

memorandum

DATE NOV 07 1991

REPLY TO
ATTN OF: EH-31.3

SUBJECT: Guidance on Performance of Fire Hazards Analyses

TO Distribution

The purpose of this memorandum is to provide interim guidance on the development of fire hazards analyses (FHA) for Department of Energy (DOE) facilities pending the development and issuance of a DOE standard. While FHA's are currently required for new facilities by DOE Order 6430.1A and are being performed for nuclear facilities, no comprehensive Departmental guidance on their scope and technical content currently exists. Reliance on fire protection guidelines developed by the Nuclear Regulatory Commission for the commercial nuclear power industry is not considered appropriate for all DOE facilities because of the unique and varied nature of these facilities compared to a commercial nuclear powerplant.

The guidance is provided in the attachment to this memorandum. It is general in nature and represents a minimally acceptable level of effort. It is intended to be utilized by qualified fire protection engineers.

Interpretations of these guidelines for nuclear facilities, where needed, will be provided by the Office of Nuclear Safety Policy and Standards (NE-70). For nonnuclear facilities, the Office of Safety and Quality Assurance (EH-30) will be the interpretive authority. Where generic issues overlap, EH-30 will develop the interpretation with the concurrence of NE-70.

Questions regarding this memorandum should be directed to Mr. Dennis Kubicki on FTS 233-4794.



Joseph E. Fitzgerald, Jr.
Deputy Assistant Secretary
Safety and Quality Assurance



Neal Goldenberg, Director
Office of Nuclear Safety
Policy and Standards

Attachment

cc w/attachment:
P. Ziemer, EH-1
W. Young, NE-1

Guidance on the Performance of Fire Hazards Analyses

The purpose of a fire hazards analysis (FHA) is to comprehensively and qualitatively assess the risk from fire within individual fire areas in a Department of Energy (DOE) facility so as to ascertain whether the objectives stated in Paragraph 4 of DOE Order 5480.7, "Fire Protection," are met. This must include an assessment of the risk from fire and related perils (direct flame impingement, hot gases, smoke migration, fire fighting water damage, etc.) in relation to existing or proposed fire safety features to assure that the facility can be safely controlled and stabilized during and after a fire. To the extent that this analysis completely addresses the following issues, an FHA will satisfy the requirements for a "Fire Protection Safe Shutdown Analysis." The level of detail necessary is directly related to the complexity of the facility and the potential risk to the public and facility operators.

"An FHA which addresses all relevant fire safety issues shall be performed for all new facilities as directed by DOE Order 6430.1A, for all nuclear facilities, or as directed by the DOE Program Secretarial Officer or delegated authority.

A preliminary FHA shall be performed for new facilities early in the design phase to assure an acceptable level of protection as the design is evolving. It shall be updated when significant changes occur within an individual fire area.

An FHA shall be performed under the direction of a fire protection engineer, with support from systems, electrical, and mechanical engineers, as well as operations staff, as needed.

An FHA shall contain, but not be limited to, a conservative assessment of the following fire safety issues:

- (a) Description of construction
- (b) Fire protection features
- (c) Description of fire hazards
- (d) Protection of essential safety class systems
- (e) Life safety considerations
- (f) Critical process equipment
- (g)** High value property
- (h) Damage potential: Maximum Credible Fire Loss (MCFL) and Maximum Possible Fire Loss (MPFL)
- (i) Fire Department/Brigade response
- (j) Recovery potential
- (l) Potential for a toxic, biological and/or radiation incident due to a fire
- (m) Emergency planning
- (n) Security and Safeguards considerations related to fire protection
- (o) Natural hazards (earthquake, flood, wind) impact on fire safety
- (p) Exposure fire potential

The FHA shall assume that an automatic fire protection system will malfunction. If redundant automatic fire protection systems are provided in the area, only the system which causes the most vulnerable condition is assumed to fail. Passive fire protection features, such as blank fire-rated walls or continuous fire-rated cable wraps, are assumed to remain viable.

The focus of the FHA shall be the individual fire areas which comprise the facility. A fire area is defined as a location bounded by fire rated construction, having a minimum fire resistance rating of 2 hours, with openings protected by equivalently rated fire doors, dampers or penetration seals. The boundaries of exterior fire areas (yard areas) shall be as determined by the Program Secretarial Officer or delegated authority. Where a facility is not subdivided by fire-rated construction, the fire area shall be defined by the exterior walls and roof of the facility.

An essential element of an acceptable FHA is an inventory of all safety class systems within the fire area that are susceptible to fire damage. This includes those primary and supporting mechanical and electrical systems which must function effectively during and after a fire event to assure safety, including safe shutdown where applicable. For example, loss of the building ventilation system in a fire (due to damage to power cables) may result in an ambient air temperature rise which may cause the failure of sensitive electrical safety class components, such as relays. Such safety class systems may include, but are not limited to, process monitoring instrumentation, instrument air, the facility hydraulic system, and emergency lighting system.

All credible fire-related failure modes of safety class systems (Class A systems as defined in DOE 5000.3A) shall be considered. For example, it is insufficient to assume that fire will merely cause the loss of function of safety class equipment when power cables to that equipment is within the fire area. It is also necessary to consider the potential for spurious signals which may cause the malfunction of such equipment. Similarly, fire induced electrical faults may trip upstream electrical disconnect devices in such a way as to render inoperable other safety class systems that may not even be located within the fire area. In addition, the effects of combustion products, manual fire fighting efforts, and the activation of automatic fire suppression systems must be assessed.

Fire propagation and the potential for fire-induced radiological dispersal through the facility air distribution system must be considered. These effects must be considered for the normal operating mode of the air distribution system as well as alternate modes, such as shutdown, that may result from the fire.

An acceptable tool that may be used in the development of an FHA is a fire model, as applied by qualified fire protection engineers. However, the use of such models is predicated on their being conservative and validated. As of this date, DOE has not sanctioned to use of any one model for use in an FHA. However, efforts are currently underway to further develop FIRAC toward this end. DOE acceptance of individual models found acceptable by

the Nuclear Regulatory Commission for the commercial nuclear power industry will be considered on a case by case basis until a DOE Fire Model is approved.

Alternately, an assumption can be made that all potentially vulnerable systems will be damaged within the fire area. Acceptable exceptions to this assumption are water-filled steel pipes, tanks, and similar components of superior structural integrity with welded fittings and adequate pressure relief.

The quantity and associated hazards of flammable and combustible materials that can be expected to be found within the fire area shall be factored into the analyses. Consideration should also be given to the presence of transient combustibles associated with storage and maintenance activities. Averaging combustible loading as a means to characterize the fire severity is not considered an acceptable technique.

FHA's for high bay locations shall consider the effects of smoke/hot gas stratification that may occur at some intermediate point below the roof or ceiling. Similarly, the effect of smoke movement through doors and dampers held open by fusible links needs to be addressed.

The fire hazards analysis shall be documented, including all assumptions, and shall be referenced in the facility SAR.