

U.S. Department of Energy
Washington, D.C.

ORDER

DOE 5480.7

12-18-80
11-16-87

Republished:

SUBJECT: FIRE PROTECTION

-
1. PURPOSE. To establish requirements for an "improved risk" level of fire protection sufficient to attain Department of Energy (DOE) objectives. A higher standard of protection may be justified in certain instances for the purpose of national security, program continuity, or protection of the public.
 2. CANCELLATION. Chapter VII, DOE 5480.1A, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION PROGRAM FOR DOE OPERATIONS, of 12-18-80.
 3. SCOPE. The provisions of this Order apply to all Departmental Elements and contractors performing work for the Department as provided by law and/or contract and as implemented by the appropriate contracting officer.
 4. OBJECTIVES.
 - a. To ensure that no threats to the public health or welfare will result from fire;
 - b. That there are no undue hazards to employees from fire;
 - c. That vital DOE programs will not suffer unacceptable delays as a result of fire; and
 - d. That property damage will be held to manageable levels.
 5. REFERENCES.
 - a. DOE directives in the 5480 series, which outline the Departmental environmental protection, safety, and health protection program policies, procedures, and responsibilities.
 - b. DOE 5482.1B, ENVIRONMENT, SAFETY, AND HEALTH APPRAISAL PROGRAM, of 9-23-86, which establishes the environmental protection, safety, and health protection appraisal program.
 - c. DOE 5484.1, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION INFORMATION REPORTING REQUIREMENTS, of 2-24-81, which establishes procedures for the reporting of information having environmental protection, safety, or health protection significance.

DISTRIBUTION:
All Departmental Elements

INITIATED BY:
Assistant Secretary for
Environment, Safety and Health

- d. Title 29 CFR Part 1910, "Occupational Safety and Health Standards," which establishes occupational safety and health standards to ensure safe or healthful employment and places of employment.
- e. National Fire Protection Association Code 101, "Life Safety Code," which establishes building features important to life safety.
- f. The Atomic Energy Act of 1954, as amended (68 Stat. 919, 42 U.S.C. 2073, et seq.), which provides policy for the development, use, and control of atomic energy.

6. DEFINITIONS.

- a. Improved Risk. The term involves the use and application of judgment and thus does not lend itself to a precise, fixed definition applicable in all locations and situations. It has the same meaning and intent as is commonly understood when this or the term, "Highly Protected Risk," is used in the insurance industry. Generally, an improved risk property is one that would qualify for complete insurance coverage by the Factory Mutual System, the Industrial Risk Insurers, and other industrial insurance companies that limit their insurance underwriting to the best protected class of industrial risk. Essential elements of a program complying with the improved risk concept are included in this directive. Improved risk protection requires compliance with the fire protection and loss prevention standards detailed in DOE 5480.4, ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH PROTECTION STANDARDS, of 5-15-84. This term also implies that qualified fire protection engineering judgment has been used to obtain the highest economically justifiable level of industrial loss prevention. The most evident characteristic of an improved risk property is the existence of reliable, automatic fire extinguishing systems throughout all buildings of combustible construction or content where the building is vital to operational continuity or may experience a large property loss from fire in the absence of an automatic extinguishing system.
- b. National Security. Those aspects of national security as outlined in the Atomic Energy Act that could be affected adversely by fire, explosion, or other catastrophes.
- c. Protection of the Public Health and Welfare. Control of fire, explosion, or effects of hazards to minimize potential injury to the public and damage to property not owned by the Department.
- d. Property. All Government-owned or leased property for which the Department has responsibility, except:
 - (1) Property furnished under contract requiring contractor assumption of the risk of loss or damage to Government-furnished property.

- (2) Property covered by a private insurance policy specifying the Department of Energy as the beneficiary.
- e. Fire Protection. Protection from a broad range of fire risks normally included in the analysis conducted by fire protection engineers. These include some aspects of related perils such as explosion, windstorm, earthquake, lightning, and water damage. Fire prevention programs are a necessary part of fire protection programs.
- f. Maximum Credible Loss. The maximum loss that could occur from a combination of events resulting from a single fire. Considerable judgment is required to evaluate the full range of potential losses, but in general, readily conceivable fires in sensitive areas are considered. Examples are power wiring failures in cable trays, flammable liquid spills, and high-value parts storage areas or combustible exposures to sensitive machines. Any installed fire protection systems are assumed to function as designed. Due to the uncertainties of predicting human action, the effect of emergency response is generally omitted except for post-fire actions such as salvage work, shutting down water systems, and restoring production.
- g. Maximum Possible Fire Loss. The maximum possible loss that could occur in a single fire area assuming the failure of both automatic and manual fire extinguishing actions.
- h. Property Loss. The dollar cost of restoring damaged facilities or equipment to their original condition, whether or not such restoration actually occurs. In determining loss, the estimated damage to the building and contents shall include replacement cost, less salvage value, plus the cost of decontamination and cleanup. Effects upon program continuity, auxiliary costs of fire extinguishment, and consequent effects on related areas should be included if the effects can be determined.
- i. Consultant Fire Protection Survey Program. The program under which fire protection surveys of principal DOE facilities are conducted for the Office of Operational Safety by fire protection engineers of selected contractors administered by this organization.
- j. Fire Protection System. Any system designed to control or extinguish fires or to limit the extent of fire damage. These include:
- (1) Automatic suppression systems such as sprinklers, Halon, or carbon dioxide systems.
 - (2) Watchmen or automatic detection systems, water supplies, plus a fire department.
 - (3) Walls and doors.
 - (4) Building separation with credit for water supplies plus a fire department.

7. RESPONSIBILITIES AND AUTHORITIES.

a. The Director of Operational Safety (EH-34).

- (1) Develops fire protection requirements for programs and facilities and coordinates the development of design criteria with the Director of Projects and Facilities Management (MA-22) and other appropriate Headquarters organizations to assure the consistency of such criteria with the requirements of applicable codes and standards and the provisions of DOE 5480.4.
- (2) Evaluates and appraises in accordance with DOE 5482.1B the adequacy of Field Element fire protection programs and provides assistance to all Departmental Elements on all aspects of fire protection.
- (3) Administers the consultant fire protection survey program, issues survey reports to applicable Departmental Elements, and reviews programs for handling recommendations resulting from the surveys.

b. Program Senior Officials, for matters affecting facilities under their programmatic responsibility, shall:

- (1) Review proposed fire protection programs for that property under their responsibility.
- (2) Review field requests for exemptions from DOE criteria with EH-34 and MA-22 when requests require approval.
- (3) Review field implementation of the recommendations resulting from the consultant fire protection survey program. The Office of Operational Safety will act as the primary point of contact for the survey program and will distribute survey reports to Headquarters and field organizations as applicable.
- (4) For DOE facilities not subordinate to a field organization, the procedures of paragraph 7c shall be followed.

c. Heads of Field Organizations.

- (1) Provide and maintain an improved risk level of fire protection adequate to meet the objectives of paragraph 4 for all physical property or material that represents an investment by the Department.

- (2) Provide and maintain a higher standard of fire protection than required to meet the improved risk requirements in instances when justified for purposes of national security, program continuity, or protection of the public.
- (3) Submit requests for exemptions to EH-34 for those facilities where, in the judgment of the Head of the Field Organization, compliance with paragraph 4 above is not feasible.
- (4) Establish and maintain a system to assure that the intent of all DOE fire protection standards is incorporated in the plans and specifications for all new buildings and for major modifications of existing buildings.
- (5) Assist the Office of Operational Safety in coordinating the consultant fire protection team surveys at those facilities included in the survey program, establish action plans for compliance with recommendations resulting from the surveys, and forward compliance plans, exemption requests, and other requested data to EH-34.
- (6) Establish and maintain lists of facilities for which they have fire protection appraisal responsibility and designate for each the minimum frequency at which fire protection appraisals will be made. This list shall include facilities at which:
 - (a) Property is valued at \$1,000,000 or more. (All values in this paragraph and subparagraphs 9c and d, below, are based on Factory Mutual System's Industrial Cost Trends of 1-87, using a 1-19-87 multiplier of 1.0. Post-1987 escalated values may be based on either Factory Mutual or Engineering News Record indexes.)
 - (b) Property valued at less than \$1,000,000 is located but where a fire protection appraisal is deemed to be justified.
 - (c) A credible loss could delay a vital program in excess of 3 months or a significant component of a program in excess of 6 months.
- (7) Conduct fire protection appraisals of facilities for which they have responsibility.
- (8) Provide loss prevention advice and assistance to contractors in need of assistance or who do not have their own professional staff assistance.
- (9) Submit to the EH-34 an annual summary as set forth in DOE 5484.1 covering the fire protection program and loss experience of the previous year.

8. DELEGATION OF "AUTHORITY HAVING JURISDICTION." For those fire protection standards specifying alternative means of compliance subject to "the authority having jurisdiction," this authority is the applicable Departmental Element.
9. COMPLIANCE WITH IMPROVED RISK OBJECTIVES.
 - a. Threats to the Public Health or Welfare and Hazards to Life. The objectives of having no threats to the public health and welfare and no undue hazards to life from fire can be considered to have been attained when:
 - (1) Department of Energy buildings comply with the intent of the Life Safety Code and with specific requirements of 29 CFR Part 1910 applicable to exits and fire protection features.
 - (2) The potential for fast spreading fires is controlled by severe restrictions on the ratings of interior finish materials for flame spread and smoke development and by compartmentation of hazardous materials.
 - (a) Materials of unusual fire characteristics such as exposed urethane foams and materials developing large quantities of toxic products of combustion shall be prohibited for interior finish.
 - (b) Hazardous materials, such as flammable liquids and explosives, shall be severely restricted in quantity and handled in conformance with all applicable codes. Special protection features suitable to the hazard should be installed and limits imposed on the number of people who must be exposed to the hazard.
 - (c) Where noncompliance with some Life Safety Code provisions may be required for public safety, as in some containment structures, additional protective systems and personnel limits should be maintained.
 - (3) The facility containment systems are designed to preclude an offsite release of hazardous amounts of toxic materials under maximum credible fire conditions.
 - (4) Exhaust and ventilation systems, including filters, are protected or isolated from the effects of a credible fire to the extent that hazardous amounts of toxic materials or combustion products will not escape.
 - (5) Natural or artificial means of controlling liquid runoffs from a credible fire are provided so that contaminated or polluting liquids will not escape the site, including potentially contaminated water resulting from firefighting operations.

- b. Unacceptable Program Delays. The objective of no unacceptable impairment of a vital program can be considered to have been attained when:
- (1) The maximum credible fire will not result in the loss of use of a vital facility for a period longer than that specified as acceptable to the applicable Program Senior Official.
 - (2) In the absence of a defined acceptable shutdown period, the maximum credible fire will not result in the interruption of a vital program (weapons production, uranium enrichment) for a period in excess of 3 months, or a significant part of a program (major accelerator, single diffusion plant) for a period in excess of 6 months.
- c. Property Damage Limitation. The objective of limiting property loss can be considered to have been attained when fire protection systems are provided as follows:
- (1) When the maximum possible property loss is in the range of \$1-25 million, an automatic fire protection system is provided that will limit the probable loss to the lower figure.
 - (2) When the maximum possible property loss is in the range of \$25-50 million, a redundant protection system is provided that, even in the failure of the primary system, should limit the loss to the lower figure.
 - (3) When the maximum possible property loss exceeds \$50 million, redundant systems are provided as in subparagraphs 9c (1) and (2), above, and a failure-proof type of fire protection system, such as blank walls or physical separation, is provided to limit the maximum property loss to \$75 million.
- d. Higher Standard of Protection. A higher standard of protection, usually including some form of automatic protection, is described in paragraph 1 as being justified when certain considerations, beyond those mentioned in subparagraphs 9a through c, above play a major role in the management decision process. The specific level at which an automatic protection system should be installed requires qualified fire protection engineering judgment. In general, the probable loss should be limited to \$250,000 in such cases. The following points should be considered in evaluating the need for automatic fire extinguishing systems:
- (1) Importance. Vital property may require protection without regard to the dollar loss potential. For example, it may be desirable to protect a low-value or temporary storage shed when it may contain critical or long procurement time construction items. In illustration,

a trailer may have a temporary protection system when it is used as a control center for a vital, one-time event. Particularly high public visibility or sensitivity may also be justification for protection of otherwise low-value property.

- (2) Effect on Production. Protection costs may be high in relation to the value protected but still warranted, as in the case of cooling towers and electrical switchgear, where loss of the unit could result in the shutdown of other facilities.
- (3) Cost Versus Benefit Ratios. A building such as a lumber or paint shed may be of low value and importance but may be easily protected by extending sprinklers from an adjoining protected building at a low incremental cost.
- (4) Exposure. Construction sheds or trailers may warrant protection when they must be installed in or adjacent to more important facilities.
- (5) Future Conditions. Even when the above conditions are not applicable, protection may still be warranted when conditions are extrapolated to the future. For example, a storage building may be of low value when designed, but normal escalation of content value may indicate it would need protection in a few years, in which case it would be more effective to install the protection as part of the original construction. Similarly, evaluation of office or low hazard laboratory occupancies may indicate that the hazard or combustible loading of similar facilities increases consistently with time, justifying protection at an early phase. Provision of automatic protection in the initial construction also allows more flexibility for future modifications. For example, conversion to a higher hazard occupancy may be prohibited due to a lack of appropriate built-in protection.

10. ESSENTIAL ELEMENTS OF AN IMPROVED RISK FACILITY.

- a. An improved risk facility is characterized by a sufficiently high level of fire protection to fulfill requirements for insurability by the Factory Mutual System, Industrial Risk Insurers, or other private industrial fire insurance companies that limit their underwriting to the best protected class of industrial risks. A basic requirement is the provision of automatic fire extinguishing systems in all areas subject to serious property damage or business interruption losses as a result of fire. Above all other requirements, to qualify for an improved risk rating, it is necessary that strong, tangible evidence be available attesting to existence of continuing sincere interest by management and employees in minimizing losses from fire and related perils.

- b. DOE facilities qualifying as improved risks will incorporate the following physical improvements and internal programs, and maintain records for appraisal of the programs:
- (1) Review of plans prior to contemplated construction to assure adequacy of fire risk appraisal and protection, and followup review to ensure that fire protection features are provided where necessary to comply with paragraph 9 above.
 - (2) Regular self-inspections, tests, fire loss potential reviews and appraisals to identify the nature, location, and severity of fire risks (injuries, dollar loss, programmatic interruption, release of toxic and radioactive materials) as well as to determine adequacy of fire loss control devices and activities.
 - (3) Periodic audits by outside fire protection authorities such as contractor facility appraisals by field fire protection engineers.
 - (4) Plans, procedures, devices, and trained personnel adequate to permit controlling any credible fire emergency that may arise on the facility.
 - (5) Limitation by physical means (e.g., geographic isolation, fire-walls, firedoors, draft barriers) of areas that can be directly damaged in the event of a single fire.
 - (6) Quality construction which in most cases is defined as fire resistive or noncombustible type buildings with segregation or isolation of particularly hazardous operations.
 - (7) Enclosures of adequate fire resistant construction for stairways, elevators, ducts, and other openings coupled with fixed or manual devices (such as self-closing doors or dampers, draft stops, or water curtains) to control or limit both vertical and horizontal fire spread potentials.
 - (8) Protection of special hazards by isolation, segregation, or use of special fire control systems (e.g., automatic sprinklers, inert gas flooding, explosion suppression) together with devices (e.g., relief valves, filters, roof hatches, scuppers, blast walls) for limiting or controlling damage potentials of fire, hazardous smoke, gases, and water runoff, or other occurrences, that may reasonably be anticipated during a fire emergency.
 - (9) Adequate, reliable fire protection water supplies and distribution systems coupled with adequate hydrants, inside standpipes, and other devices to facilitate utilization of such water during fire emergencies.

- (10) Adequate automatic and manual means for detecting and reporting incipient fires including, but not limited to, watchman service.
 - (11) Automatic sprinkler protection for all combustible construction or occupancies where potential losses exceed Departmental criteria.
- c. Improved risk facilities shall be appraised periodically by the appropriate organization in sufficient depth to establish that:
- (1) The programs described in subparagraph 10b above are being conducted.
 - (2) Loss potentials, including programmatic effects, have been determined and appropriate protection systems have been provided to reduce the effects to the acceptable levels in paragraph 4 or an exemption from these requirements has been obtained.
 - (3) Effective action has been taken to comply with previous recommendations, initiate corrective actions on previously identified deficiencies, and reduce the adverse effects of noncompliance in areas where compliance has not yet been achieved or where exemptions have been allowed.
 - (4) Losses, impairments, and unusual incidents are investigated and analyzed in sufficient depth to identify causes, economical and effective corrective methods, and areas where similar problems may exist or where additional studies may be required.
- d. In addition to internal, Headquarters, and field appraisals, improved risks are generally characterized as those also surveyed by independent third party interests. For major facilities, this service is provided by the consultant fire protection survey program.
- e. Periodic fire protection appraisals of each facility shall be initiated by qualified fire protection engineering personnel as soon as practicable after listing of the facility by the Department. The appraisals shall include the items under subparagraph 10c, above.
- f. In addition to performing periodic appraisals, the appraising office will maintain a continuous surveillance of improved risk facilities by:
- (1) Assuring that plans, proposals, loss reports, investigation report, and other applicable materials are reviewed by knowledgeable personnel in sufficient depth to determine that the facility is maintaining the review and protection programs described in subparagraph 10b, above.
 - (2) Providing technical assistance and advice as requested by the contractor and as deemed necessary by the field organization.

- (3) Assuring that facility management is kept advised of requirements, programs, and applicable information generated by Headquarters, or other agencies, and that information developed by the facility or by other facilities with mutual interests, is disseminated among the interested parties.

11. CONSULTANT FIRE PROTECTION SURVEY PROGRAM.

- a. Consultant fire protection team surveys will be conducted periodically at facilities determined to be of major importance to the DOE mission. Major improved risk survey groups have been contracted to conduct surveys of the improved risk status of Department facilities.
 - (1) A survey shall be conducted at each facility containing more than \$25,000,000 in replacement value of Government property.
 - (2) Following the initial survey, a resurvey shall be made at each facility at approximately 5-year intervals.
 - (3) Reports of the surveys shall be submitted to EH-34 for review and distribution to the appropriate contractors through the appropriate DOE Element.
- b. For each survey, Heads of DOE Elements:
 - (1) Shall designate a coordinator to assist the team in obtaining logistical support, facility access, and technical information as determined necessary by the Office of Operational Safety.
 - (2) Shall review the contractor's compliance efforts and forward compliance data as requested by EH-34.
 - (3) May omit any appraisal that would coincide with the period in which the consultant fire protection team survey is being conducted.
- c. Following each survey, the appropriate organization will be requested to submit an action plan.
 - (1) Action plans are submitted directly to the Office of Operational Safety.
 - (2) Initial action plans are requested in the transmittal letter accompanying the final report of the survey and will be due at the next scheduled update.
 - (3) Action plans will be reviewed by EH-34 and revised status reports will be requested approximately once a year for those sites requiring prolonged corrective actions.

- d. Output data from the action plans shall be furnished yearly to appropriate Departmental Elements for budgeting and planning purposes.

BY ORDER OF THE SECRETARY OF ENERGY:



LAWRENCE F. DAVENPORT
Assistant Secretary
Management and Administration