Highly Protected Risk

A Best Practice - developed by the EFCOG Fire Protection Task Group

*Revision: 0 Date:*

Contents

[INTRODUCTION 2](#_Toc10016)

[THE HPR OBJECTIVE 2](#_Toc10017)

[Programmatic Elements of an HPR Environment 2](#_Toc10018)

[Design Elements of an HPR Environment 6](#_Toc10019)

[Loss Prevention 7](#_Toc10020)

[HPR GUIDANCE 9](#_Toc10021)

[DOE Directives 9](#_Toc10022)

[Other Resources 9](#_Toc10023)

[Graded Approach 11](#_Toc10024)

[CONCLUSION 11](#_Toc10025)

*The development of this paper was a collaborative effort by fire protection subject matter experts affiliated with the Department of Energy’s EFCOG Fire Protection Task Group. The purpose of this paper is to provide guidance and education, not regulation. This paper does not claim to represent DOE’s position or policy on any topic and should not be interpreted as authoritative.*

*Revision 0 of this paper is offered as a starting point for an ongoing discussion on the term HPR. Comments and suggestions for improving the paper are welcomed and will be periodically incorporated into future revisions.*

*For more information on the term “highly protected risk”, the reader is encouraged to review;*

* DOE Order 420.1C*, Facility Safety (available at* [https://www.directives.doe.gov/*)*](https://www.directives.doe.gov/)
* DOE Standard 1066, *Fire Protection* (available at [https://www.directives.doe.gov/)](https://www.directives.doe.gov/)
* *The DOE/ERDA/AEC Fire Protection Program; A Historical Analysis* (available on the DOE fire protection repository, [http://hqlnc.doe.gov/eh/Fire+Protection.nsf/hp?OpenForm)](http://hqlnc.doe.gov/eh/Fire%2BProtection.nsf/hp?OpenForm)

# INTRODUCTION

The U.S. Department of Energy (DOE) has a portfolio of facility assets valued at over $100 billion. These facilities support programs which are vital to the security and prosperity of the United States; innovative science, energy efficiency, nuclear security, environmental cleanup, and many others. Damage to any one of these programs would be detrimental to the U.S. In some cases, the loss of a unique capability would be unrecoverable. Unlike private industries, which commonly seek protection through industrial insurance coverage, DOE does not insure its assets as a matter of federal law. To state that DOE is “selfinsured” is not accurate, since the federal government does not have an established and funded program to address losses from fire or other related events. To protect its critical facilities and operations, DOE employs a loss prevention model known as “highly-protected risk” (HPR) or “improvedrisk”.

One of the stated objectives of DOE Order 420.1C, *Facility Safety*, is to “provide a level of safety protection consistent with the ‘highly protected risk’ class of industrial risks.” Plainly, DOE endeavors to manage its fire risk in a way which is consistent with the highest expectations of a conservative insurance underwriter. This objective requires significant facilities (nuclear and non-nuclear) and processes to be protected by an overlapping combination of robust fire protection physical features, emergency response capabilities, and well-organized programmatic and procedural infrastructures. Such measures often promote fire prevention and mitigation to a greater degree than building and fire codes. In addition, there is an expectation for these various fire safety constructs to interlace with other safety programs and systems to create an overarching safety environment within DOE’s Integrated Safety Management System (ISMS).

There are three measurable outcomes of the HPR environment; reductions in fire frequency, reductions in fire severity, and reductions in fire impact (both in property damage and business interruption). These outcomes are well below the norm of comparable facilities or industries.

# THE HPR OBJECTIVE

HPR consists of facility- and/or process-specific attributes (usually defined during design) as well as programmatic elements. To employ one without the other would not satisfy the HPR model (e.g. robust design without the underpinning of a robust program is insufficient). These elements form the foundation of a comprehensive fire loss prevention program at DOE sites and facilities.

## Programmatic Elements of an HPR Environment

Invoking the design requirements of DOE-STD-1066, NFPA codes and standards, and/or FM Global Data Sheets, by itself, will not fully satisfy the Department’s objective to manage its assets at an HPR-level of protection. In addition to designed features, programmatic elements play an irreplaceable role in the umbrella of protection. Expected programmatic elements indicative of an HPR environment include:

1. **Management Commitment to Loss Prevention**: Perhaps the single most important element of an HPR protected environment is a management commitment to safety and loss prevention. This perspective is beneficially built into the ISMS perspectives embodied in DOE directives and safety philosophy, but this commitment should be codified in a fire protection policy statement that establishes and provides authority to a fire protection program, with a defined and empowered staff member as the responsible party for the program. Support of the policy

should be demonstrated in observable and documentable behaviours as an essential element of the fire protection program and a contributing element to the overarching ISMS program. It is recognized, however, that the commitment to loss prevention must be balanced against other programmatic and contractual requirements.

1. **Program and Documentation:** From the site policy and the management commitment should flow a structured program and the associated documentation to support it. Minimally, such documentation should include a site-wide program description to address design, operations, emergency response, loss prevention, wildland fire, and specific program criteria (including quality assurance within the program). The DOE orders and standards indicate that the program should: (a) document the overall program or management systems established to assign responsibilities and authorities, and define policies and requirements; and (b) provide for the performance and assessment of fire protection and emergency response program activities.

1. **Procedures:** Once a program and associated documentation is developed, procedures covering key aspects of the program are expected to be developed and maintained. As a minimum, this should include procedures on: (a) site-specific requirements, (b) staff organization, resources, training, and roles and responsibilities, (c) inspection, testing and maintenance (IT&M) of fire protection systems, (d) use and storage (including inventory control) of combustible, flammable, radioactive, and hazardous materials, (e) hot-work control, (f) identification and tracking of fire protection system impairments, (g) fire prevention measures, (h) facility and FHA assessments, (i) design and construction oversight, and (j) equivalencies, exemptions, modifications, and variances processes.

1. **Self-Assessment:** DOE orders beyond those directly applicable to fire protection, such as DOE Order 414.1, *Quality Assurance*, require a structured quality assurance program that includes self-assessment of all safety and quality programs. DOE orders and standards stipulate that a documented comprehensive evaluation of the fire protection program be performed at least every three years, by or under the supervision of a fire protection engineer, to review the adequacy of the site-wide and/or facility fire protection program. The intent of specifying a fire protection engineer is to ensure that a top-to-bottom understanding of all programmatic and technical expectations of DOE orders and standards is incorporated into the assessment program. Care must be taken in obtaining specific individuals that have detailed understanding of all aspects of the requirements applicable to the site. Utilizing Appendix E of DOE Standard

DOE-STD-1066, *Fire Protection,* or DOE Standard DOE-STD-1137, *Fire Protection Engineering Functional Area Qualification Standard,* for evaluating potential auditors is a recommended starting point. When possible, this review should include assessors who are independent of the fire protection program.

1. **Method of Managing Non-Compliances:** The DOE HPR philosophy, with respect to direct compliance, is like traditional industrial facilities, in that the DOE recognizes that consideration of a wide range of safety and other programmatic requirements can necessarily lead to noncompliances. Such non-compliances should be tracked and prioritized and are expected to be documented and either accepted by DOE or corrected. The timely completion of high-risk deficiencies is expected. Independent verification of appropriate closure may be warranted.

1. **Fire Protection Staff:** The DOE HPR philosophy necessarily requires staffing over a range of positions. As a minimum, there is an expectation that some high-level staff member or members will be responsible for program implementation. Further, a program is required to ensure that it has access to qualified, trained fire protection staff across all areas. DOE orders specifically mention engineers and emergency response staff, but past practices suggest expectations for qualified personnel across other program elements (e.g., maintenance staff, systems inspectors, fire inspectors, training staff, quality assurance investigators/auditors, etc.). Necessary staffing levels, organizational structure, training requirements, and roles and responsibilities needed to implement the fire protection program are to be established and documented. In the past, such resources were assumed to be in-house, but such resources are increasingly obtained via resource-sharing amongst sites or contract services, and can include all facets of the program. In the latter case, assumptions regarding fire protection staffing may require examining contracts, the stability of subcontractor companies, qualification packages for non-employees and a host of other issues to ensure that DOE expectations are maintained.

1. **Emergency Services:** DOE sites are expected to have access to fully staffed, equipped and trained public or private emergency service. At many locales, such services are provided via dedicated fire departments. At others, services are provided by a combination of on-site resources that might include teams outside traditional fire departments (e.g., hazardous materials response teams, medical response teams, building emergency response teams, etc.). External relationships for mutual aid or third-party specialty responses may also form a portion of the response capabilities. The objective is to maintain adequate emergency response capabilities to effectively and safely respond to and mitigate credible emergency incidents; including fire, emergency medical, hazardous materials, technical rescue, and other applicable operations. A Baseline Needs Assessment must be used to document the site’s emergency response needs and capabilities against its hazards. The emergency service provider(s) should be completing pre-incident planning, to include tactics and strategies for responding to emergencies in significant facilities, and should be regularly drilling the responding crew(s). Further, DOE facilities are expected to incorporate the emergency services providers into their larger emergency response programs, which are also required under DOE orders and expectations.

1. **Training:** On-site personnel should receive training which is commensurate with their responsibilities and the unique hazards of the site. This may include awareness of the hazards, use of fire extinguishers, protocols for emergency events and a range of other facets, depending on the level at which the personnel are involved in the fire protection program. Specific training expectations are incorporated into DOE directives for emergency response personnel. As well, there are expectations for a training and qualifications program for DOE staff and high-level program management, including fire protection engineers, commensurate with their duties. As previously noted, training expectations for other staff will be in line with their respective duties,

but the expectation for training and qualification permeates the entire fire protection program, and should not be thought to be limited to those areas specifically delineated in DOE directives.

1. **Facility Inspections:** Comprehensive facility inspections are to be conducted by trained fire protection specialists. One objective of such assessments is to validate that an HPR-level of protection is provided for significant facilities and processes. DOE HPR philosophy has been built significantly upon the ideas of low combustible loading, utilizing non-combustible materials where possible, minimization of traditional ignition sources (e.g., extension cords, exposed electrical, hot-surface equipment, smoking, etc.), and reinforcement of improved risk mentalities (e.g., don’t buy and store more than is needed, etc.). Facility inspections can be structured to provide continual feedback to self-assessment programs and be used as an indicator of management dedication to the fire protection program.

1. **Impairment Protocols:** Protocols are critical for assessing the operability of fire protection systems and for implementing compensatory measures when the system does not meet the operating requirements. Compensatory measures are determined by, or under the direction of, an FPE, based on the significance of the impairment compared to performance objectives. Further, such impairments should be evaluated based on their impact not only to fire protection issues, but also cognizant of other safety disciplines (particularly those responsible for nuclear and hazardous materials evaluation). Because of the potential impact to other operating constraints and safety programs (e.g., nuclear, criticality, hazardous materials, personnel protection, etc.), there is an expectation that the impairment system go beyond that traditionally described in National Fire Protection Association (NFPA) and insurance industry documents, and merge with the larger ISMS programs of an individual site.

1. **Inspection, Testing, and Maintenance of Systems/Features:** Systems and features are expected to be inspected, tested, and maintained in accordance with NFPA codes and standards. Failure to perform activities which prove operability casts doubt on the readiness of the system. Perhaps most fundamental to this program is identifying where systems exist, the IT&M expectations associated with individual systems (which can vary from NFPA requirements based on credit from other safety disciplines), and those responsible for IT&M operations and the quality assurance aspects that accompany the systems and those maintaining them. Once established, alterations to the frequency and means of performing IT&M activities can be accepted by the AHJ, with appropriate justification and trending. Acceptance criteria can vary considerably, with some being associated with traditional NFPA IT&M approaches where test results should be compared to previous data to determine any adverse trends to system performance or reliability. In other case, notably with safety-class and safety-significant systems, more specific criteria (including absolute values and particular test methods) are also expected and must be incorporated into test procedures.

1. **Traditional Fire Protection Program Elements:** The DOE recognizes the importance of some elements that are expected to be incorporated, with appropriate programmatic documentation and review. Such items include elements previously discussed (definition of engineering controls, fire inspection programs, etc.), but also those that interface with other safety

programs (e.g., hot work, vehicle parking and control to allow for emergency response, emergency response capabilities, etc.). The specific elements are either directly noted within

DOE orders and standards (such as hot work and wildland fire mitigation) or indirectly expected (integration with emergency management systems, those that interface with other safety programs (e.g., hot work, vehicle parking and control to allow for emergency response, emergency response capabilities, etc.).

1. **Innovation in Fire Protection:** Because the DOE Complex features unique operating environments that often do not fit within traditional fire protection approaches, an informed approach using both traditional information and cutting-edge research is often employed to ensure that the expected level of protection is achieved. While the modern operating environment is often compliance-based, thanks to 10 CFR 851 and other influences, use of traditional industrial fire protection approaches (e.g., risk analysis, process engineering and safety, etc.), performance-based information and technology that is founded in peer-reviewed and recognized research efforts are often warranted. DOE both encourages and cautions this approach, much like certain industrial sectors, recognizing that such efforts are both necessary and require consensus.

## Design Elements of an HPR Environment

The design requirements of DOE Order 420.1C, DOE-STD-1066 and applicable building codes and national codes and standards are paramount to meeting the base expectations for HPR. The design for new buildings or modifications to existing buildings must include all appropriate aspects of fire protection and life safety through design, construction, commissioning, and startup.

Plans and contemplated construction are reviewed with the objective of assuring fire risk has been adequately appraised and mitigated by controls. However, the types of controls and the overall approach vary greatly, dependent on the level of acceptable risk. In some buildings and facilities, detailed integration with other safety disciplines and specific consideration of various loss scenarios must be implemented and the idea of a “graded approach” (discussed below) needs to be kept in mind. In many areas, specific DOE design criteria and the expectation of implementation of insurance industry loss prevention documents is directly referenced in DOE directives. However, there is also an expectation that DOE site staff think beyond those documents, based on the overarching HPR philosophy discussed above, and identify solutions that best address the problem and focus on mitigation.

1. **Automatic suppression:** Automatic suppression is to be designed, installed, and maintained when a maximum possible fire loss exceeds DOE’s accepted loss limit, when a system is required by applicable codes, or when a fire hazards analysis determines a need for automatic suppression.

1. **Automatic fire detection, alarm, and notification:** Automatic fire detection is to be designed, installed, and maintained when required by applicable codes, or when a fire hazards analysis determines a need for fire detection, alarm, and notification. Central monitoring of fire alarms and prompt dispatching of the response personnel will result in arriving at the scene earlier and present an opportunity to suppress the fire before it grows beyond the capability of the responders.

1. **Manual fire suppression:**  Manual fire extinguishers are to be installed throughout the facility and regularly inspected, tested, maintained, and replaced. When required, standpipes are adequately designed, installed, and maintained.

1. **Water Supply:** An adequate and reliable water supply is provided for manual and automatic suppression needs. NFPA 1 and the building codes have developed a minimum “fire flow” requirement based on the facility construction and size.

1. **Construction materials:** Superior (fire resistive or non-combustible) construction features are designed into the structure to resist fire propagation or structural failure.

1. **Separation / Compartmentalization:** Fire barriers are to be designed, installed, and maintained when required by applicable codes, or when a fire hazards analysis determines a need for separation to limit maximum possible fire loss.

1. **Lightning Protection:** A lightning protection system is to be designed, installed, and maintained when a fire hazards analysis determines a need for such protection.

## Loss Prevention

The DOE has regularly established loss limits directly within its directives, with the requirements for engineered controls increasing as the loss potential increases. Evaluation of these losses, usually through the Fire Hazards Analysis (FHA) approach, should include not only the direct loss associated with the event, but also considerations such as:

1. **High-Value Equipment:** Traditionally, high-value equipment has been perceived as the term directly implies – equipment having a value above a specified (or program defined) dollar amount. However, the term must also be viewed as meaning important to production or mission continuity, wherein the loss of the equipment could have a direct impact, through loss of production capability, or indirectly, through extended procurement or rebuilding of unique pieces of equipment. The latter conditions require fire protection program staff and engineers to dig deeply into their facilities’ operations to clearly understand these aspects.

1. **Mission Interruption:** In the classical application within the DOE, mission interruption suggested a direct and significant impact to one of its programs. Since the late-1970s, a wider group of facilities have entered the picture, resulting in additional departments within the overall DOE structure, which has caused the idea of mission interruption to become far more nebulous. Not only are the considerations now more diverse at a high level due to the perspective of multiple divisional offices (i.e., Office of Science, National Nuclear Security Administration, Office of Energy Efficiency and Renewable Energy, Office of Fossil Energy, etc.), there may be significant variation at the field office level (i.e., multiple Field Offices at the same site), at the site level (e.g., Sandia National Laboratories’ operations across multiple sites and locations) and at the contractor level (e.g., the multiple cleanup contracts at the Hanford Site and the Idaho Cleanup Project). There may even be external influences that drive mission interruption considerations, such as “work for others” operations or co-located programs from other branches of government. It is also important to recognize that

there may be associative losses, wherein interruption of one program or mission snowballs into other programs or missions. A recent and very good example of this is the 2014 salt truck fire at WIPP, which resulted in the idling of waste shipments across the DOE complex. Fire protection program staff and engineers to work closely with their site management and DOE counterparts, often well above the scope of an individual piece of equipment, area, building or complex of structures to determine how significant a loss could be relative to the given mission.

1. **Program and/or Investigation Costs and Interruptions:** Within DOE, post-accident investigations are a default, with a minimum of a lessons-learned determination being expected for every event. These costs have, in the past, been considered part of the normal operating expenses for a site and have been neglected. Large investigations are often detailed and costly, with many subject matter experts involved, and in most cases have a significant cost, impact to mission and/or interruption to program goals. Obviously, the impacts associated can’t be easily predicted, but enough such investigations and resulting program modifications have been performed that general costs and/or impacts can potentially be determined.

1. **Environmental Protection or Restoration:** The costs associated with environmental restoration in a post-event condition was generally neglected prior to the end-of-mission conditions at several former weapons facilities in the 1990s, under the premise that cleanup would be at the discretion of the individual Site and Field Office. However, since that time a combination of more directed site budgets, environmental regulations, environmental restoration missions, expectations for protection of the environment (both public and federal) and lowering tolerances for conflict with the public has driven a focus for ensuring that protection of the environment is a programmatic priority. As such, including programmatic elements and engineered protections that help to minimize environmental impacts have become part of the DOE HPR philosophy. One example of this is the 1969 Rocky Flats fire where it took approximately 1,000,000 manhours to clean-up the area post-fire.

1. **Protection of Workers/Human Capital:** In addition to property protection, HPR concepts and protection features can be, and have been proven, effective in meeting life safety objectives. HPR concepts might require deeper consideration of chemical use and transport, additional physical protection (either spatial or via fire barriers) to segregate workers from fire health hazards, improved notification or planning for emergency conditions or increased fire prevention efforts to eliminate or reduce hazards.

1. **Consideration of External Events:** External events span a wide range of considerations that must be evaluated at each site, and in some cases individual areas within a site. Such issues have been around DOE for many years, but increased attention has come more recently. These include wildland fire management, security integration considerations (due to the potential for arson or use of fire systems in insurgency operations), fire and explosion exposures from adjacent facilities and encroachment of the public on formerly-remote DOE sites. These issues require increased attention beyond minimal considerations in codes and standards, to ensure such external events do not impact critical facilities or programs.

# HPR GUIDANCE

## DOE Directives

DOE establishes an expectation and provides some guidance in the application of HPR within the following directives;

1. **DOE Order 420.1C, *Facility Safety*:** Within DOE Order 420.1C is not only the founding reference to the HPR philosophy, but also many of the programmatic, engineering and response aspects that form DOE’s specific approach to the overall philosophy. As well, DOE Order 420.1C includes discussion of elements pertinent to DOE personnel at various levels and those assigned to contractor staff. The relationship is intentionally designed to be a combination of collaboration (in establishing and outlining the risk acceptance limitations) and oversight (ranging from selfassessments at the contractor level to HQ audits of individual sites). The approach to HPR at any given site or group of sites is founded within this relationship.

1. **DOE-STD-1066, *Fire Protection*:** DOE Order 420.1C indicates that DOE-STD-1066, or some approved equivalent, is an acceptable method to implement the HPR philosophy. Augmenting this is official correspondence from DOE indicating that application of DOE-STD-1066, or some approved equivalent, is the preferred means of implementing fire protection and life safety requirements of 10 CFR 851. DOE-STD-1066 provides a wealth of information relative to the DOE philosophy for HPR. It is, by its own definition and reference from DOE Order 420.1C, the default minimum implementation document for HPR philosophy.

The guidance provided by DOE for implementation of 10 CFR 851 also suggests adoption of DOESTD-1066 (2012 or 2016), with recognition that programs with an equivalent level of HPR philosophy can also be implemented with the approval of the local Field Office.

Deviations from the prescriptive guidance of the standard should be technically justified and documented. Methods and controls meant to comply with performance-based requirements are meant to be documented and routinely evaluated to ensure continued implementation.

## Other Resources

**1. National Fire Protection Association (NFPA) Codes and Standards:** Although NFPA codes and standards are recognized as a default baseline requirement via both DOE Order 420.1C and 10 CFR 851, it should be recognized that the adoption of the entire range of the NFPA National Fire Codes set goes well beyond common practice in the built environment. There are a range of documents from NFPA that are considered baseline protection standards due to their reference in national building/fire codes and NFPA 101, *Life Safety Code*. However, there is also a broader set that is not directly referenced by those codes and are developed for specific industry applications. These latter documents can be considered in the mix of implementing documents for the HPR philosophy, in that they are often specifically developed with some level of increased risk protection to begin with. Such documents include, but are not limited to, NFPA 45, *Standard for Protection of Laboratories Using Chemicals*; NFPA 75, *Standard for the Fire*

*Protection of Information Technology Equipment*; and NFPA 214, *Standard on Water-Cooling Towers*. To determine whether or not a particular NFPA document might contribute to the HPR philosophy requires some effort to establish whether that document is considered a baseline requirement in national building codes (e.g., NFPA 30 and NFPA 80 are referenced by the International Fire Code), if the document is repetitive to requirements of national building codes

(e.g., the NFPA 90-series documents are not significantly different from the requirements of the International Fire Code and International Mechanical Code) and whether (or by how much) the added features of a given standard necessarily increase the level of safety in a given situation.

1. **FM Global Loss Prevention Data Sheets:** While there are many insurance standard sets available, a longstanding relationship between DOE and what is now Factory Mutual (FM) Global led to specific mention of FM Global Loss Prevention Data Sheets (LPDS) within DOE guidance. Use of the LPDS provide a technical augmentation to many situations, and the Loss Prevention Data Sheets often address topics not addressed by NFPA documents and national codes. There are currently over 250 FM Data Sheets, covering a wide range of systems, equipment, and process designs. The data sheets can be viewed and downloaded at no cost at

[http://www.fmglobal.com/research-and-resources/fm-global-data-sheets.](http://www.fmglobal.com/research-and-resources/fm-global-data-sheets) Note that the direct reference to FM Global Loss Prevention Data Sheets does not restrict the use of similar documents published by other insurers, as they may cover topics beyond those of FM Global or may cover them in a different approach that can be more readily implemented.

1. **Industry Group Standards:** Like NFPA and FM Global documents, industry group standards have achieved a level of standing both within national building/fire codes and as augmentations to those minimums. These include, but are not limited to, standards published by the Compressed Gas Association (CGA), American Petroleum Institute (API), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), American Water Works Association (AWWA), American Glovebox Society (AGS), and American Society of Civil Engineers (ASCE).

1. **Handbooks, Research Reports and Industry Data:** Due to the varied and unique conditions often encountered at DOE facilities, there is often a need to utilize industry experience and opinion as documented through handbooks, research reports and industry data to determine effective solutions. Although most handbooks will rightfully note that they are not the official interpretation of the publishing organization, they are generally peer-reviewed and of sufficient trustworthiness to help derive intent and expert opinion – which in turn allow DOE and contractor staff to determine what risks are being accepted and how control can be built upon.

Handbooks and reports published by the NFPA, the Society of Fire Protection Engineers, the National Institute of Standards and Technology and a wide variety of other institutions can provide insights on how to address specific hazards or develop mitigation of those hazards. Many DOE sites also have fire protection technical papers related to their unique hazards, such as plutonium or uranium. In many cases, these sources can be used to augment prescriptive requirements and feed risk-based/performance-based determinations, as well as to provide a reliable foundation to address unique situations not covered elsewhere. There is an obvious expectation that such information be used judiciously and that the information is peer-reviewed and from a reputable source.

1. **Risk-Based/Performance-Based Frameworks:** In some ways, the DOE HPR philosophy has always been a risk-based framework. However, as time has progressed, specific frameworks that allow standardization of approach have developed. These do not only allow for the development of alternative approaches, but can also help to quantify how much increase in protection is achieved even with prescriptive approaches. Such frameworks are common to other safety disciplines in DOE (e.g., nuclear safety, criticality safety, etc.).

1. **Expert-Based Guidance:** When prescriptive guidance is not available for unique situations, but the situations have long-standing history in industrial fire protection or the insurance industry, expert-based guidance can be used to determine an HPR-level of protection.

## Graded Approach

A graded approach should be used to ensure that DOE assets are protected by sensible and conservative measures, while not introducing unnecessary burden on operations or unwarranted expense to DOE programs. Some situations may warrant an increased or decreased level of protection from what guidance and precedent suggest. A risk-based/performance-based approach may be appropriate for one operation, while inappropriate for another. Redundant engineered systems might be justified to protect one operation, while this would be clearly financially intolerable throughout all of DOE’s operations. The goal is to achieve a level of risk which is acceptable to DOE programs.

At the highest level, a site’s graded approach might be described in a policy or program document. In many cases, graded approaches for facility and/or process-specific hazards are evaluated and technically justified in an FHA. Still other low-risk situations may be supported by AHJ decisions and/or other documented engineering judgements.

The graded approach facet of the DOE HPR philosophy is perhaps the most debated, particularly considering a growing compliance-based approach to demonstrating programmatic health. The graded approach requires a close relationship between the local field office and the contractor with respect to determining risk.

# CONCLUSION

The U.S. Department of Energy’s missions represent innumerable national interests in technology, environmental protection, national security, energy efficiency, and other areas. To protect its people and programs from the threat of fire, DOE employs the programmatic and design concepts of HPR. DOE federal and contractor staff are responsible to apply these principles consistently and thoughtfully, using a graded approach to ensure that they do not represent unjustified burden. The conscientious application of these principles has been proven to result in a very low fire loss.