Annual Fire Protection Program Summary
for Calendar Year 2018

UNITED STATES DEPARTMENT OF ENERGY

Summary Provided by:

Office of Environmental Protection and ES&H Reporting

Office of ES&H Reporting and Analysis

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Foreword

The submission of this 2018 Annual Fire Protection Summary Report is required by the Department of Energy (DOE) Order 231.1B, *Environment, Safety and Health Reporting.* This summary report is the primary source for quantifying fire and fire-related monetary losses to facilities, property, and equipment across the DOE complex.

This report for calendar year (CY) 2018 was summarized from information submitted by 28 reporting elements representing approximately 99 percent of DOE's facility and property valuation. (Most DOE facilities report into the Fire Protection Database, except for the Power Marketing Administrations and Headquarters offices.) Headquarters, and Field/Area/Site abbreviations are identified in the Glossary, and fire protection, valuation, and rate terms are listed in the Definitions.

The fire protection data for CY 2018 were extracted from the DOE Fire Protection Reporting Database, with the following organizations reporting:
Ames Laboratory
Argonne National Laboratory
Brookhaven National Laboratory
East Tennessee Technology Park
Fermi National Accelerator Laboratory
Idaho National Laboratory
Kansas City Plant
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Los Alamos National Laboratory
National Renewable Energy Laboratory
Nevada National Security Site
Oak Ridge National Laboratory
Office of River Protection
Pacific Northwest National Laboratory
Paducah Gaseous Diffusion Plant
Pantex Plant
Portsmouth Gaseous Diffusion Plant
Princeton Plasma Physics Laboratory
Richland Operations Office
Sandia National Laboratory
Savannah River Site
Stanford Linear Accelerator Laboratory
Strategic Petroleum Reserves
Thomas Jefferson National Accelerator Facility
Waste Isolation Pilot Plant
West Valley Demonstration Project
Y-12 Plant

Organizational elements are required to input their fire protection data by April 30th of each year; however, the Office of Environment, Health, Safety and Security (AU) accepts data through May.

The Fire Protection Reporting System is located at: http://energy.gov/ehss/policy-guidance-reports/databases/fire-protection-database. [Password required] AU continues to work with the DOE Fire Safety Committee to improve the data submission system and the content of the annual report to improve its utility.

IMPORTANT NOTE: When preparing the 2019 report, it was discovered that one site overstated "Medical Costs" by $20,000,000 due to an input error in the Fire Protection Database. This affected not only the site's medical costs, total recurring costs, and cost rates per $100 of valuation, but the DOE-wide costs and cost rates as well. The error has been corrected in the database and amended throughout this updated report, as detailed in the *Table of Corrections in this Version* below.

Table of Corrections in this Version

Page No.	Paragraph/Figure No.	Previous Information	Updated Information
1	Paragraph 8	$268,840,893	$248,840,893
	Paragraph 8	16%	7%
	Paragraph 8	17 cents	15.9 cents
	Paragraph 8	15 cents	15.4 cents
	Paragraph 8	12%	3%
15	Paragraph 1	$268,840,893	$248,840,893
	Paragraph 1	16%	7%
	Paragraph 1	17 cents	15.9 cents
	Paragraph 1	15 cents	15.4 cents
	Paragraph 1	12%	3%
	Figure 7	Medical $25,975,633	Medical $5,975,633
	Figure 7	*Percentages*	*Recalculated*
	Paragraph 2	44%	47%
16	Figure 8	Hanford 53 cents per $100	Hanford 35 cents per $100
	Figure 8	DOE Average = 17 cents	DOE Average = 16 cents
	Paragraph 1	17 cents	16 cents

Glossary

Headquarters Organizational Elements

AU	Environment, Health, Safety and Security
EE	Energy Efficiency & Renewable Energy
EM	Environmental Management
FE	Fossil Energy
LM	Legacy Management
NE	Nuclear Energy
NNSA	National Nuclear Security Administration
PMA	Power Marketing Administrations
SC	Science

Field/Area/Site Organizational Elements

CAO	Carlsbad Area Office
CH	Chicago Operations Office
GFO	Golden Field Office
GJO	Grand Junction Office
DOE-ID	Idaho Operations Office
KCSO	Kansas City Site Office
LSO	Livermore Site Office
LASO	Los Alamos Site Office
NETL	National Energy Technology Laboratory
NPR	Naval Petroleum Reserves
NSO	Nevada Site Office
ORO	Oak Ridge Operations Office
ORP	Office of River Protection
PXSO	Pantex Site Office
RL	Richland Operations Office
SSO	Sandia Site Office
SRO	Savannah River Operations Office
SPR	Strategic Petroleum Reserve Office
YSO	Y-12 Site Office

Site Abbreviations and Acronyms

ALA	Ames Laboratory
ANL	Argonne National Laboratory
AEMP	Ashtabula Environmental Management Project
BAPL	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
ETTP	East Tennessee Technology Park
FNAL	Fermi National Accelerator Laboratory
FEMP	Fernald Environmental Management Project
INL	Idaho National Laboratory
ID-EM	Idaho Cleanup Project
KAPL	Knolls Atomic Power Laboratory
KCP	Kansas City Plant
KSO	Kesselring Site Operations
KAFB	Kirtland Air Force Base
LBNL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratory
LANL	Los Alamos National Laboratory
MOAB	Moab Uranium Mill Tailings Remedial Action (UMTRA) Project
NBL	New Brunswick Laboratory
NETL	National Energy Technology Laboratory
NREL	National Renewable Energy Laboratory
NRF	Naval Reactors Facilities
NNSS	Nevada National Security Site
ORISE	Oak Ridge Institute for Science and Education
ORNL	Oak Ridge National Laboratory
ORP	Office of River Protection
TWPC	TRU Waste Processing Center
PAD	Paducah Gaseous Diffusion Plant
PTX	Pantex Plant
PGDP	Paducah Gaseous Diffusion Plant
PNNL	Pacific Northwest National Laboratory
PORTS	Portsmouth Gaseous Diffusion Plant
PPPL	Princeton Plasma Physics Laboratory
RL	Richland Operations Office
SLAC	SLAC National Accelerator Laboratory
SNL-NM	Sandia National Laboratories, New Mexico
SNL-CA	Sandia National Laboratories, California
SRS	Savannah River Site
TJNAF	Thomas Jefferson National Accelerator Facility
WIPP	Waste Isolation Pilot Plant
WVDP	West Valley Demonstration Project
Y-12	Y-12 Plant
YMP	Yucca Mountain Project

Note: GJO, KAPL, MOAB, NBL may have property valuations in FIMS and/or PIDS, but do not report into the Fire Protection Database. TJNAF reports into the database, but there are no property valuations in PIDS and FIMS. Therefore, these sites are not included in the overall DOE fire protection calculations.

Definitions

For reference information only, the following definitions are provided from the archived DOE Manual (M) 231.1-1, *Environment, Safety, and Health Reporting Manual*, and the archived DOE Order (O) 5484.1, *Environmental Protection, Safety and Health Protection Information Reporting Requirements*, to clarify key concepts. Section references to these documents are given at the end of each definition.

FIMS (Facility Information Management System): The Department's corporate real property database as mandated by DOE Order 430.1C (Real Property Asset Management). Real property includes land, and anything permanently affixed to it, such as buildings, fences, bridges, etc.

PIDS (Property Information Database System): The central database that provides an electronic means for obtaining standardized property information about DOE and its entities. PIDS manages and reports property volumes and original acquisition dollar values of government owned property annually.

Property Value/Valuation: The approximate replacement value of all DOE-owned buildings/facilities and equipment. Included are the cost of all DOE-owned supplies and average inventory of all source and special nuclear materials. Excluded are 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). (APPENDIX C, DOE M 231.1-1)

Total Valuation: Obtained by combining information from FIMS and PIDS.

Estimated Loss: Monetary loss determination is based on all estimated or actual costs to restore DOE facility and equipment to pre-occurrence conditions irrespective of whether or not such restoration is performed. The estimate includes: (1) any necessary nuclear decontamination; (2) restoration in areas that received water or smoke damage; (3) any loss reductions for salvage value; and (4) any lost revenue experienced as a result of the accident. The estimate excludes: (1) down time; and (2) any outside agency payments. Losses sustained on private property are not reportable, even if DOE is liable for the damage and loss consequences resulting from the occurrence. (APPENDIX C, DOE M 231.1-1)

Fire Loss: All damage or loss sustained as a direct consequence of (and following the outbreak of) a fire shall be classified as a fire loss. Exception: the burnout of electric motors and other electrical equipment through overheating from electrical causes shall be considered a fire loss only if a self-sustained combustion exists after power is shut off. (APPENDIX C, DOE M 231.1-1)

Fire Loss Rate: Unit of comparison in *cents* loss per $100 of valuation (facilities and equipment) as a consequence of fire events.

Fire Protection Loss: All damage or loss sustained as a consequence of fire events, or non-fire events involving fire protection systems; including leaks, spills, and inadvertent releases.

Non-Fire Loss: All damage sustained as a consequence of non-fire events involving fire protection systems; including leaks, spills, and inadvertent releases.

Executive Summary

The Department of Energy (DOE) Order 231.1B, *Environment, Safety, and Health Reporting*, requires organizations responsible for maintaining property under the stewardship of DOE to enter reportable fire related incidents into the DOE fire protection database. Annual summary reports are produced and made available to evaluate fire protection programs and support DOE analysis.

In calendar year 2018, DOE sites reported no fire or fire-protection related fatalities. There was one minor injury reported (Table 1) at LLNL when a worker had ringing in his ears after a small amount of flash powder ignited unexpectedly. The single injury represents a 67% decrease from 3 injuries reported in 2017.

There were 55 notable fire or fire protection-related occurrences reported into the DOE Occurrence Reporting and Processing System (ORPS) in 2018. This is a 41% decrease from the 94 occurrences reported in 2017. The notable decrease in reported occurrences may have resulted from changes in the revised ORPS Order 232.2A, which combined and/or eliminated certain reporting criteria. The 232.2A Order replaced the prior six Significance Categories with three new Report Levels of High, Low and Informational. Informational Level reports, at Program Office direction, may be captured only in local issues management systems. Note: Of the 55 reported events, 12 events were deemed High Level (Table 2), 16 were Low Level, and 27 were Informational.

Data compiled from the Fire Protection Reporting Database determines there were a total of 96 fire protection losses in CY 2018 (Table 3), in the amount of $1,017,020. This is a decrease of 5% from the 101 total fire events, in the amount of $1,070,080 reported in CY 2017. Out of the 96 Events, 69 events resulted in monetary losses and 53 events resulted in fire losses directly attributable to fire or smoke.

The 53 fire loss events noted in this CY 2018 report (Table 3), resulted in a monetary loss of $917,935, a 9% decrease from $1,008,295 reported in CY 2017. There were 16 non-fire loss events due to leaks, spills or inadvertent releases in 2018, totaling $99,084, a 60% increase from 2017 events, totaling $61,786.

Highlighted in Figure 2, there were 13 *major* fire losses at 7 sites in 2018, costing $10,000 or more, compared with 15 losses at 10 sites in 2017. Of these, 4 losses are of $50,000 or greater, compared with 5 losses in 2017 (Table 4).

Loss comparisons among DOE sites are performed by normalizing data against total facility and property valuation as reported in the FIMS and PIDS databases. Total DOE valuation for sites reporting into the Fire Protection Database in 2018 was $156.2 billion, a 4% increase from $150.2 billion in 2017 (Figure 4). The overall 2018 fire loss rate for reporting sites was 0.06 *cents* for each $100 in total site valuation, a 14% decrease from 0.07 in 2017 (Figure 5).

Recurring costs for fire protection activities were $248,840,893 in 2018, a 7% increase from $231,645,722 in 2017 (Figure 7). As a ratio of cost to total valuation, in 2018 reporting sites spent approximately 15.9 cents per $100 of valuation for recurring fire protection activities, compared with 15.4 cents in 2017, a 3% increase.

The DOE reported 6,489 Fire Department responses in 2018, an 11% increase from the 5,860 reported in 2017 (Table 9).

Personnel Injuries Reported in ORPS

There was one fire protection-related personnel injury reported in ORPS during 2018, a 67% decrease from three reported in 2017.

Table 1
Fire Protection Personnel Injuries

Site	Description
LLNL	NA--LSO-LLNL-LLNL-2018-0004 On January 12, 2018, a worker was preparing to burn a small amount of flash powder via an electrical conductor. The electrical conductor became dislodged from the material and upon reinsertion, the material unexpectedly burned prior to electrical input. The worker experienced slight ringing in his ears and was transported to Health Services where he was treated and released with no injuries or work restrictions. A second worker in the area reported ringing in his ears the next day and was also treated and released.

Notable Occurrences Reported in ORPS

In 2018, there were 55 fire or fire protection-related occurrences reported into the DOE Occurrence Reporting and Processing System (ORPS), a 41% decrease from the 94 in 2017. This notable decrease in reported occurrences likely reflects guidance from new ORPS Order 232.2A that combines and/or eliminates certain reporting criteria, replaces the prior six Significance Categories with three Report Levels (High, Low, Informational), and allows Informational Level reports (at Program Office discretion) to be captured only in local issues-tracking systems and not reported into ORPS. Of the 55 reported events, 12 were deemed High Level, 16 were Low Level, and 27 were Informational.

Table 2 displays summaries of the 12 fire protection-related events that were rated as High Level occurrences.

Table 2
Summaries of Notable Fire Protection ORPS Occurrences
(High Level Reports)

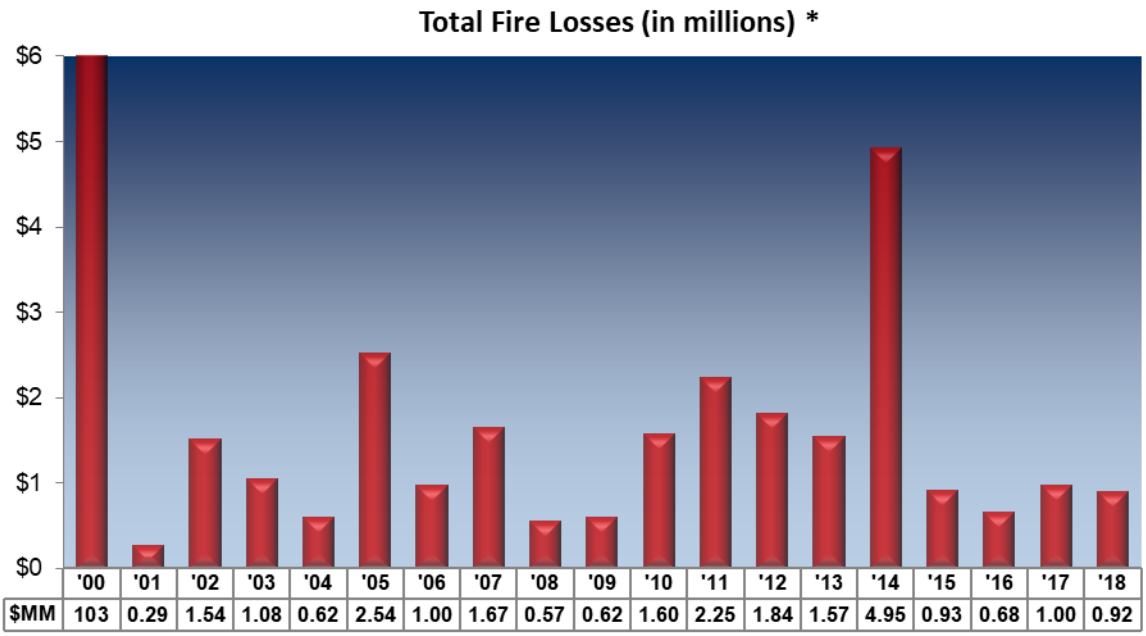
Site	Description
ID-EM	EM-ID--FID-RWMC-2018-0001 On April 11, 2018, four repackaged sludge drums experienced over-pressurization events, at least one of which ejected the lid off the drum. FD personnel responded to the alarm, identified a drum with the lid off emitting smoke, and applied extinguishing media to the drum. The fire fighters subsequently went through decontamination procedures.
INL	NE-ID--BEA-ATR-2018-0010 On June 24, 2018, the ATR Senior Reactor Operator reported flames coming from a single 120-volt AC relay in the RC-3 relay cabinet located behind the reactor control room alarm panels. Operators initiated a reactor SCRAM and manual reactor reverse. The SRO used a hand-held dry chemical fire extinguisher, which failed to extinguish the fire. The reactor control room Halon fire suppression system was manually activated. The fire was then observed to be extinguished and the ATR was verified to be in a safe shutdown condition.
LBNL	SC--BSO-LBL-OPERATIONS-2018-0003 On August 7, 2018, as part of the effort to identify and manage time-sensitive chemicals, a worker opened a jar of sodium amide inside a chemical fume hood resulting in a bright yellow flash of fire. The glass jar shattered and the fire sprinkler in the hood activated. The sprinkler activation caused severe flooding on several floors of the building.
LBNL	SC--BSO-LBL-NSD-2018-0001 On June 4, 2018, an operator at the 88-inch Cyclotron noticed smoke coming from a switchbox at the transformer pad. The FD responded and monitored the switchbox and decided fire suppressant was not necessary. The fire self-extinguished.
LANL	NA--LASO-LANL-ACCCOMPLEX-2018-0005 On October 13, 2018, failure of two 42-kV high-voltage capacitors caused the capacitor housings to rupture and the di-electric oil to burn. The heat and smoke from the small fires set off the fire alarm and the Los Alamos Fire Department (LAFD) personnel responded and monitored the situation until the fires extinguished themselves.
LANL	NA--LASO-LANL-ACCCOMPLEX-2018-0004 On August 28, 2018, a leak in a magnet cooling water line caused a loss of cooling water to five magnets in a beam line resulting in the five magnets overheating and producing smoke. The heat generated in the magnets caused damage to the epoxy on the magnet coils, which began to smoke, activating the fire alarms activated. The operators de-energized the magnets and the LAFD responded to the scene. The tunnel was full of smoke but LAFD did not find any signs of flames. An investigation identified a hose disconnected from a magnet and other magnets with damage from overheating.
NNSS	NA--NVSO-MSTS-NNSS-2018-0007 On July 28, 2018, while monitoring lightning strikes using the Wildland Fire Detection Camera System, the Operations Command Center identified fire and smoke plumes in two areas of the NNSS. Fire and Rescue (F&R) units responded to a wildland fire, but due to the remote mountainous terrain could not gain access to the fire. With no assets at risk and lightning still in the area, F&R established a fire watch. There are no structures or radiological contaminated areas located at or near the fire location. Due to the active fire and ongoing fire operations, personnel were restricted from access and the roadways were barricaded.

Summaries of Notable Fire Protection ORPS Occurrences (continued) (High Level Reports)

PNNL	SC--PNSO-PNNL-PNNLBOPER-2018-0008 On September 30, 2018, a power operator heard a noise coming from Physical Sciences Laboratory. Upon opening the door, he found damage to a fume hood, evidence of heat, broken glass, and smoke damage to the ceiling tiles. The FD investigated and confirmed there was no ongoing fire. Further evaluation determined an unintended explosion had occurred.
PAD	EM--PPPO-FRNP-PGDPDAR-2018-0011 On September 15, 2018, the Paducah Site experienced a total loss of site power when a Tennessee Valley Authority (TVA) power line fell across a secondary line and resulted in a small grassland fire that was confined within the site boundary. An Operational Emergency was declared. On-site and local county firefighters responded to the grassfire and extinguished it.
SNL	NA--SS-SNL-NMSITE-2018-0003 On July 12, 2018, a series of events related to fire alarm notifications occurring at Technical Area V (TA-V) called into the question the health of the Corporate Fire Protection Program. Several issues, taken together, were deemed to constitute a systemic failure of the Fire Protection Program. The Senior Manager at TA-V declared a TSR violation for the three nuclear facilities within the TA-V footprint. All work was paused, and access was restricted pending development of compensatory measures and actions.
SNL	NA--SS-SNL-6000-2018-0003 On June 12, 2018, while conducting a test at Thunder Range, a high voltage firing system failed to fire. While placing the high voltage firing system into a safe configuration, the Explosives Operator removed the firing cable and installed the shorting plug, receiving a shock during the process. The EO was transported to the hospital and then released.
SNL	NA--SS-SNL-NMSITE-2018-0002 On April 11, 2018, contractor personnel were using a digger-derrick truck with a boom to remove an old electrical pole on the ground under re-energized overhead lines. The boom of the truck came within the arc flash restricted area boundary and the proximity of the boom claw to the energized line caused an electrical arc, severing the aluminum cabling line which dropped to the ground. The arc flash caused the line interrupter to trip and de-energize the cable; however, after the line hit the ground the circuit re-closer at the substation automatically re-energized the line, which initiated a fire because the line was on the ground and in contact with dry grass. The FD was contacted to control and extinguish the resulting brush fire.

Fire Protection Losses

Figure 1
DOE Property and Facility Fire Loss Amounts Since 1999



	'00	'01	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	'18
$MM	103	0.29	1.54	1.08	0.62	2.54	1.00	1.67	0.57	0.62	1.60	2.25	1.84	1.57	4.95	0.93	0.68	1.00	0.92

Note: The CY 2000 figure includes $100 million LANL range fire loss, and the CY 2014 total includes the $2.4 million WIPP vehicle fire event.

* In the *Annual Fire Protection Summary* reports from 2011-2014, Fire Protection Loss figures included both fire losses and non-fire losses, such as system leaks, spills and unintentional releases. Prior to 2011 and from 2015 forward, the figures include only losses from actual fire events. Non-fire loss events are detailed in the *Water-Based Fire Suppression System Actuations* and *Non-Water-Based Fire Suppression System Actuations* sections of this report.

Table 3
DOE 2018 Fire Protection Loss Events

Loss Category	Fire Loss Type	No. of Events *	Loss Amount
Fire Loss Events	Fire/Smoke Vehicle	3 Events	$11,906
	Fire/Smoke Brush	9 Events	$229,820
	Fire/Smoke Other	13 Events	$43,474
	Fire/Smoke Building	28 Events	$632,736
	Total Fire Loss Events	**53 Events**	**$917,936**
Non-Fire Loss Events	Leaks, Spills, Releases	16 Events	$99,084
	Total Fire Protection Loss Events	**69 Events**	**$1,017,020**
None	No Monetary Losses	27 Events	$0.00
	Total Fire Protection Events	**96 Events**	**$1,017,020**

In 2018 there were 96 total fire protection events reported into the Fire Protection Reporting Database, a decrease of 5% from the 101 in 2017, resulting in $1,017,020 in monetary losses, also a 5% decrease from $1,070,080 in 2017. Of the 96 total events, 69 resulted in monetary losses, up 8% from 64 in 2017.

Of the 69 events resulting in monetary losses, 53 were fire loss events (directly attributable to fire or smoke), a 2% increase from 52 in 2017, and 16 were non-fire loss events (leaks, spills, and inadvertent releases), up 33% from the 12 in 2017. There were an additional 27 events with no reported costs.

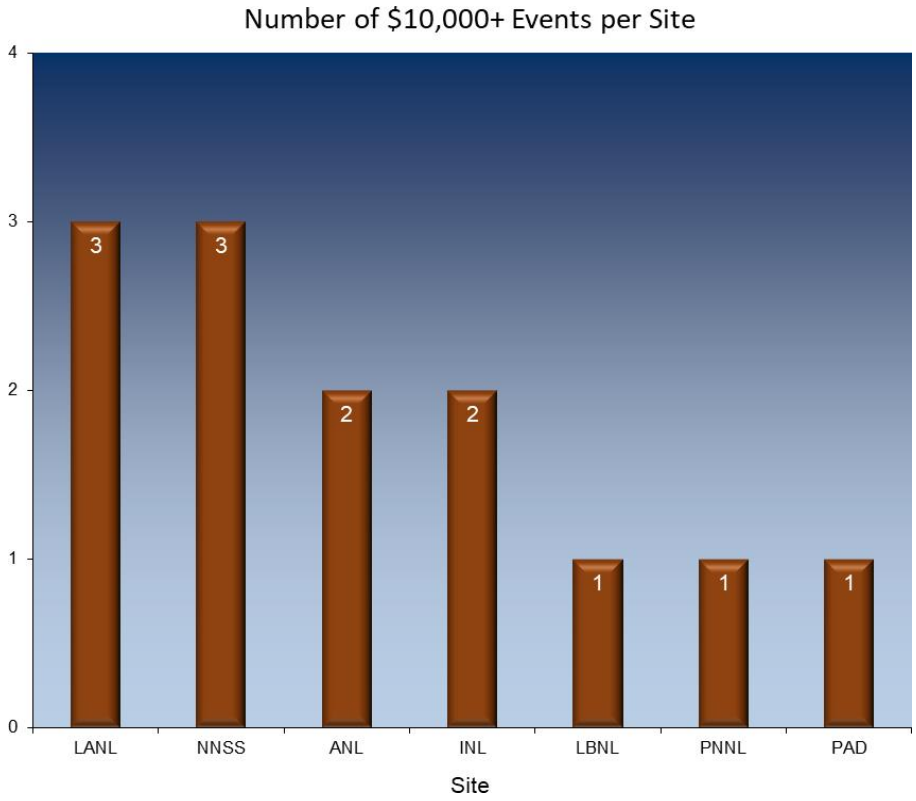
The 53 fire loss events in 2018 resulted in $917,936 in fire losses, a 9% decrease from $1,008,295 in 2017. The 16 non-fire losses (leaks, spills or inadvertent releases) resulted in $99,084 in losses, a 60% increase from $61,786 in 2017.

The 27 events with no reported costs are typically small incidents that were resolved quickly by local staff, or events where all associated costs were absorbed by the Fire Department. They are not included in the counts presented later in this report, except as part of the number of water-based and non-water-based system actuations.

Major Fire Loss Events

The fire loss data indicates that a small proportion of incidents constitute the majority of the $917,936 total fire protection losses reported by DOE sites. In 2018, there were 13 major fire losses at 7 sites costing $10,000 or more, compared with 15 major losses at 10 sites in 2017. Of these, 4 resulted in losses of $50,000 or greater, compared with 5 losses in 2017. The 13 major loss events (25% of the 53 total events) represented $835,677, or 91% of the reported 2018 fire losses for the entire Complex.

Figure 2
Significant Fire Loss Events by Site



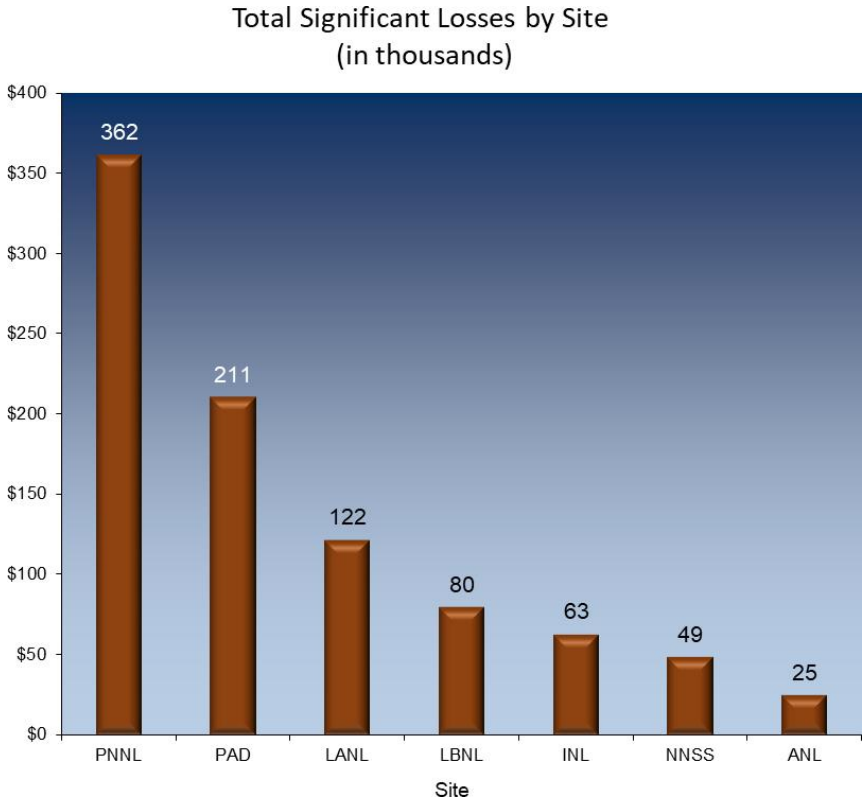
Thirteen fire loss events resulting in losses of $10,000 or greater were reported at 7 sites. LANL and NNSS each reported three significant loss events.

Table 4 provides descriptions of the four costliest fire losses ($50,000 or greater). These four incidents represent $692,000, or 75% of the total DOE fire protection losses for the year.

Table 4
Summaries of Fire Events with Losses of $50,000 or Greater

Site	Loss Type/Cause	Description	Loss Amount
LANL	Fire/Smoke (Building) Design/Material	During a routine explosive pressing operation, a pellet initiated within the press causing extensive damage to the press. Initiation of explosives is an anticipated consequence and mitigated.	$50,000
LBNL	Fire/Smoke (Building) Procedure	A contractor performing remediation of a peroxide forming chemical did not follow established workflow protocol, did not provide proper equipment, and changed the procedure without receiving approval. The peroxide forming chemical exploded upon friction (opening the container) and fused the fume hood fire sprinkler. Flooding throughout four floors occurred.	$80,000
PAD	Fire/Smoke (Brush) Electrical	A wildland fire from high voltage power supply lines on north side of plant resulted in a complete site power outage for approximately 6 hours.	$200,000
PNNL	Fire/Smoke (Building) Design/Material	There was a significant fire in the PNNL Physical Sciences Laboratory building on 9/30/18 involving a pressurized hydrogen release/fire inside a “walk-in” style fume hood as part of a Solid Oxide Fuel Cell experiment. The fire was primarily contained inside of the fume hood and caused some smoke damage to the laboratory space. A small compressed gas cylinder (lecture bottle) also ruptured causing some minor damage to the walls/ceiling and damaged an inactive leaf of a double door adjacent to the fume hood. The direct cause of the fire was not determined but appeared to be due to a failure/malfunction of a component within the fume hood. The estimated costs are for repairs and investigation support from outside experts.	$362,000

Figure 3
Significant Fire Loss Amounts by Site

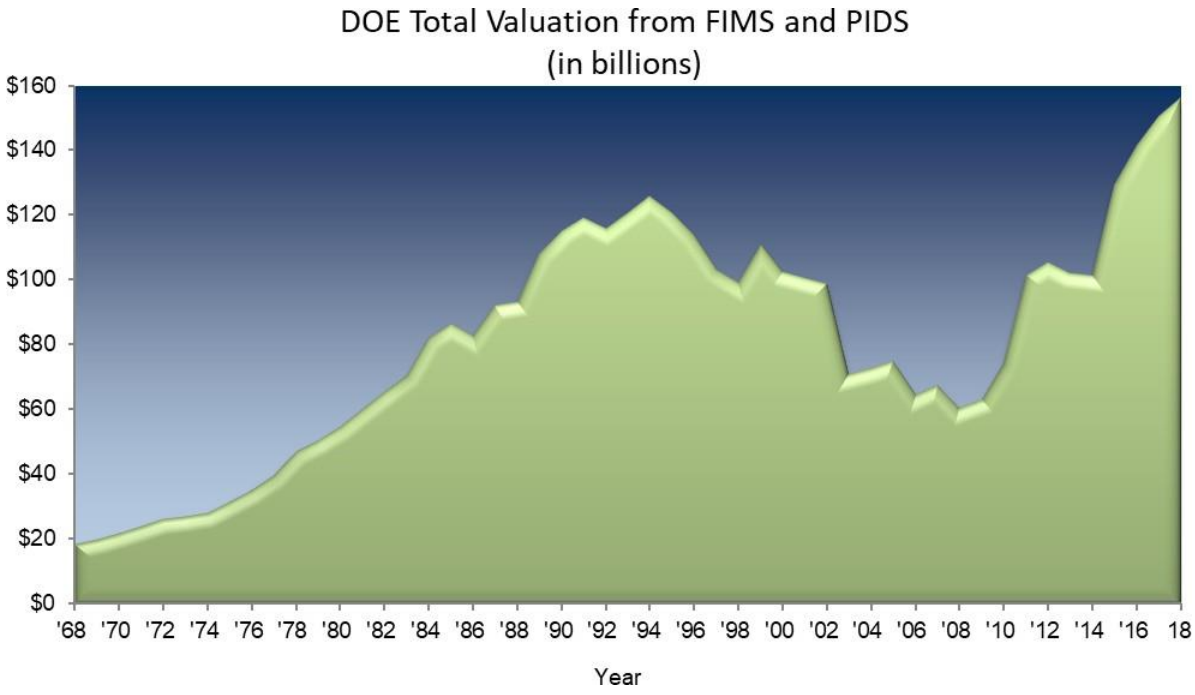


Total losses from the 7 sites above reflect fire events resulting in losses of $10,000 or greater in CY 2018. PNNL reported $362,000 in costs associated with a pressurized hydrogen release/fire inside a "walk-in" style fume hood, and Paducah reported $200,000 in losses associated with a wildland fire.

Fire Loss Rates

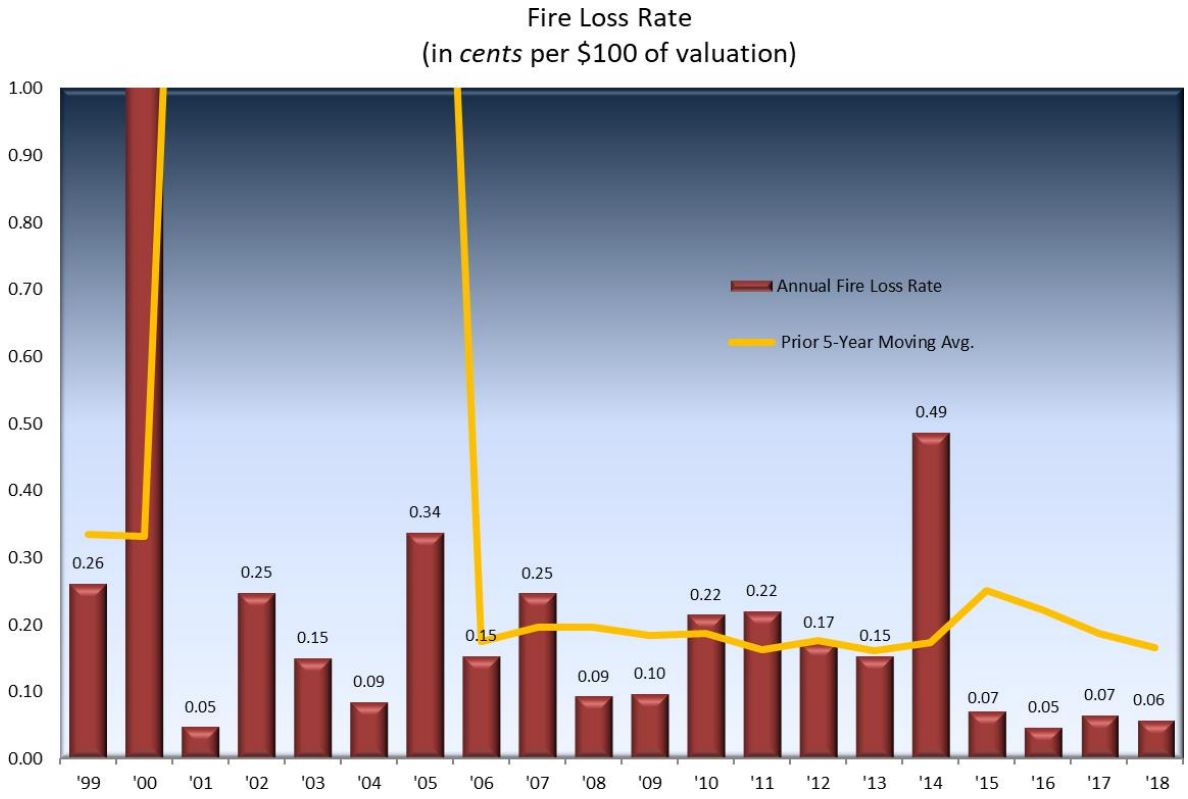
Facility and property valuation estimates serve as a common denominator for normalizing and calculating fire loss rates.

Figure 4
Total Valuation Since 1968



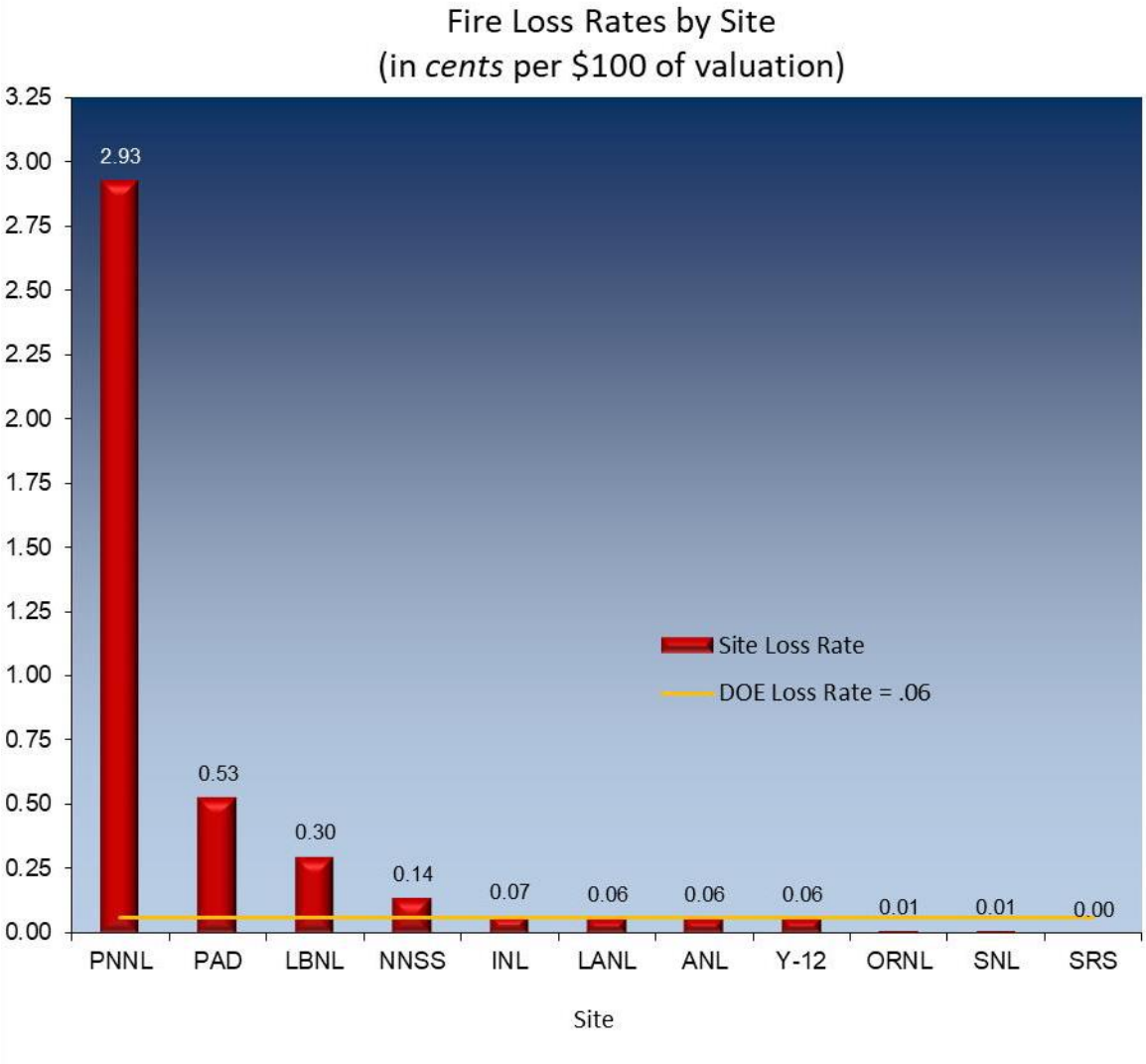
In CY 2018, total DOE valuation for sites reporting into the Fire Protection Database was $156.2 billion, a 4% increase from $150.2 billion in 2017.

Figure 5
DOE Fire Loss Rates Since 1999



DOE's calculated 2018 Fire Protection Loss Rate for sites reporting into FIMS, PIDS, and the Fire Protection Reporting Database System, was approximately 0.06 *cents* per $100 of total valuation, a 14% decrease from 0.07 in 2017. For comparison, the prior 5-year moving average is displayed as a line.

Figure 6
2018 Fire Loss Rates by Site



The fire loss rates for the 11 DOE sites reporting fire losses in 2018 are displayed in Figure 6 above. PNNL again stands out for the reported costs associated with the pressurized hydrogen release/fire inside a fume hood. For comparison, the DOE-wide 2018 rate of .06 *cents* per $100 is displayed as a line.

DOE Fire Loss History

Table 5
DOE Fire Loss History

Year	Valuation (Millions)	Fire Loss (Dollars)	Fire Loss Rate (Cents per $100 Valuation)	Previous 5-Year Average (Cents per $100 Valuation)
1950	1,800.00	496,439	2.76	–
1951	2,177.10	356,115	1.64	–
1952	3,055.10	805,707	2.64	–
1953	4,081.00	575,572	1.41	–
1954	6,095.90	375,874	0.62	–
1955	6,954.20	455,788	0.66	1.81
1956	7,364.10	3,147,423	4.27	1.39
1957	7,973.20	1,476,599	1.85	1.92
1958	8,102.50	751,825	0.93	1.76
1959	10,301.80	1,197,901	1.16	1.67
1960	10,708.60	1,401,051	1.31	1.77
1961	11,929.90	5,856,055	4.91	1.91
1962	12,108.80	3,313,364	2.74	2.03
1963	13,288.90	1,376,054	1.04	2.21
1964	14,582.80	1,351,035	0.93	2.23
1965	15,679.30	3,850,069	2.46	2.18
1966	16,669.00	856,973	0.51	2.41
1967	17,450.90	2,782,934	1.59	1.53
1968	18,611.90	869,083	0.47	1.31
1969	20,068.30	28,054,334	13.98	1.19
1970	22,004.30	1,700,792	0.77	3.80
1971	24,155.80	1,936,049	0.80	3.47
1972	26,383.50	920,651	0.35	3.52
1973	27,166.70	2,375,688	0.87	3.27
1974	28,255.50	1,179,877	0.42	3.36
1975	31,658.30	5,252,349	1.66	0.64
1976	35,512.70	2,292,576	0.65	0.82
1977	39,856.10	3,613,984	0.91	0.79
1978	47,027.10	17,477,979	3.72	0.90
1979	50,340.80	2,541,023	0.50	1.47
1980	54,654.70	8,545,935	1.56	1.49
1981	59,988.80	4,643,488	0.77	1.47
1982	65,360.40	4,200,968	0.64	1.49
1983	70,484.40	10,497,062	1.49	1.44
1984	82,166.90	6,467,320	0.79	0.99
1985	86,321.84	4,129,297	0.48	1.05
1986	82,787.52	5,295,292	0.64	0.83

DOE Fire Loss History (continued)

Year	Valuation (Millions)	Fire Loss (Dollars)	Fire Loss Rate (Cents per $100 Valuation)	Previous 5-Year Average (Cents per $100 Valuation)
1987	91,927.20	3,010,829	0.33	0.81
1988	92,998.00	8,303,120	0.89	0.74
1989	107,948.00	7,505,551	0.70	0.63
1990	115,076.00	17,470,746	1.52	0.61
1991	118,868.68	2,428,805	0.20	0.81
1992	118,267.06	3,653,554	0.31	0.73
1993	119,826.25	3,018,534	0.25	0.72
1994	124,350.29	3,403,650	0.27	0.60
1995	120,321.68	1,632,466	0.14	0.51
1996	113,471.00	6,025,832	0.53	0.23
1997	102,947.24	6,112,887	0.59	0.30
1998	99,127.79	1,378,788	0.14	0.36
1999	110,858.47	2,911,040	0.26	0.33
2000	102,514.01	103,174,122	10.06	0.33
2001	103,215.56	505,586	0.05	2.32
2002	98,779.44	2,461,847	0.25	2.22
2003	70,812.80	1,075,309	0.15	2.15
2004	72,601.95	622,613	0.09	2.16
2005	74,951.25	2,537,565	0.34	2.12
2006	64,547.05	997,805	0.15	0.17
2007	67,382.01	1,674,515	0.25	0.20
2008	60,576.55	573,161	0.09	0.20
2009	63,569.89	623,299	0.10	0.18
2010	74,417.99	1,608,762	0.22	0.19
2011*	101,351.17	2,250,744	0.22	0.16
2012*	105,238.57	1,840,121	0.17	0.18
2013*	101,940.69	1,572,342	0.15	0.16
2014*	101,437.21	4,953,200	0.49	0.17
2015	129,041.10	929,879	0.07	0.25
2016	141,386.52	679,619	0.05	0.22
2017	150,206.75	1,008,295	0.07	0.19
2018	156,161,05	917,936	0.06	0.17

* The *Fire Loss (Dollars)* figures from 2011-2014 (column 3 above) include both fire and non-fire losses such as system leaks, spills, and releases. The calculated *Fire Loss Rate* and the *Previous 5-Year Average* (columns 4 and 5 above) for 2011-2014 also include both fire and non-fire losses. Prior to 2011 and from 2015 forward, the figures reflect only actual fire losses.

Recurring Fire Protection Program Costs

Total DOE recurring fire protection costs for 2018 were $248,840,893, a 7% increase from $231,645,722 in 2017. When fire protection costs are compared with the total property valuation (extracted from FIMS and PIDS), in 2018, DOE spent approximately 15.9 *cents* per $100 (dollars) of property valuation for recurring fire protection activities. This represents a 3% increase from 15.5 *cents* per $100 in 2017.

Figure 7
Recurring DOE Fire Protection Program Costs by Activity

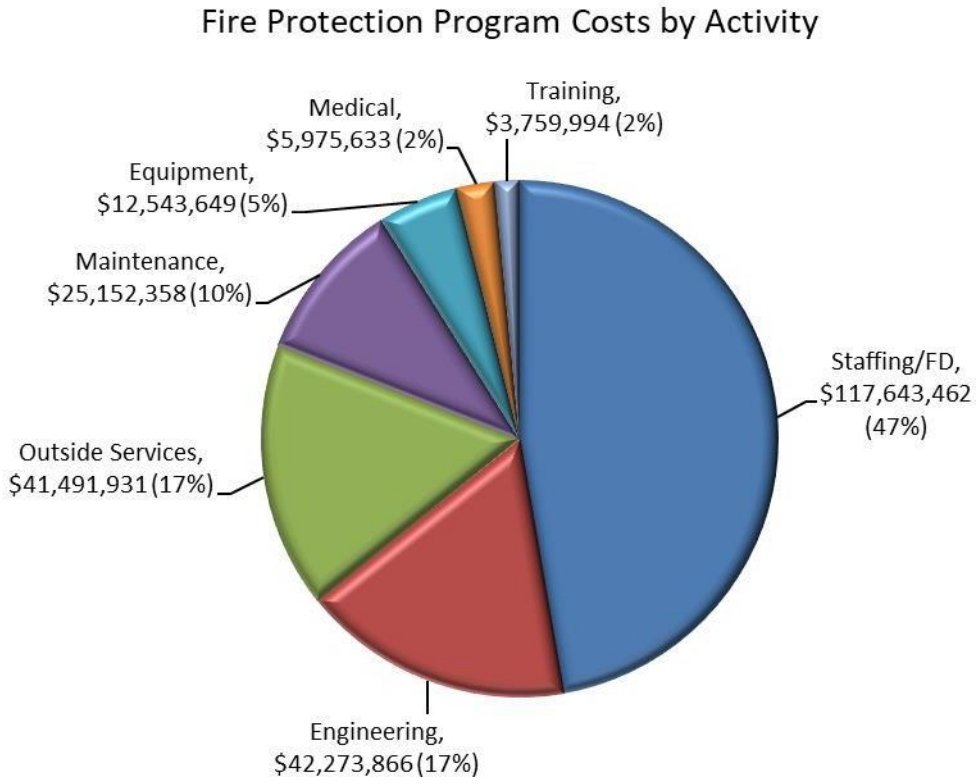


Figure 7 displays the recurring cost distribution by *Activity Type*, during the 2018 calendar year. Staffing/Fire Department costs represented 47% of all fire protection costs.

Figure 8
Recurring Fire Protection Program Cost Rates by Site

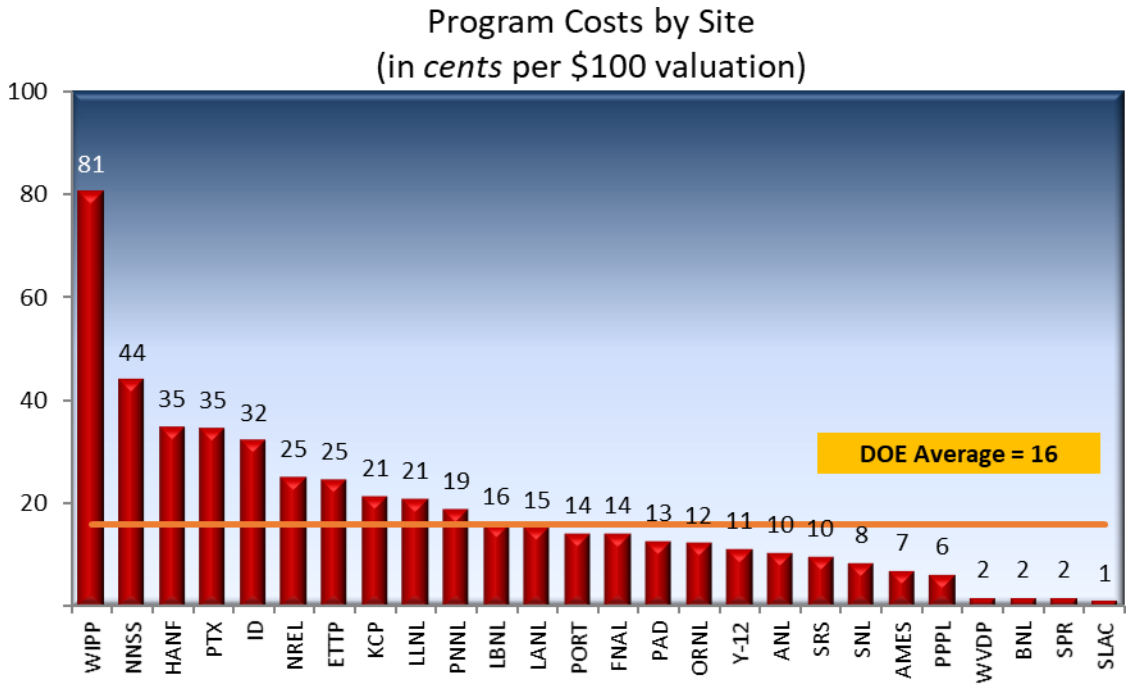


Figure 8 displays the recurring cost rates in *cents* per $100 of valuation at DOE sites. It should be noted that recurring cost activities are not consistently reported across the Complex, such as outside contracts and maintenance activities. For comparison, the DOE-wide 2018 rate of 16 cents per $100 of valuation is displayed as a line.

IMPORTANT NOTE: When preparing the 2019 report, it was discovered that one site overstated "Medical Costs" by $20,000,000 due to an input error in the Fire Protection Database. This affected not only the site's medical costs, total recurring costs, and cost rates per $100 of valuation, but the DOE-wide costs and cost rates as well. The error has been corrected in the database and amended throughout this updated report, as detailed in the *Table of Corrections in this Version* on page v.

Water-Based Fire Suppression System Actuations

In 2018, DOE facilities reported actuations of 18 wet-pipe suppression systems, 16 of which resulted in financial losses totaling $99,084, a 29% increase from $76,689 in 2017. (Two events had no costs associated with them.) The distribution of the 18 events is displayed in Table 6.

Table 6
Cause Distribution of Water-Based Fire Suppression System Actuations

Cause	No. of Events
Electrical	1
Design	2
Employee	3
Weather	4
Other/Unspecified	8
Total	**18**

The three costliest water-based actuation events ($10,000 or greater), representing $48,033, or 48% of the total water-based suppression system costs. All occurred at Y-12 as summarized in Table 7.

Table 7
Costliest Water-Based Fire Suppression System Actuations

Site	Loss Type	Description	Loss Amount
Y-12	Leaks, Spills, Releases	System wet-up due to failure of the air compressor.	$10,000
Y-12	Leaks, Spills, Releases	This was in a rooftop fan-house. The single sprinkler head actuated due to corrosion.	$18,937
Y-12	Leaks, Spills, Releases	System wet-up due to failure of the air compressor.	$19,096

Non-Water-Based Fire Suppression System Actuations

Chlorofluorocarbons, including Halon, are regulated under the 1991 Clean Air Act due to their detrimental impact on the ozone layer. The Environmental Protection Agency has published implementation regulations to: 1) prohibit Halon production; 2) establish container labeling requirements; 3) impose Federal procurement restrictions and Halon taxes; 4) issue requirements for the approval of alternative agents; and 5) list essential areas where Halon protection is considered acceptable.

DOE policy, as stated in Memorandum DOE F 132S.8, *Managed Phase Out of Halon Fixed Fire Suppression Systems,* does not allow the installation of any new Halon systems. Field organizations have been requested to aggressively pursue alternative fire suppression agents to replace existing systems, and to effectively manage expanding Halon inventories. The Department's long-term goal is the eventual replacement of all Halon systems.

In 2018, the number of reported active Halon systems at DOE sites decreased 6% to 120 systems, while inventory amounts increased 11% to approximately 48,742 pounds of Halon. The three costliest events are summarized in Table 8.

Table 8
Costliest Non-Water-Based Fire Suppression System Actuations

Site	Loss Type	Description	Loss Amount
ANL	Fire/Smoke (Building)	Inadvertent actuation of aragonite system caused by faulty pull station.	$10,000
ANL	Fire/Smoke (Building)	Inadvertent actuation of aragonite system caused by faulty pull station.	$10,000
INL	Fire/Smoke (Building)	On 6/24/18, the Advanced Test Reactor (ATR) Senior Reactor Operator (SRO) reported flames coming from a single 120V AC relay in the RC-3 relay cabinet located behind the reactor control room alarm panels. Concurrently, a manual fire alarm was activated in the reactor control room and the SRO used a handheld dry chemical fire extinguisher, which failed to extinguish the fire. The reactor control room Halon 1301 fire suppression system was manually activated. The fire was then observed to be extinguished.	$43,495

There were 7 actuations of non-water-based suppression systems reported in 2018, six of which resulted in costs of $70,995, a 147% increase from $28,764 in 2017. The three costliest events are summarized in Table 8.

Fire Department Responses

Table 9
Fire Department Responses

Call Category	2018 Reponses
HazMat Calls	203
Fire Calls	412
Other Emergency Calls	1,673
Medical Calls	1,924
Non-Emergency Calls	2,277
Total Fire Department Reponses	**6,489**

In 2018, DOE reported 6,489 Fire Department responses, an 11% increase from 5,860 in 2017. The distribution of Fire Department response types is displayed in Table 9.

Note: Comparing this data to actual responses is challenging because sites do not report incident responses in a consistent fashion. The DOE Fire Protection Committee continues to examine the use of a standard reporting format which would comply with the National Fire Protection Association's Guide 901, *Uniform Coding for Fire Protection*, which may be linked to other DOE incident reporting programs.

Summary provided by:

Office of ES&H Reporting and Analysis