looped, multiple path fire protection water supply for the Linac automatic sprinkler system and fire hydrants. The system is supplied by the local water utility district.

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FIRE DEPARTMENT ACTIVITIES

The following is a summary of fire department responses for CY-93.

1. Fire 2,799
2. Other Emergency 2,407
3. Other Non-Emergency 3,547
4. Medical 1,940

There are about 26 DOE fire departments with more than 100 vehicles and other types of apparatus. Each year these organizations are involved in activities, such as replacement or reconditioning of equipment, training, inspection and fire prevention activities. The following is a summary of highlighted fire department activities completed during the calendar year.

EMERGENCY RESPONSE VEHICLES

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Location Type of Equipment

AL/WIPPPurchased one fire truck, one wildland fire apparatus, and one twenty foot hazardous materials response trailer.

CH/ANL-EFfour wheel drive truck with a 200 gallon tank and pump for wild land fire suppression activities.

CH/FA Hazardous material spill trailer (\$9,000).

E/TEC/PETCReplaced one emergency management vehicle (mini-van) with a full-size suburban. This vehicle is leased from GSA and is to be equipped and utilized as a command post vehicle. Also, a HAZMAT trailer was recently procured to be utilized onsite to deal with minor chemical releases. Approximately \$30,000 was spent on this trailer and equipment.

OR/Y-121,500 gpm Pumper (\$260,000), HAZMAT response (\$290,000) Heavy Rescue (\$250,000), Ambulance (\$75,000).

OR/K-251,500 gpm pumper (\$211,000), Rescue truck (\$147,111),

Fire Protection Summary  
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Ambulance (\$47,895).

RF Two new mobile units for support vehicles (Pickup Trucks).  
One new Command Suburban. GSA lease contracts.

SR Three 1,500 gpm E-One pumpers with 1,000 gallon tanks and  
in-line foam capability (\$787,000). SRO-2206 was  
excessed and replaced by a new forestry brush truck.  
SRO-3570 was equipped with a new pickup bed which makes  
it useable as a service truck.

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OTHER EMERGENCY RESPONSE EQUIPMENT

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LocationType of Equipment

AL/PI Purchased 1,000 feet of 5 inch hose.

ID/INEL Purchased a number of confined space equipment including both AMIS and MiniGard III gas detectors (\$47,678.).

PNR/NRFTwenty-seven sets of turnout gear for volunteer fire fighters (\$15,600.), additional rescue gear (\$25,600) and a large hi-expansion foam generator (\$4,166).

RF Six BioPak 240 closed circuit breathing apparatus at \$6,000 each, two Air CART confined space breathing air source, which is also utilized for supply air during Hazmat responses, at \$3,000 each, fire extinguisher bar coding system to assist the managing over 4,000 extinguishers (\$3,500.).

RL/HANHigh angle and confined space rescue equipment (\$34,900).

SF/LBLVehicle Exhaust system for apparatus room (\$45,000).

IN-HOUSE TRAINING

A large number of training activities are reported annually which cover the fire fighting and emergency medical training typical of DOE fire departments or brigades. Most locations reported that training was given to employees on the use of fire extinguishers and hazardous materials response. Several locations reported that hands-on training was conducted where building fires were extinguished. There were also many reports of fire department personnel serving as instructors in the various communities or colleges.

A significant training accomplishment was achieved this year in that a number of fire departments began to share training programs and props with other DOE and off-site organizations. For example, the RL/HAN fire department's Self Contained Breathing Apparatus (SCBA) Training Course, which includes a smoke generating tractor-trailer sized maze, was utilized for the

Fire Protection Summary  
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SCBA training needs at 10 DOE sites. During this schedule, A Washington, DC stop-off was made, where over 100 congressional representatives had a chance to tour the facility.

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Other notable training activities are as follows:

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LocationType of Equipment

AL/PANCPR Instructor Training was conducted for Security Department Instructors.

AL/PANA Fire Officer attended a 3-day Instructor Training Course for Survival Flashover Simulator at Lubbock Fire School.

OR/ORNLContinued with the "Fire and Emergency Television Network Satellite" at fire headquarters, which provides both low cost and effective classroom training exercises.

RL/HANAt the request of the West Valley Demonstration Project in Hamburg, NY, a fire department training officer provided two days of confined space rescue training to the sites confined space rescue team and one day of training to the local mutual aid fire department.

RL/HANThe Hanford fire department received a state-of-the-art fire ground and incident command simulator that includes scale models of the Hanford facility to permit realistic training. This high-tech equipment allows for the development of various scenarios and incorporates realistic fire ground simulations for placement of personnel during controlled tabletop-type fire and hazardous materials response exercises.

SNR/KAPLDesigned and constructed the SCBA, "Mask Confidence Course", which utilized Incident Prevention and Fire Brigade personnel for initial and refresher training.

INSPECTION AND FIRE PREVENTION

All Field Organizations report on aggressive inspection and fire prevention programs aimed at keeping employees aware and systems intact. Site employee programs such as evacuation drills and extinguisher training are usually coordinated with the National Fire Prevention week. Many sites report on the use of bar coding hardware to inspect and verify routine fire protection

features such as fire doors and extinguishers. Most organizations report on conducting both formal building inspections, and informal housekeeping walkthroughs to spot any glaring protection deficiencies.

FIRE PROTECTION PROGRAM HIGHLIGHTS

The following list includes major highlights experienced within the DOE fire protection program for CY 1992:

1. Recurring fire protection costs for CY 1994 approached \$99.1 million for the DOE complex.<sup>8</sup> On a ratio of cost to replacement value, the DOE spent approximately 8.2 cents per \$100 replacement value for recurring fire protection activities. Costs do not include any supplemental contracts with off-site fire departments or any fire protection construction projects. A breakdown is provided in the following chart, based on information received from most field organizations.

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<sup>8</sup> Recurring costs from CY-92 (74 million dollars) were based on limited information sent into headquarters from field organizations. Because of this, headquarters requested further details on recurring costs which are reflected in this summary. Recurring costs were additionally provided for CY-92 indicating costs of approximately 82 million dollars. Of this amount, 84 percent related to fire department and system maintenance activities, with the remaining spent on engineering fees.

2.EH undertook a number of fire safety initiatives in CY 1994 related to fire safety research, training, technical assistance and criteria development. In research, EH sponsored fire tests which investigated the effectiveness of oil-filled radiation shielding windows and confirmed the hypothesis that this equipment can withstand fire durations for up to three hours. Additionally, EH sponsored initial tests on 55 gallon metal waste drums which concluded that these storage containers are not impervious to a credible fire scenario.

The Office again sponsored the 2-week Basic Fire Protection Engineering Course at Factory Mutual, continued the program of Life Safety Code Courses, and began the Fire Alarm Code Course program. EH sponsored the DOE/Contractor Annual Fire Protection Conference in Augusta, Georgia.

To facilitate information exchange within the Department, the Office expanded the distribution of the fire protection newsletter, disseminated a number of safety notes and bulletins and included fire safety information in the Safety Connection as a regular feature.

Within the realm of technical assistance, EH participated in a number of field office requests for fire protection assistance including the review of fire safety features at the Superconducting Super Collider and Alaska power Administration. Additionally EH processed 12 field office exemption requests, and completed a number of interpretations on DOE's fire protection order.

CY 1994 also saw EH developed criteria on the managed phaseout of Halon systems, as well as guidelines for medical standards for DOE firefighters. Work was also continued on the glove box and filter plenum fire protection criteria and the fire protection assessment guide.

3.Ronald and Nancy Reagan provided a lunch and ceremony honoring the Rocketdyne Fire Department (OK/EETEC) and other municipal fire departments for their role in combating the fire storms that devastated the Southern California area. Rocketdyne was responsible for setting up and conducting helicopter tanking operations in support three large brush fires in the Los Angeles area. The ceremony was conducted at the Ronald Regan Presidential Library and Museum as part of the Fire Fighters Appreciation Day festivities.

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PERSONNEL ACTIONS