

Annual Fire Protection Program Summary for Calendar Year 2019



UNITED STATES DEPARTMENT OF ENERGY

Summary Provided by:

Office of Environmental Protection and ES&H Reporting

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Foreword

The submission of this 2019 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) 2019 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 2019 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

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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.

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

AMES	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

Valuation Definitions:

FIMS (Facility Information Management System): The Department's corporate real property database including 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).

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

Loss Definitions:

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 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.

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.

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 and fire protection-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 2019, DOE sites reported no fire or fire protection-related injuries or fatalities into the DOE Occurrence Reporting and Processing System (ORPS).

The top AU Headquarters Keyword (Table 1) associated with fire protection occurrences reported in ORPS was *Fire Protection Equipment Degradation*, assigned to 47 events (62%), followed by *Facility Fire*, assigned to 20 events (26%).

There were 76 fire or fire protection-related occurrences reported into ORPS in 2019. This is a 38% increase from the 55 occurrences reported in 2018. Of the 76 occurrences, 8 were rated *High Level* (Table 2), 32 were *Low Level*, and 36 were *Informational Level*.

Information reported by DOE elements into the Fire Protection Reporting Database documented a total of 112 fire protection losses in 2019 (Table 3), resulting in monetary losses of \$2,482,807. This represents a 17% increase in the number of events, and a 144% increase in monetary loss amounts from 2018. Of the 112 events, 71 resulted in monetary losses while 41 had no reported monetary losses.

There were 58 fire loss events (directly attributable to fire or smoke) in 2019 (Table 3), resulting in monetary losses of \$2,360,843. This represents a 9% increase in the number of events and a 157% increase in the monetary loss amounts from 2018. There were 13 non-fire loss events due to leaks, spills, or inadvertent releases related to fire-protection systems in 2019, totaling \$121,964. This represents a 19% decrease in the number of events, but a 23% increase in the monetary loss amounts from 2018.

In 2019, there were 13 *major* fire losses at 7 sites, costing \$10,000 or more (Figure 2); the same number as in 2018. Of these, 7 resulted in losses of \$50,000 or greater, compared with 4 in 2018 (see 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 2019 was \$225.2 billion, a 44% increase over 2018 (Figure 4). The calculated DOE 2019 fire loss rate for reporting sites was 0.10 *cents* for each \$100 in total site valuation, a 67% increase from 0.06 in 2018 (Figure 5).

The two largest fire loss events were the Hanford ORP laboratory fire, which resulted in a \$750,000 loss; and the Sheep Fire wildfire at Idaho National Laboratory, which resulted in a \$700,000 loss. Together, these two events represented 61% of all DOE fire losses in 2019 (Figure 6).

Recurring costs for fire protection activities were \$264,221,831 in 2019, a 6% increase from 2018 (Figure 7 displays the recurring cost distribution by *Activity Type*, during the 2019 calendar year.

As a ratio of cost to total valuation, in 2019 DOE sites spent approximately 12 cents per \$100 of valuation for recurring fire protection activities, a 26% decrease from 2018. This decrease reflects much higher facility and property valuations in 2019 used for the calculations. WIPP (77 cents), Hanford (53 cents), and NNSS (40 cents) had the highest Fire Protection Program Cost Rates (Figure 8).

The DOE reported 7,028 Fire Department responses in 2019, an 8% increase from 2018 (Table 9).

Personnel Injuries/Fatalities Reported in ORPS

There were no ORPS reportable fire or fire protection-related injuries or fatalities reported in 2019.

Fire Protection Occurrences Reported in ORPS

In 2019, there were 76 fire or fire protection-related occurrences reported into the DOE Occurrence Reporting and Processing System (ORPS), a 38% increase from the 55 in 2019. Of the 76 reported events, 8 were rated *High Level*, 32 were *Low Level*, and 36 were *Informational Level*.

Table 1 displays the distribution of Fire Protection ORPS occurrences by AU Headquarters Keyword.

Table 1: Distribution of Fire Protection ORPS Occurrences

Code	Keyword	Occurrences
03A	Fire Protection Equipment Degradation	47
03C	Facility Fire	20
03D	Explosives Safety Issue	6
03B	Fire Suppression Actuation	4
03G	Wildland Fire	2
Total		76

In 2019, *Fire Protection Equipment Degradation* represented 62% of all fire protection ORPS reports, followed by *Facility Fires* with 26%.

Table 2 (next page) displays summaries of the 8 fire protection events that were rated as *High Level* ORPS occurrences.

Table 2: Summaries of *High Level* Fire Protection ORPS Occurrences

Site	Occurrence Description
ORNL	<p>SC-OSO—ORNL-X10EAST-2019-0001</p> <p>On January 11, 2019, a haze was seen in Building 5800, Laboratory D105, followed by fire alarm and subsequent water flow alarm notifications. The building was evacuated. FD observed an operating sprinkler, smoke, and visible flames in Laboratory D103A, coming from a research air-handling unit on the mezzanine level that supplies conditioned air to an environmental chamber. Using a handline, FD personnel attacked the fire and fully extinguished it within 10 minutes.</p>
LANL	<p>NA—LASO-LANL-LANL-2019-0002</p> <p>On March 29, 2019, a brush fire was discovered in Los Alamos Canyon, near Technical Area (TA)-53. TA-53 was evacuated, an Operational Emergency was declared, and the FD began work to mitigate the fire. Following full containment of the fire, the OE was terminated, normal operations at TA-53 were restored, and access control to the area was released. The cause of the brush fire was identified as an overhead power line arcing. On identification, the fire was one acre in size and grew to ten acres before it was fully contained.</p>
Y-12	<p>NA—NPO-CNS-Y12NSC-2019-0022</p> <p>On May 20, 2019, a System Engineer (SE) saw a fire at the electrical transformer behind the salt bath of Building 9215, which was in routine systematic heating operation mode with no material being processed. The SE visually confirmed that no power was going to the main power source for the salt bath, evacuated the area immediately, informed the Shift Manager to call 911, and went outside to direct emergency personnel and Fire Protection Operations, who responded and successfully extinguished the fire with a dry chemical solvent.</p>
PTX	<p>NA—NPO-CNS-PANTEX-2019-0046</p> <p>On June 8, 2019, the Deluge Eagle Quantum Premier Fire Suppression System lost communication due to the failure of Fire Alarm Receiving System. At that time, the operability requirement Limiting Condition for Operation (LCO) should have been entered until a Panel Watch was established or transmission was restored, but the LCO was not entered during the brief outage, resulting in a Technical Safety Requirement violation.</p>
PTX	<p>NA—NPO-CNS-PANTEX-2019-0051</p> <p>On July 18, 2019, a battery booster pack/jump pack unit on the East wall of the parts/tool crib overheated and ignited combustible materials in the Vehicle Maintenance Facility. The fire caused the activation of a single sprinkler head on the fire suppression system. After the fire was extinguished, the fire suppression system was shut down to limit water damage to the area. Firefighters reported that although the fire suppression system extinguished most of the fire, they still had to extinguish flames a foot high in the primary area of the fire.</p>

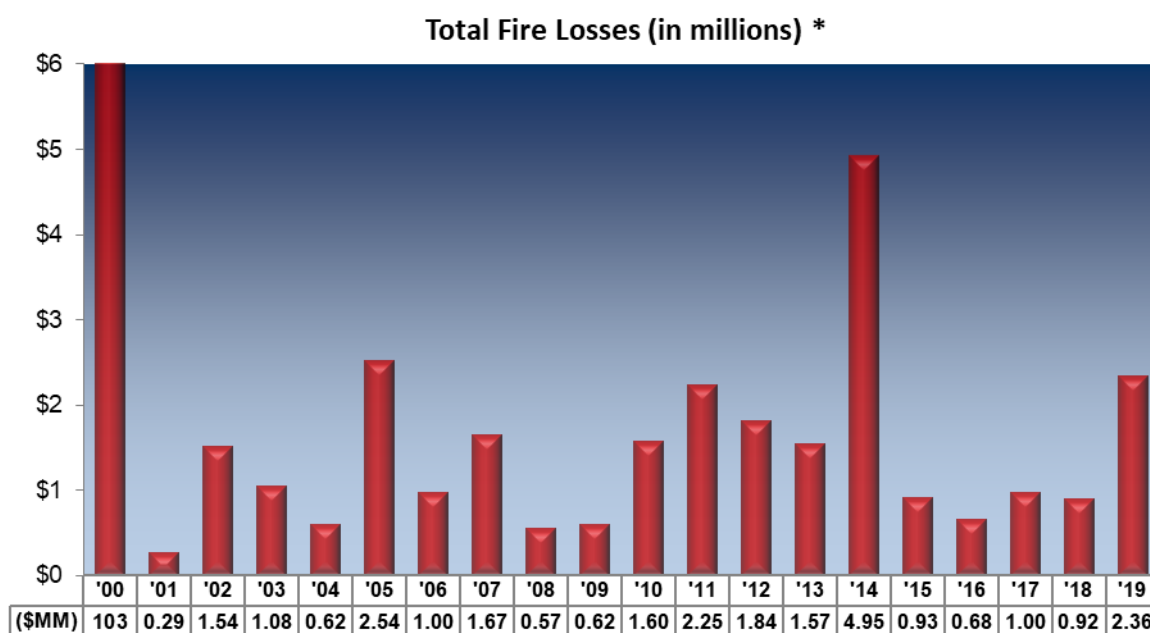
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Site	Occurrence Description
FNAL	<p>SC—FSO-FNAL-FERMILAB-2019-0007</p> <p>On July 8, 2019, a High Level RF Booster Technician was attaching a temporary cable for a bus bar thermal measurement to a cable tray located above and to the rear of a row of power supplies. As the technician was climbing down, his lanyard, which held a film badge and pocket dosimeter, fell into a gap in the top cover of the supply above the main circuit breaker of the supply, initiating an arc-flash as it made contact with the line-side terminals. The worker's wrist was exposed to the arc-flash as he swept the lanyard back out of the gap with his hand. The arc extinguished when the lanyard was pulled out of the gap. The dosimeters had ignited, and the technician used his hands to extinguish them. The technician reported the incident to supervision and was sent to the Fermi Medical Office, where first aid was given for the burn.</p>
INL	<p>NE-ID—BEA-CFA-2019-0003</p> <p>On July 22, 2019, a lightning strike ten miles northeast of the Materials and Fuels Complex (MFC) started a wild land fire. The fire (named the Sheep Fire) burned 87,000 acres. Variable winds made it difficult to extinguish and the fire encroaching on a number of Idaho National Laboratory (INL) complexes. A site area emergency was declared. As the fire grew, evacuation of MFC, the Advanced Test Reactor Complex, Central Facilities Area, Naval Reactor Facilities, Idaho Nuclear Technologies and Engineering Center, the Radioactive Waste Management Complex, and Advanced Mixed Waste Treatment Project complexes occurred. INL firefighters and heavy equipment operators were deployed to assist with fire containment. No commercial power to INL facilities was lost during the fire and most importantly, no personnel were injured either evacuating from the area or in fighting the fire.</p>
LBNL	<p>SC---LBL-BS-2019-0003</p> <p>On December 9, 2019, a researcher was performing an acid to alcohol reduction reaction in a chemical fume hood on the fourth floor of Building 978, Room 4310. This reaction involves a quenching step where 100 milliliters of 15% sodium hydroxide is added, which is an exothermic step. A failure occurred during this step exposing the lithium aluminum hydroxide to water, which resulted in a fire inside the fume hood. This activated the fire sprinkler located inside the fume hood, releasing up to 2,000 gallons of water. The fire was contained in the fume hood and extinguished by the water.</p>

Fire Losses

Fire Losses are events that involve fire, smoke, or both, that result in monetary losses. Figure 1 displays the 20-year trends of fire losses at DOE

Figure 1: DOE Property and Facility Fire Loss Amounts Since 2000



In 2019, DOE elements reported \$2,360,843 in fire losses, a 144% increase over 2018.

Note: The 2000 figure includes the \$100 million loss from the LANL range fire, and the 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 displays the 2019 distribution, type, and monetary losses associated with Fire Loss and Non-Fire Loss events (leaks, spills, and releases).

Table 3: Fire Protection Loss Events

Loss Category	Fire Loss Type	No. of Events	Loss Amount
Fire Loss Events	Fire/Smoke Vehicle	3 Events	\$20,500
	Fire/Smoke Brush	6 Events	\$730,460
	Fire/Smoke Other	16 Events	\$794,550
	Fire/Smoke Building	33 Events	\$815,333
	Total Fire Loss Events	58 Events	\$2,360,843
Non-Fire Loss Events	Leaks, Spills, Releases	13 Events	\$121,964
	Total Fire Protection Loss Events	71 Events	\$2,482,807
None	No Monetary Losses	41 Events	\$0.00
	Total Fire Protection Events	112 Events	\$2,482,807

In 2019 there were 112 total fire protection events reported into the Fire Protection Reporting Database, a 17% increase from the 96 in 2018, resulting in \$2,482,807 in monetary losses, a 144% increase from \$1,017,020 in 2018. Of the 112 total events, 71 resulted in monetary losses, up 3% from 69 in 2018.

Of the 71 events resulting in monetary losses, 58 were fire loss events (directly attributable to fire or smoke), a 9% increase from 53 in 2018; and 13 were non-fire loss events (leaks, spills, and inadvertent releases), down 19% from the 16 in 2018. There were an additional 41 events with no reported costs.

The 58 fire loss events in 2019 resulted in \$2,360,843 in fire losses, a 157% increase from \$917,936 in 2018. The 13 non-fire losses (leaks, spills, or inadvertent releases) resulted in \$121,964 in losses, a 23% increase from \$99,084 in 2018.

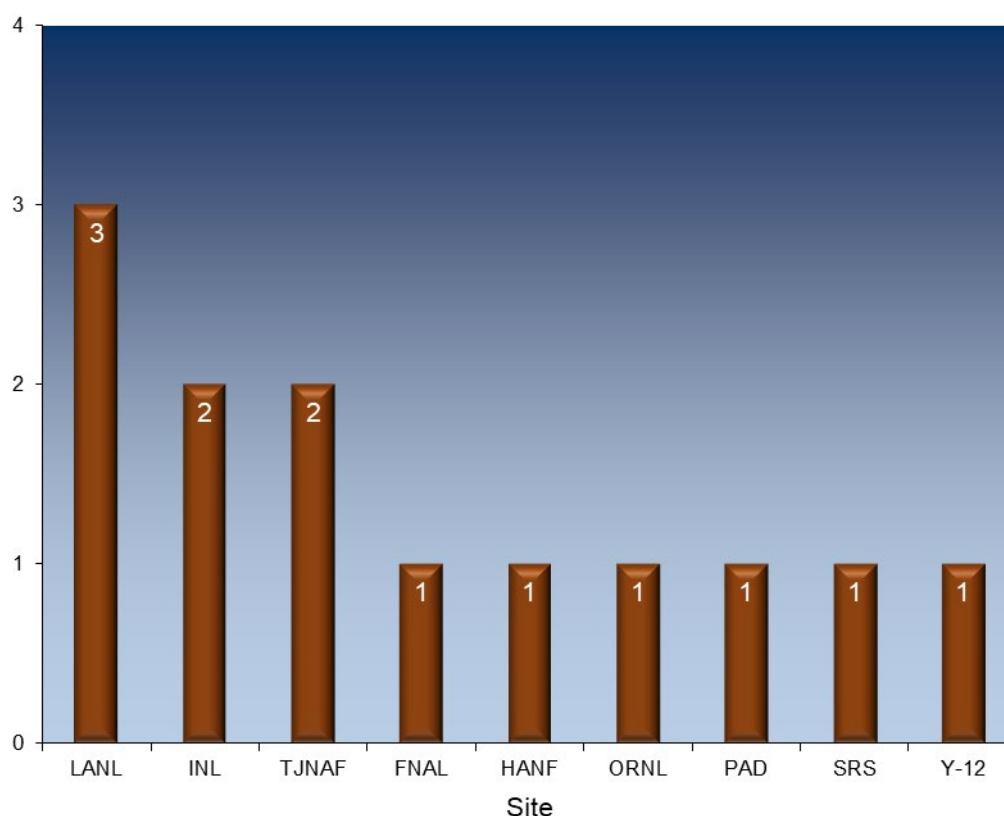
The 41 events with no reported costs are typically small incidents that were resolved quickly by local staff, or events where all associated costs were absorbed by the Fire Department. They are not included in the counts presented later in this report, except as part of the number of water-based and non-water-based system actuations.

Major Fire Loss Events

A small proportion of the fire events constitute the majority of the \$2,360,843 total fire losses reported by DOE sites. In 2019, there were 13 major fire losses at 7 sites costing \$10,000 or more, the same number as in 2018. The 13 major loss events (22% of the 58 total events) represented \$2,207,001, or 93% of all reported fire losses in 2019. Of the 13 events, 7 resulted in losses of \$50,000 or greater, compared with 4 in 2018.

Figure 2 displays the distribution of the 13 major (\$10,000+) fire loss events at DOE sites.

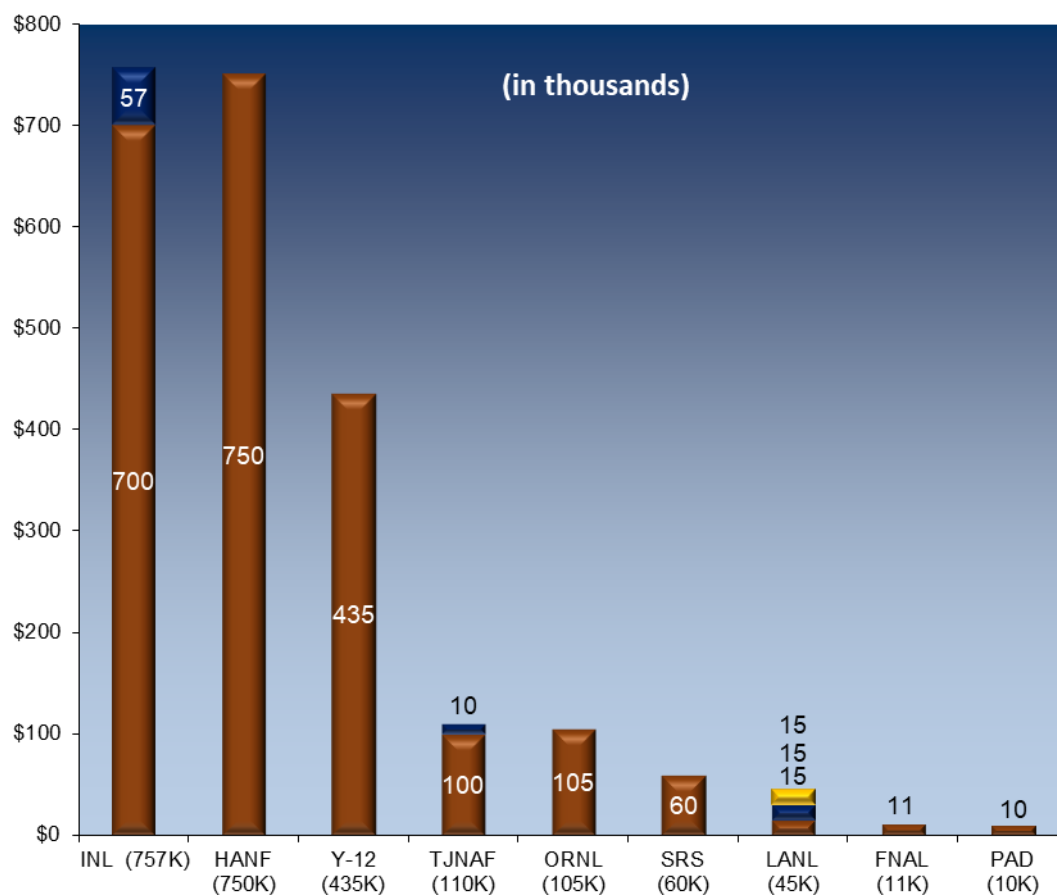
Figure 2: Major Fire Loss Events by Site



DOE sites reported 13 major fire loss events at 9 sites resulting in losses of \$10,000 or greater in 2019. LANL reported three and INL and TJNAF each reported two major fire loss events.

Figure 3 displays the monetary loss amounts of the major fire loss events at DOE sites.

Figure 3: Major Fire Loss Amounts by Site



Of the 9 sites that reported the 13 major fire loss events in 2019, INL reported \$757,000 in costs associated with two events, while HANF (ORP) and Y-12 reported events of \$750,000 and \$435,000, respectively. While LANL reported 3 major events, they were relatively small in monetary losses.

Table 4 provides summaries of the 7 costliest fire losses (\$50,000 or greater). These 7 events represent \$2,207,001, or 93% of all 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
HANF (ORP)	Fire/Smoke (Other)	A fire occurred at 222-S Laboratory Building resulted in fire damage to a gas chromatograph (CG) and the associated thermal desorption unit (TDU). Hanford Fire Department and 222-S Laboratory personnel responded. The fire self-extinguished.	\$750,000
	Other Cause		
INL	Fire/Smoke (Brush)	In the "Sheep Fire", lightning caused a fire that would become largest in INL history involving over 112,000 acres. Over 15 agencies assisted in the 5-day event. No injuries or interruption of power to INL missions. Approximately \$500,000 in suppression costs, \$60,000 in power pole and sign damage, and \$140,000 in emergency restoration expenses.	\$700,000
	Weather		
Y-12	Fire/Smoke (Building)	An internal failure in a transformer that supplied power to a salt bath resulted in a fire destroying the transformer unit. The Fire Department responded and extinguished the fire using two 20 lb. dry chemical fire extinguishers.	\$434,901
	Electrical		
ORNL	Fire/Smoke (Building)	A "haze" was seen in Building 5800, Laboratory D105, followed by fire alarm and subsequent water flow alarm notifications. The building was evacuated. FD observed an operating sprinkler, smoke, and visible flames in Laboratory D103A, coming from a research air-handling unit on the mezzanine level that supplies conditioned air to an environmental chamber. Using a handline, FD personnel attacked the fire fully and extinguished it within 10 minutes.	\$105,000
	Design/Material		
TJNAF	Fire/Smoke (Building)	HMS Q2 PSU in Hall-C failed. The PSU had just undergone a polarity change and was ramped up to 623.00A. After less than a minute, the PSU tripped off due to DC Power overload.	\$100,000
	Procedure		

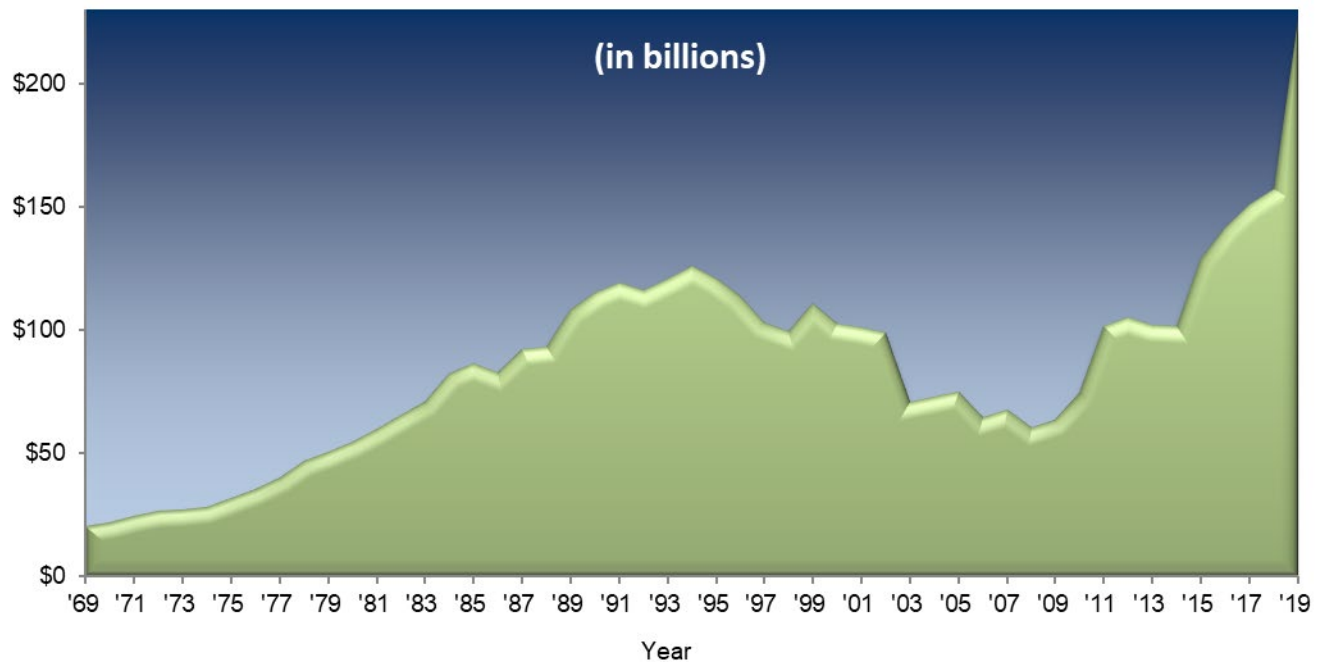
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Site	Loss Type/Cause	Description	Loss Amount
SRS	Fire/Smoke (Building)	SRSFD responded to an office trailer on fire. Units arrived to find fire and smoke. Fire attack was initiated, and fire was extinguished with hose lines. An investigation found the area of origin to be near the HVAC unit.	\$60,000
	Other Cause		
INL	Fire/Smoke (Building)	During the digestion of a soil sample in lab A-1 at IRC, a fire occurred in an analytical microwave. The researcher placed the sample in the analytical microwave and left the instrument to perform other work. Upon checking the sample, flames and smoke were observed originating from the analytical microwave. The researcher exited the lab and immediate emergency actions were taken. Cause was determined to be due to the wrong probe being used.	\$57,100
	Employee		

Calculated Fire Loss Rates

Facility/property valuation is calculated by combining data from the Facility Information Management System (FIMS) and Property Information Database System (PIDS). The combined figures serve as a common denominator for calculating and normalizing fire loss rates. Figure 4 displays the total DOE valuation trend over the past 50 years.

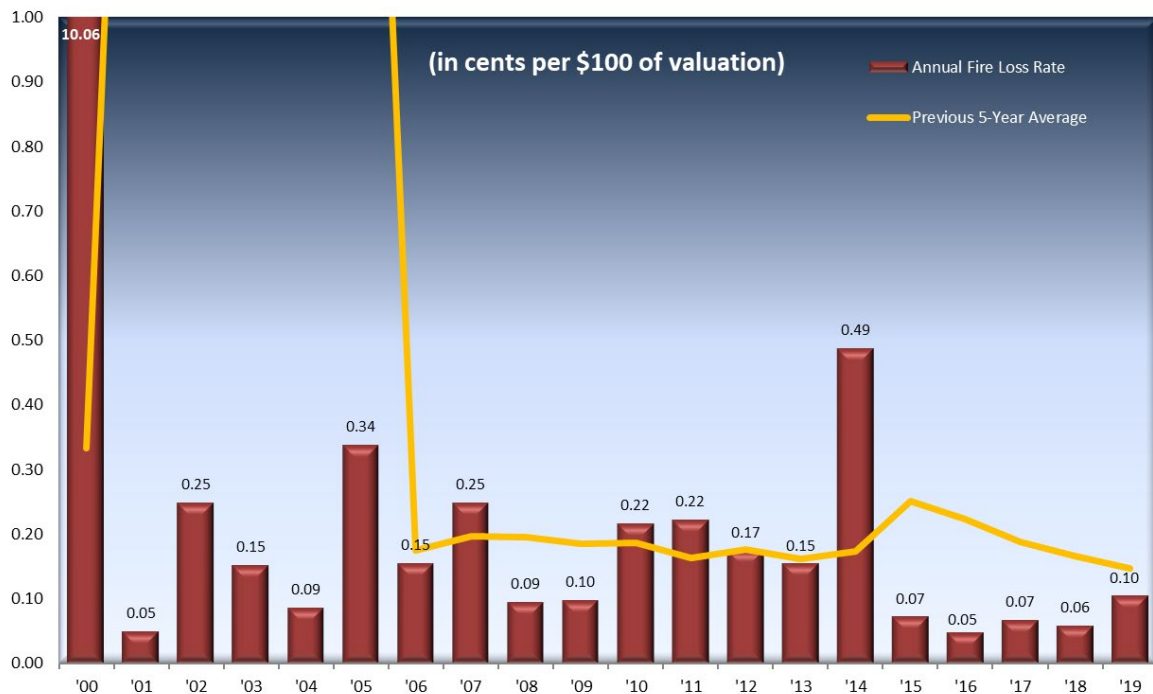
Figure 4: DOE Total Valuation from FIMS and PIDS



In 2019, total DOE valuation for sites reporting into the Fire Protection Database was \$226.1 billion, a 44% increase over \$157.0 billion in 2018.

Fire Loss Rates are calculated using monetary losses and total valuation. Figure 5 displays the DOE *Fire Loss Rates* over the past 20 years.

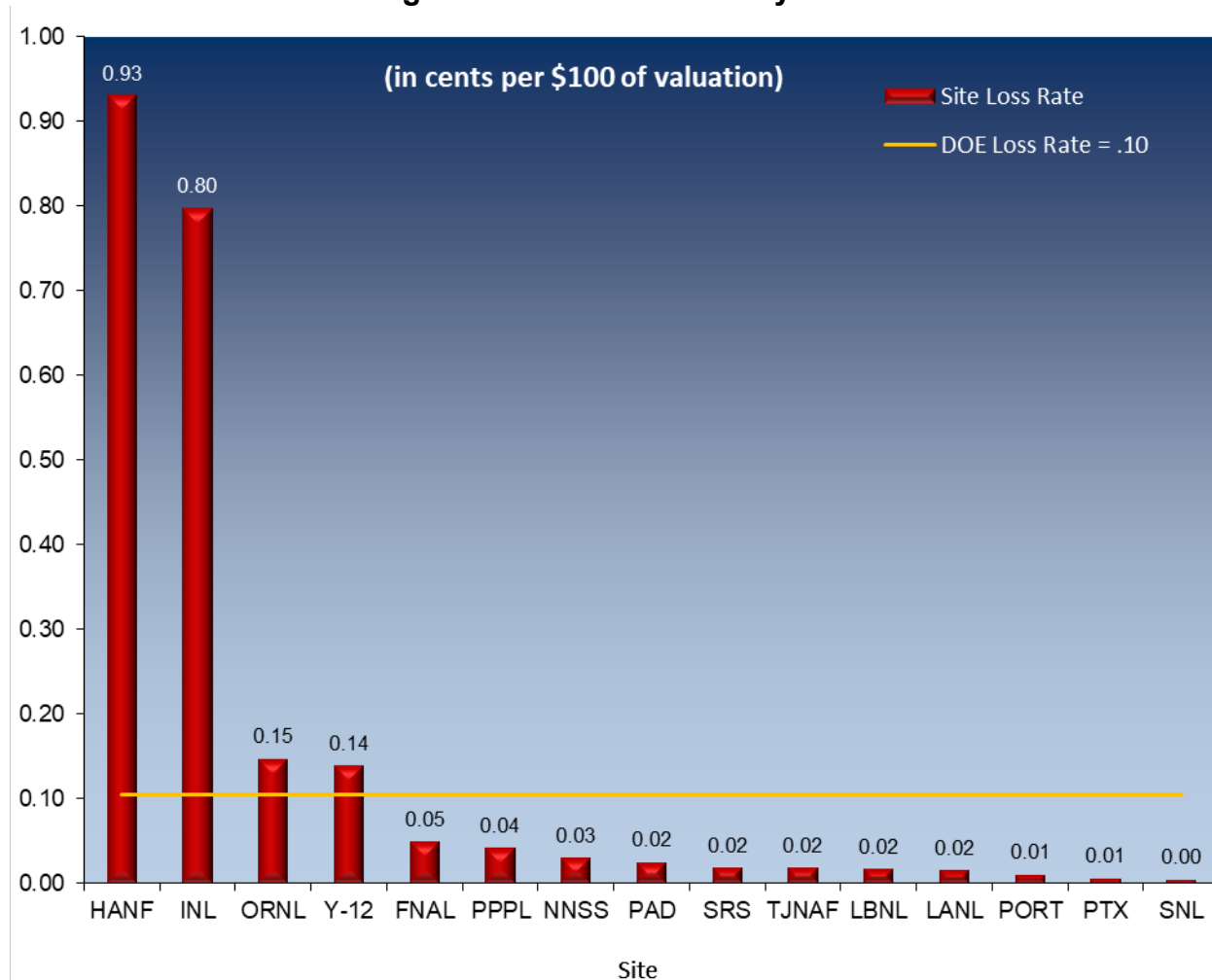
Figure 5
DOE Fire Loss Rates Since 2000



DOE's calculated 2019 *Fire Loss Rate* for sites reporting into FIMS, PIDS, and the Fire Protection Reporting Database System, was approximately 0.10 *cents* per \$100 of total valuation, a 67% increase from 0.06 in 2018. For comparison, the prior 5-year moving average is displayed as an orange line.

Figure 6 displays the calculated *Fire Loss Rates* for the sites that reported monetary fire losses into the Fire Protection Database in 2019.

Figure 6: Fire Loss Rates by Site



Fifteen sites reported fire losses in 2019, a 36% increase from 11 sites in 2018. HANF and INL had the highest *Fire Loss Rates* of 0.93 and 0.80 cents per \$100 of valuation, respectively. The DOE-wide 2019 rate of .10 cents per \$100 was a 67% increase from 2018 and is displayed as an orange line. ORNL and Y-12 also reported loss rates higher than the overall DOE rate.

The two largest fire loss events were the Hanford ORP laboratory fire (with equipment damage), which resulted in a \$750,000 loss; and the Sheep Fire wildfire at Idaho National Laboratory, which resulted in a \$700,000 loss. Together, these two events represented 61% of all DOE fire losses in 2019.

DOE Fire Loss History

Table 5 displays DOE historical fire loss information, including valuations, monetary losses, and calculated *Fire Loss Rates* since 1950.

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

DOE Fire Loss History (continued)

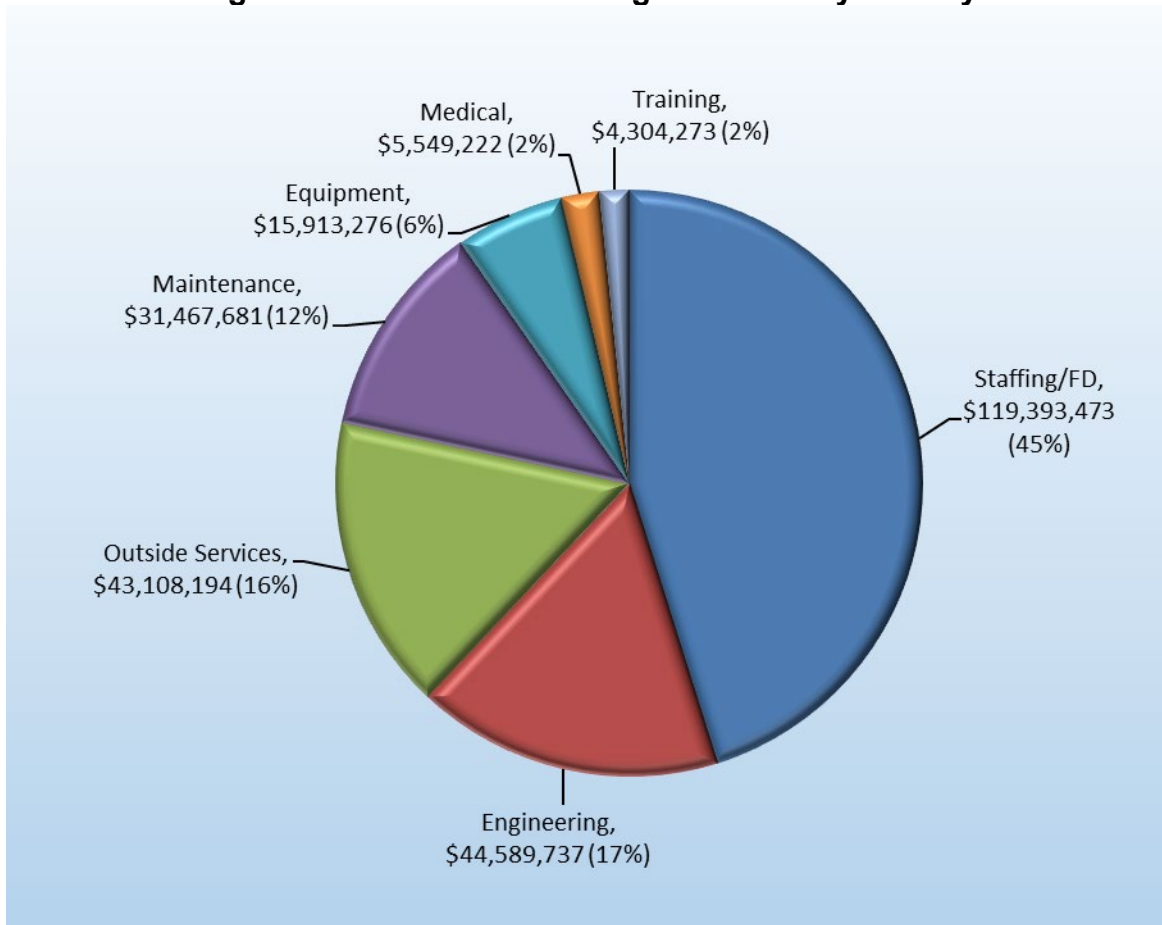
Year	Valuation (Millions)	Fire Loss (Dollars)	Fire Loss Rate (Cents per \$100 Valuation)	Previous 5-Year Average (Cents per \$100 Valuation)
1985	86,321.84	4,129,297	0.48	1.05
1986	82,787.52	5,295,292	0.64	0.83
1987	91,927.20	3,010,829	0.33	0.81
1988	92,998.00	8,303,120	0.89	0.74
1989	107,948.00	7,505,551	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	150,891.65	1,008,295	0.07	0.19
2018	156,161.05	917,936	0.06	0.17
2019	225,242.45	2,360,843	0.10	0.15

* 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

Figure 7 displays the recurring cost distribution by *Activity Type*, during the 2019 calendar year.

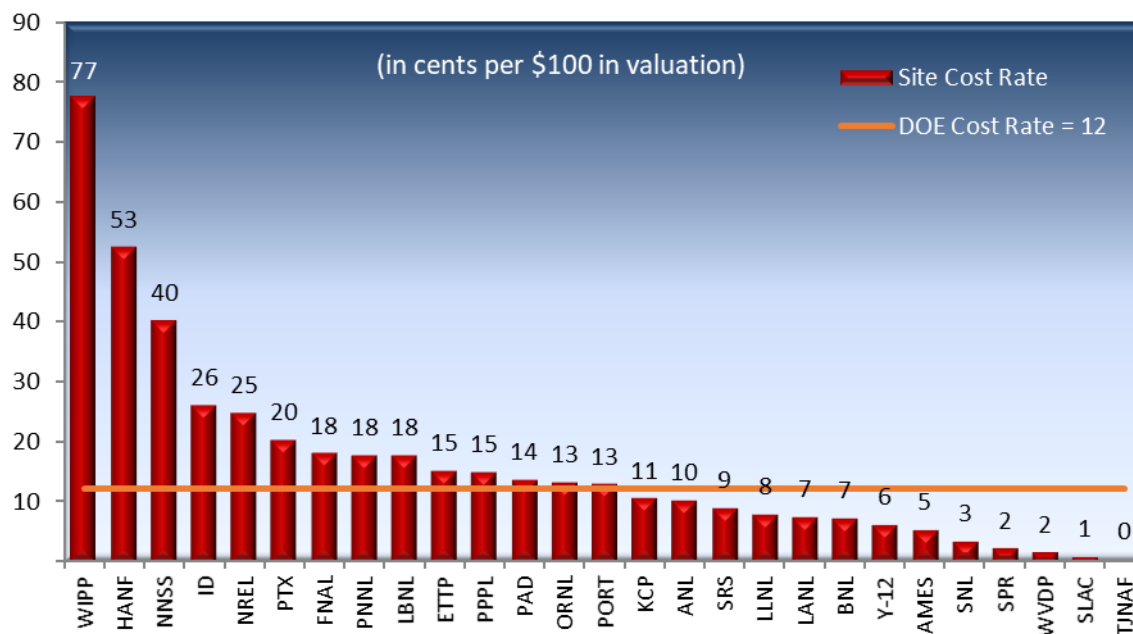
Figure 7: Fire Protection Program Costs by Activity



Total DOE recurring fire protection costs for 2019 were \$264,221,831, a 6% increase from \$248,840,893 in 2018. *Staffing/Fire Department Costs* represented 45% of all fire protection costs, compared with 47% the prior year.

A *Fire Protection Program Cost Rate* may be calculated the same way as *Fire Loss Rates*, using facility and property valuations. Figure 8 displays the *Fire Protection Program Cost Rates* for the sites.

Figure 8: Fire Protection Program Cost Rates by Site



The 2019 DOE *Fire Protection Program Cost Rate* was approximately 12 *cents* per \$100 (dollars) of property valuation for recurring fire protection activities, displayed as the orange line on the chart. This represents a 26% decrease from 17 *cents* per \$100 in 2018.

WIPP had the highest rate at 77 cents per \$100 of valuation, followed by HANF and NNSS with 53 cents and 40 cents, respectively. It should be noted that recurring cost activities are not consistently reported across the Complex, such as outside contracts and maintenance activities.

Water-Based Fire Suppression System Actuations

Table 6 displays the distribution of Water-Based Fire Suppression System Actuations by cause.

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

Cause	No. of Events
Procedure	2
Employee	2
Weather	3
Design/Material	4
Other/Unspecified	4
Total	15

In 2019, DOE facilities reported actuations of 15 wet-pipe suppression systems, 12 of which resulted in financial losses totaling \$120,364, a 22% increase from \$99,084 in 2018.

Table 7 displays summaries of the three costliest Water-Based Fire Suppression Actuation events (\$10,000 or greater), representing \$80,000 (67%) of the 2019 total.

Table 7: Costliest Water-Based Fire Suppression System Actuations

Site	Loss Type/Cause	Description	Loss Amount
LANL	Leaks, Spills, Releases	While driving a vehicle a worker experienced a personal medical condition causing the vehicle to accelerate at a high rate of speed into a building shearing the fire riser off at the base and flooding the building.	\$40,000
	Employee Related		
LANL	Leaks, Spills, Releases	A duct cool-down/spray system activated, flooding the nuclear filter plenum and ducting.	\$20,000
	Other Cause		
LBNL	Leaks, Spills, Releases	A PI was conducting research in a fume hood with a water-reactive chemical in an inert environment. The glass vessel for the experiment cracked at a seam and allowed water from an ice bath into the vessel. The water and chemical reacted and caused a heat release that activated the fume hood fire sprinkler. Approximately 500 gallons of water spilled throughout the floor, and down two floors of this multi-story building.	\$20,000
	Procedure Related		

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 2019, the number of reported active Halon systems at DOE sites decreased 3% to 116 systems. Inventory amounts also decreased 1% to approximately 48,252 pounds of Halon.

In 2019, there were 8 actuations of Non-Water-Based Suppression Systems reported, 5 of which resulted in losses of \$22,023, a 69% decrease from \$70,995 in 2018.

Table 8 displays summaries of the three costliest events.

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

Site	Loss Type	Description	Loss Amount
SNL	Fire/Smoke (Building)	Smoke from construction soldering activities activated a computer room under-floor special suppressions system. The building was evacuated and shut off power to the computer room air conditioning (CRAC) units which resulted in the loss of significant experimental data.	\$6,423
ORNL	Fire/Smoke (Other)	CO2 activation from the SNS control room when CO2 system discharged with no apparent fire or fire alarm activation.	\$5,000
ORNL	Fire/Smoke (Other)	Fire department dispatched emergency traffic for reported possible modulator #3 fire at bldg. 8300 but found no sign of smoke or fire in modulator #3. Modulator extinguishing agent had already been deployed. Thermal imaging showed no abnormal temperatures in the modulator. No signs of smoke or fire found.	\$5,000

Fire Department Responses

Table 9 displays the distribution of Fire Department Responses by Call Category.

Table 9: Fire Department Responses

Call Category	2019 Reponses
HazMat Calls	269
Fire Calls	459
Other Emergency Calls	1,909
Medical Calls	1,976
Non-Emergency Calls	2,415
Total Fire Department Reponses	7,028

In 2019, DOE reported 7,028 Fire Department Responses, an 8% increase from 6,489 in 2018.

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

