

# Appendix R to Part 50—Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979

## I. Introduction and Scope

### I. イントロダクション及びスコープ

This appendix applies to licensed nuclear power electric generating stations that were operating prior to January 1, 1979, except to the extent set forth in § 50.48(b) of this part. With respect to certain generic issues for such facilities it sets forth fire protection features required to satisfy Criterion 3 of Appendix A to this part.

本附則は、10CFR50.48(b)で示される項目を除いて、1979年1月1日以前に運転を開始した原子力発電所に対して適用される。その種の施設に対する、ある種の一般の問題に関して、附則AのCriterion 3を満足するために要求される防火対策を示す。

Criterion 3 of Appendix A to this part specifies that “Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions.”

附則AのCriterion 3は「安全上重要なSSC(構造物、システム、要素)は火災と爆発の可能性と影響を、他の安全要求と同様に、最小にするようにデザインされ、配置されねばならない」としている。

When considering the effects of fire, those systems associated with achieving and maintaining safe shutdown conditions assume major importance to safety because damage to them can lead to core damage resulting from loss of coolant through boiloff.

火災の影響を考えると、安全な緊急停止を達成し、保持しようとするこれらのシステムは、当然、とても重要である。なぜならこれらのシステムへのダメージは、冷却水の喪失からboiloffに至り、炉心のダメージになり得るから。

The phrases “important to safety,” or “safety-related,” will be used throughout this Appendix R as applying to all safety functions. The phrase “safe shutdown” will be used throughout this appendix as applying to both hot and cold shutdown functions.

“important to safety,”、“safety-related,”という語は、この附則 R 全体で、すべての安全機能に適用するものとして使われる。“safe shutdown”という語は、この附則の全体で、高温、低温停止機能の両方に適用される。

Because fire may affect safe shutdown systems and because the loss of function of systems used to mitigate the consequences of design basis accidents under postfire conditions does not per se impact public safety, the need to limit fire damage to systems required to achieve and maintain safe shutdown conditions is greater than the need to limit fire damage to those systems required to mitigate the consequences of design basis accidents. Three levels of fire damage limits are established according to the safety functions of the structure, system, or component:

火災は安全緊急停止システムに影響するので、そしてまた、火災発生後の状況で、設計上想定する事故による影響を緩和するシステムの機能喪失は公衆の安全には、実質的には影響を与えないので、安全な緊急停止を達成、保持するシステムに対する火災被害を制限する必要性は、設計上想定する事故による影響を緩和するために要求されるシステムへの火災被害を制限する必要性より、はるかに高い。

→ここでは何を言おうとしているのか？ 例えば、配管破断を修復するシステムへの火災被害を防ぐことは、実際には配管破断は起こらずに、火災が起こっている状況なので、それほど重要ではなく、緊急停止が出来なくなる方が恐ろしい、の意？

(は)の解釈:ここでいう配管が緊急停止システムを構成する重要部品であれば、火災被害を徹底的に防ぎなさいということを述べている。同じ配管であっても、単なる水損を起こすだけのものならば優先度は低い。

Safety function	Fire damage limits
Hot Shutdown ※50.2 の定義 Safe shutdown の中に引用あり。	One train of equipment necessary to achieve hot shutdown from either the control room or emergency control station(s) must be maintained free of fire damage by a single fire, including an

<p>ただし、Hot shutdown, Cold shutdown とともに定義が無い?</p>	<p>exposure fire.<sup>1</sup>          制御室もしくは緊急制御室から高温停止を達成するのに必要な一系統の装置が、単一火災による被害を免れるよう維持されていなければならない。単一火災には exposure fire も含まれる</p>
<p>Cold Shutdown</p>	<p>Both trains of equipment necessary to achieve cold shutdown may be damaged by a single fire, including an exposure fire, but damage must be limited so that at least one train can be repaired or made operable within 72 hours using onsite capability.          低温停止を達成するのに必要な二系統の装置は、単一火災による被害を受けても構わない。ただし、一系統は現地の資材で 72 時間以内に修理されるか、作動しなければならない。</p>
<p>Design Basis Accidents          ※50.2 の定義</p>	<p>Both trains of equipment necessary for mitigation of consequences following design basis accidents may be damaged by a single exposure fire.          設計上想定する事故における被害を抑制するために必要な二系統の装置は、単一のエクスポージャー火災で尊重しても構わない          (結局のところ、design basis accidents とは何か解らない)</p>

<sup>1</sup> *Exposure Fire*. An exposure fire is a fire in a given area that involves either in situ or transient combustibles and is external to any structures, systems, or components located in or adjacent to that same area. The effects of such fire (e.g., smoke, heat, or ignition) can adversely affect those structures, systems, or components important to safety. Thus, a fire involving one train of safe shutdown equipment may constitute an exposure fire for the redundant train located in the same area, and a fire involving combustibles other than either redundant train may constitute an exposure fire to both redundant trains located in the same area.

エクスポージャー火災とは、当該空間または隣接空間にある構造物、システム、要素に無関係な固定的または一時的可燃物が関与する所与の空間における火災である。(日本語らしくない?)

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The most stringent fire damage limit shall apply for those systems that fall into more than one category. Redundant systems used to mitigate the consequences of other design basis accidents but not necessary for safe shutdown may be lost to a single exposure fire. However, protection shall be provided so that a fire within only one such system will not damage the redundant system.

2つ以上のカテゴリーに入るシステムに対しては最も厳格な火災被害限界が適用されるべきである。他の設計上考慮する事故の影響を緩和するために使われるが安全停止系には不要となる冗長系システムは、単一エクスポージャー火災で機能喪失しても構わない。

## II. General Requirements

### II. 一般要求事項

*A. Fire protection program.* A fire protection program shall be established at each nuclear power plant. The program shall establish the fire protection policy for the protection of structures, systems, and components important to safety at each plant and the procedures, equipment, and personnel required to implement the program at the plant site.

**A.火災防護プログラム** (一部、意識されているので)火災防護プログラムは、それぞれの原子力プラントで策定されねばならない。プログラムでは、安全上重要な構造物、システム、要素を火災から防護する戦略(policy)を立てて、プログラムを実行するための手順、人員、器具を〇〇する必要がある。(英文が閉じていない?)

The fire protection program shall be under the direction of an individual who has been delegated authority commensurate with the responsibilities of the position and who has available staff personnel knowledgeable in both fire protection and nuclear safety.

火災防護プログラムは、代表権を委任されている個人の指揮で、かつその個人には火災防護と原子力安全の両方を理解している職員を使うことが出来る状態で、作られねばならない。

The fire protection program shall extend the concept of defense-in-depth to fire protection in fire areas important to safety, with the following objectives:

火災防護プログラムは、以下の目的に対して、火災エリアの火災防護を深く防護したコンセプトを拡張すべきである。

To prevent fires from starting;

出火防止

To detect rapidly, control, and extinguish promptly those fires that do occur;

早期の感知、抑制および起こりうる火災の速やかな消火

To provide protection for structures, systems, and components important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant.

消火システムで迅速に消すことができない火災に対して、安全上重要な構造体、システム、要素が安全な停止を妨げないように防護すること

*B. Fire hazards analysis.* A fire hazards analysis shall be performed by qualified fire protection and reactor systems engineers to (1) consider potential in situ and transient fire hazards; (2) determine the consequences of fire in any location in the plant on the ability to safely shut down the reactor or on the ability to minimize and control the release of radioactivity to the environment; and (3) specify measures for fire prevention, fire detection, fire suppression, and fire containment and alternative shutdown capability as required for each fire area containing structures, systems, and components important to safety in accordance with NRC guidelines and regulations.

和訳の内容が?

**B.火災ハザード解析** 火災ハザード解析は、資格認定された火災防護及び原子炉エンジニアによって、以下の目的で実施されなければならない。(1)現場での恒常的または過渡的な火災ハザードを考慮する。(2)施設内のあらゆる場所を対象に、発生し

た火災が、原子炉の安全な緊急停止を起こす能力もしくは環境への放射性物質の排出を最小にする或いは制御する能力への影響度を決定する(予測する)。(3)安全にとって重要な SSC を含むそれぞれの火災領域に求められる、出火防止、火災感知、消火および火災の封じ込め(防火区画?)並びに他の緊急停止機能のための方法を、NRC のガイドラインおよび基準に従って選定する。

*C. Fire prevention features. Fire protection features shall meet the following general requirements for all fire areas that contain or present a fire hazard to structures, systems, or components important to safety.*

**C.火災防止機能** 火災防止機能は、安全上重要な SSC に対する火災ハザードが存在する火災領域において、以下の一般要件を満足しなくてはならない。

1. In situ fire hazards shall be identified and suitable protection provided.

現場の火災ハザードを特定し、そして適切な防護を用意すること

2. Transient fire hazards associated with normal operation, maintenance, repair, or modification activities shall be identified and eliminated where possible. Those transient fire hazards that can not be eliminated shall be controlled and suitable protection provided.

通常運転、保守、補修、または改修措置による過渡的な火災ハザードは確認されなければならない。そして可能な部分を取り除かれねばならない。取り除くことが出来ない過渡的な火災ハザードは制御しなければならぬし、適切な防御が用意されねばならない。

3. Fire detection systems, portable extinguishers, and standpipe and hose stations shall be installed.

火災感知システム、消火器および連結送水管ならびにホース室が設置されねばならない

4. Fire barriers or automatic suppression systems or both shall be installed as necessary to protect redundant systems or components necessary for safe shutdown.

防火バリア(定義は?)または自動消火設備、もしくはその両方が安全な緊急停止のために必要とされる多重系のシステムまたは機器を守るために設置されねばならない。

5. A site fire brigade shall be established, trained, and equipped and shall be on site at all times.

発電所の消防隊が、結成され、訓練され、装備を整えて四六時中、現場に配備されねばならない。

6. Fire detection and suppression systems shall be designed, installed, maintained, and tested by personnel properly qualified by experience and training in fire protection systems.

火災感知と消火システムが、経験と訓練で適切に質が確保された職員により、設計され、設置され、維持され、検査されねばならない。

7. Surveillance procedures shall be established to ensure that fire barriers are in place and that fire suppression systems and components are operable.

その場の防火バリアと消火システム・機器の作動を保証する監視手順が確立されねばならない。

*D. Alternative or dedicated shutdown capability. In areas where the fire protection features cannot ensure safe shutdown capability in the event of a fire in that area, alternative or dedicated safe shutdown capability shall be provided.*

D.代替の停止能力 火災防護システムでは、あるエリアの安全な停止が確保できない場合には、代替となる安全停止システムを設置すること

### III. Specific Requirements

#### Ⅲ.個別要求事項

*A. Water supplies for fire suppression systems. Two separate water supplies shall be provided to furnish necessary water volume and pressure to the fire main loop.*

A.消火系への水供給 2つの独立な水供給システム火災の main loop に必要な水量と圧力を確保するために必要である。

Each supply shall consist of a storage tank, pump, piping, and appropriate isolation and control valves. Two separate redundant suction in one or more intake structures from a large body of water (river, lake, etc.) will satisfy the requirement for two separated water storage tanks. These supplies shall be separated so that a failure of one supply will not result in a failure of the other supply.

2系統はそれぞれ貯水タンク、ポンプ、配管と適切な断熱材および制御バルブで構成される。大容量の水(川、湖など)から一以上の取水構造による、2つの分離された給水は、2つの分離された貯水タンクの条件を満たす。これらの給水は、一系統の給水が損なわれた時、残りの給水系の故障にならないよう、分離されていなければならない。

Each supply of the fire water distribution system shall be capable of providing for a period of 2 hours the maximum expected water demands as determined by the fire hazards analysis for safety-related areas or other areas that present a fire exposure hazard to safety-related areas.

それぞれの給水系は、安全に関与するエリアまたはその他のエリアで火災暴露の危険がある安全に関与するエリアの火災ハザード解析から必要とされる最大の必要水流を2時間にわたって供給できること。

When storage tanks are used for combined service-water/fire-water uses the minimum volume for fire uses shall be ensured by means of dedicated tanks or by some physical means such as a vertical standpipe for other water service. Administrative controls, including locks for tank outlet valves, are unacceptable as the only means to ensure minimum water volume.

貯水タンクが日常水と消火水の兼用で用意される場合には、分割その他の物理的方法—例えば、垂直な立管—により消火に必要な水量を確保すること。タンク出口のバルブをロックする等の人為的方法は許容しない。

Other water systems used as one of the two fire water supplies shall be permanently connected to the fire main system and shall be capable of automatic alignment to the fire main system. Pumps, controls, and power supplies in these systems shall satisfy the requirements for the main fire pumps. The use of other water systems for fire protection shall not be incompatible with their functions required for safe plant shutdown. Failure of the other system shall not degrade the fire main system.

2つのうちの1つをその他の水源とする場合には、水源は恒常的に連結されており、消火システムに整合していること。これらのシステムのポンプ、制御、電源などは消火系の要件を満たすこと。その他の給水システムはプラントの安全な停止に必要とされる機能と不整合がないこと。その他のシステムの故障がメインのシステムに影響を与えないこと。

**B. Sectional isolation valves.** Sectional isolation valves such as post indicator valves or key operated valves shall be installed in the fire main loop to permit isolation of portions of the fire main loop for maintenance or repair without interrupting the entire water supply.

#### B.部分的な隔離弁

**C. Hydrant isolation valves.** Valves shall be installed to permit isolation of outside hydrants from the fire main for maintenance or repair without interrupting the water supply to automatic or manual fire suppression systems in any area containing or presenting a fire hazard to safety-related or safe shutdown equipment.

#### C.消火栓の隔離弁

自動あるいは手動消火系への水の供給が阻害されずに保守あるいは補修をおこなうために、消火用導管と外部の消火栓を隔離する隔離弁を設置しなくてはならない。

**D. Manual fire suppression.** Standpipe and hose systems shall be installed so that at least one effective hose stream will be able to reach any location that contains or presents an exposure fire hazard to structures, systems, or components important to safety.

#### D.手動の消火

Access to permit effective functioning of the fire brigade shall be provided to all areas that contain or present an exposure fire hazard to structures, systems, or components important to safety.

Standpipe and hose stations shall be inside PWR containments and BWR containments that are not inerted. Standpipe and hose stations inside containment may be connected to a high quality water supply of sufficient quantity and pressure other than the fire main loop if plant-specific features prevent extending the fire main

supply inside containment. For BWR drywells, standpipe and hose stations shall be placed outside the dry well with adequate lengths of hose to reach any location inside the dry well with an effective hose stream.

*E. Hydrostatic hose tests.* Fire hose shall be hydrostatically tested at a pressure of 150 psi or 50 psi above maximum fire main operating pressure, whichever is greater. Hose stored in outside hose houses shall be tested annually. Interior standpipe hose shall be tested every three years.

E.ホースの水圧試験 ホース室の外に置いてある消火ホースについては年一回、ネイ部のスタンドパイプ用ホースについては3年に1回、150psiあるいは消火用導管の最大運転圧力より50psi高い圧力のどちらか高い方で水圧試験を実施しなくてはならない。

*F. Automatic fire detection.* Automatic fire detection systems shall be installed in all areas of the plant that contain or present an exposure fire hazard to safe shutdown or safety-related systems or components. These fire detection systems shall be capable of operating with or without offsite power.

#### F.自動火災検知

*G. Fire protection of safe shutdown capability.* 1. Fire protection features shall be provided for structures, systems, and components important to safe shutdown. These features shall be capable of limiting fire damage so that:

a. One train of systems necessary to achieve and maintain hot shutdown conditions from either the control room or emergency control station(s) is free of fire damage; and

b. Systems necessary to achieve and maintain cold shutdown from either the control room or emergency control station(s) can be repaired within 72 hours.

G.安全停止機能の火災防護 1.安全停止系のSSCに対して、以下の目的で、火災による損傷を制限する火災防護機能を設置しなくてはならない。

a.制御室から温態停止を達成し、維持するために必要な一系統は、火災による損傷を受けない。

b.制御室から冷態停止を達成し、維持するために必要な系統を、72 時間以内に回復できる。

2. Except as provided for in paragraph G.3 of this section, **where cables or equipment**, including associated non-safety circuits that could prevent operation or cause maloperation due to hot shorts, open circuits, or shorts to ground, of redundant trains of systems necessary to achieve and maintain hot shutdown conditions **are located within the same fire area outside of primary containment**, one of the following means of ensuring that one of the redundant trains is free of fire damage shall be provided:

この節の G3 において用意されるものを除いて、高温停止を実施し、保持するために必要な多重システムが、ホットショート、開回路、地絡によって作動が妨げられたり、不作動に陥ることになる、ケーブルもしくは装置(関連する非安全系の回路を含む)が設置された場所では、多重システムの一つが、火災による損傷を受けないように、以下の措置のうち、いずれか一つを講じなくてはならない。上記の場所とは、primary containment(一次格納容器? **最初の閉じ込め区画では? 11 行下に noninerted containments があるので、格納容器が適切**)の外側で、同じ火災領域の中。(この場所にあるケーブル、装置に対して)

a. Separation of cables and equipment and associated non-safety circuits of redundant trains by a fire barrier having a 3-hour rating. Structural steel forming a part of or supporting such fire barriers shall be protected to provide fire resistance equivalent to that required of the barrier;

b. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustible or fire hazards. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area; or

c. Enclosure of cable and equipment and associated non-safety circuits of one redundant train in a fire barrier having a 1-hour rating. In addition, fire detectors and an automatic fire suppression system shall be installed in the fire area;

Inside noninerted containments one of the fire protection means specified above or one of the following fire protection means shall be provided:

d. Separation of cables and equipment and associated non-safety circuits of redundant trains by a horizontal distance of more than 20 feet with no intervening combustibles or fire hazards;

d.ケーブル、機器、及び関連する非安全系のケーブルを、20ft 以上可燃物あるいは火災ハザードの介在がない状態に分離する。

e. Installation of fire detectors and an automatic fire suppression system in the fire area; or

e.火災検知器及び、自動消火系を設置する。

f. Separation of cables and equipment and associated non-safety circuits of redundant trains by a noncombustible radiant energy shield.

f.ケーブル、機器、及び関連する非安全系のケーブルを、不燃性の放射エネルギー遮断材で分離する。

3. Alternative or dedicated shutdown capability and its associated circuits,<sup>1</sup> independent of cables, systems or components in the area, room, zone under consideration should be provided:

a. Where the protection of systems whose function is required for hot shutdown does not satisfy the requirement of paragraph G.2 of this section; or

b. Where redundant trains of systems required for hot shutdown located in the same fire area may be subject to damage from fire suppression activities or from the rupture or inadvertent operation of fire suppression systems.

In addition, fire detection and a fixed fire suppression system shall be installed in the area, room, or zone under consideration.

**H. Fire brigade.** A site fire brigade trained and equipped for fire fighting shall be established to ensure adequate manual fire fighting capability for all areas of the plant containing structures, systems, or components important to safety. The fire brigade shall be at least five members on each shift. The brigade leader and at least two brigade members shall have sufficient training in or knowledge of plant safety-related systems to understand the effects of fire and fire suppressants on safe shutdown

capability. The qualification of fire brigade members shall include an annual physical examination to determine their ability to perform strenuous fire fighting activities. The shift supervisor shall not be a member of the fire brigade. The brigade leader shall be competent to assess the potential safety consequences of a fire and advise control room personnel. Such competence by the brigade leader may be evidenced by possession of an operator's license or equivalent knowledge of plant safety-related systems.

## H.消防隊

The minimum equipment provided for the brigade shall consist of personal protective equipment such as turnout coats, boots, gloves, hard hats, emergency communications equipment, portable lights, portable ventilation equipment, and portable extinguishers. Self-contained breathing apparatus using full-face positive-pressure masks approved by NIOSH (National Institute for Occupational Safety and Health —approval formerly given by the U.S. Bureau of Mines) shall be provided for fire brigade, damage control, and control room personnel. At least 10 masks shall be available for fire brigade personnel. Control room personnel may be furnished breathing air by a manifold system piped from a storage reservoir if practical. Service or rated operating life shall be a minimum of one-half hour for the self-contained units.

At least a 1-hour supply of breathing air in extra bottles shall be located on the plant site for each unit of self-contained breathing apparatus. In addition, an onsite 6-hour supply of reserve air shall be provided and arranged to permit quick and complete replenishment of exhausted air supply bottles as they are returned. If compressors are used as a source of breathing air, only units approved for breathing air shall be used and the compressors shall be operable assuming a loss of offsite power. Special care must be taken to locate the compressor in areas free of dust and contaminants.

I. *Fire brigade training.* The fire brigade training program shall ensure that the capability to fight potential fires is established and maintained. The program shall consist of an initial classroom instruction program followed by periodic classroom instruction, fire fighting practice, and fire drills:

### 1. *Instruction*

a. The initial classroom instruction shall include:

- (1) Indoctrination of the plant fire fighting plan with specific identification of each individual's responsibilities.
- (2) Identification of the type and location of fire hazards and associated types of fires that could occur in the plant.
- (3) The toxic and corrosive characteristics of expected products of combustion.
- (4) Identification of the location of fire fighting equipment for each fire area and familiarization with the layout of the plant, including access and egress routes to each area.
- (5) The proper use of available fire fighting equipment and the correct method of fighting each type of fire. The types of fires covered should include fires in energized electrical equipment, fires in cables and cable trays, hydrogen fires, fires involving flammable and combustible liquids or hazardous process chemicals, fires resulting from construction or modifications (welding), and record file fires.
- (6) The proper use of communication, lighting, ventilation, and emergency breathing equipment.
- (7) The proper method for fighting fires inside buildings and confined spaces.
- (8) The direction and coordination of the fire fighting activities (fire brigade leaders only).
- (9) Detailed review of fire fighting strategies and procedures.
- (10) Review of the latest plant modifications and corresponding changes in fire fighting plans.

Note: Items (9) and (10) may be deleted from the training of no more than two of the non-operations personnel who may be assigned to the fire brigade.

b. The instruction shall be provided by qualified individuals who are knowledgeable, experienced, and suitably trained in fighting the types of fires that could occur in the plant and in using the types of equipment available in the nuclear power plant.

- c. Instruction shall be provided to all fire brigade members and fire brigade leaders.
- d. Regular planned meetings shall be held at least every 3 months for all brigade members to review changes in the fire protection program and other subjects as necessary.
- e. Periodic refresher training sessions shall be held to repeat the classroom instruction program for all brigade members over a two- year period. These sessions may be concurrent with the regular planned meetings.

## *2. Practice*

Practice sessions shall be held for each shift fire brigade on the proper method of fighting the various types of fires that could occur in a nuclear power plant. These sessions shall provide brigade members with experience in actual fire extinguishment and the use of emergency breathing apparatus under strenuous conditions encountered in fire fighting. These practice sessions shall be provided at least once per year for each fire brigade member.

## *3. Drills*

- a. Fire brigade drills shall be performed in the plant so that the fire brigade can practice as a team.
- b. Drills shall be performed at regular intervals not to exceed 3 months for each shift fire brigade. Each fire brigade member should participate in each drill, but must participate in at least two drills per year.

A sufficient number of these drills, but not less than one for each shift fire brigade per year, shall be unannounced to determine the fire fighting readiness of the plant fire brigade, brigade leader, and fire protection systems and equipment. Persons planning and authorizing an unannounced drill shall ensure that the responding shift fire brigade members are not aware that a drill is being planned until it is begun. Unannounced drills shall not be scheduled closer than four weeks.

At least one drill per year shall be performed on a "back shift" for each shift fire brigade.

c. The drills shall be preplanned to establish the training objectives of the drill and shall be critiqued to determine how well the training objectives have been met. Unannounced drills shall be planned and critiqued by members of the management staff responsible for plant safety and fire protection. Performance deficiencies of a fire brigade or of individual fire brigade members shall be remedied by scheduling additional training for the brigade or members. Unsatisfactory drill performance shall be followed by a repeat drill within 30 days.

d. At 3-year intervals, a randomly selected unannounced drill must be critiqued by qualified individuals independent of the licensee's staff. A copy of the written report from these individuals must be available for NRC review and shall be retained as a record as specified in section III.I.4 of this appendix.

e. Drills shall as a minimum include the following:

(1) Assessment of fire alarm effectiveness, time required to notify and assemble fire brigade, and selection, placement and use of equipment, and fire fighting strategies.

(2) Assessment of each brigade member's knowledge of his or her role in the fire fighting strategy for the area assumed to contain the fire. Assessment of the brigade member's conformance with established plant fire fighting procedures and use of fire fighting equipment, including self-contained emergency breathing apparatus, communication equipment, and ventilation equipment, to the extent practicable.

(3) The simulated use of fire fighting equipment required to cope with the situation and type of fire selected for the drill. The area and type of fire chosen for the drill should differ from those used in the previous drill so that brigade members are trained in fighting fires in various plant areas. The situation selected should simulate the size and arrangement of a fire that could reasonably occur in the area selected, allowing for fire development due to the time required to respond, to obtain equipment, and organize for the fire, assuming loss of automatic suppression capability.

(4) Assessment of brigade leader's direction of the fire fighting effort as to thoroughness, accuracy, and effectiveness.

#### 4. *Records*

Individual records of training provided to each fire brigade member, including drill critiques, shall be maintained for at least 3 years to ensure that each member receives training in all parts of the training program. These records of training shall be available for NRC review. Retraining or broadened training for fire fighting within buildings shall be scheduled for all those brigade members whose performance records show deficiencies.

J. *Emergency lighting.* Emergency lighting units with at least an 8-hour battery power supply shall be provided in all areas needed for operation of safe shutdown equipment and in access and egress routes thereto.

K. *Administrative controls.* Administrative controls shall be established to minimize fire hazards in areas containing structures, systems, and components important to safety. These controls shall establish procedures to:

1. Govern the handling and limitation of the use of ordinary combustible materials, combustible and flammable gases and liquids, high efficiency particulate air and charcoal filters, dry ion exchange resins, or other combustible supplies in safety-related areas.
2. Prohibit the storage of combustibles in safety-related areas or establish designated storage areas with appropriate fire protection.
3. Govern the handling of and limit transient fire loads such as combustible and flammable liquids, wood and plastic products, or other combustible materials in buildings containing safety-related systems or equipment during all phases of operating, and especially during maintenance, modification, or refueling operations.
4. Designate the onsite staff member responsible for the inplant fire protection review of proposed work activities to identify potential transient fire hazards and specify required additional fire protection in the work activity procedure.
5. Govern the use of ignition sources by use of a flame permit system to control welding, flame cutting, brazing, or soldering operations. A separate permit shall be issued for each area where work is to be done. If work continues over more than one shift, the permit shall be valid for not more than 24 hours when the plant is operating or for the duration of a particular job during plant shutdown.

6. Control the removal from the area of all waste, debris, scrap, oil spills, or other combustibles resulting from the work activity immediately following completion of the activity, or at the end of each work shift, whichever comes first.

7. Maintain the periodic housekeeping inspections to ensure continued compliance with these administrative controls.

8. Control the use of specific combustibles in safety-related areas. All wood used in safety-related areas during maintenance, modification, or refueling operations (such as lay-down blocks or scaffolding) shall be treated with a flame retardant. Equipment or supplies (such as new fuel) shipped in untreated combustible packing containers may be unpacked in safety-related areas if required for valid operating reasons. However, all combustible materials shall be removed from the area immediately following the unpacking. Such transient combustible material, unless stored in approved containers, shall not be left unattended during lunch breaks, shift changes, or other similar periods. Loose combustible packing material such as wood or paper excelsior, or polyethylene sheeting shall be placed in metal containers with tight-fitting self-closing metal covers.

9. Control actions to be taken by an individual discovering a fire, for example, notification of control room, attempt to extinguish fire, and actuation of local fire suppression systems.

10. Control actions to be taken by the control room operator to determine the need for brigade assistance upon report of a fire or receipt of alarm on control room annunciator panel, for example, announcing location of fire over PA system, sounding fire alarms, and notifying the shift supervisor and the fire brigade leader of the type, size, and location of the fire.

11. Control actions to be taken by the fire brigade after notification by the control room operator of a fire, for example, assembling in a designated location, receiving directions from the fire brigade leader, and discharging specific fire fighting responsibilities including selection and transportation of fire fighting equipment to fire location, selection of protective equipment, operating instructions for use of fire suppression systems, and use of preplanned strategies for fighting fires in specific areas.

12. Define the strategies for fighting fires in all safety-related areas and areas presenting a hazard to safety-related equipment. These strategies shall designate:

- a. Fire hazards in each area covered by the specific prefire plans.
- b. Fire extinguishants best suited for controlling the fires associated with the fire hazards in that area and the nearest location of these extinguishants.
- c. Most favorable direction from which to attack a fire in each area in view of the ventilation direction, access hallways, stairs, and doors that are most likely to be free of fire, and the best station or elevation for fighting the fire. All access and egress routes that involve locked doors should be specifically identified in the procedure with the appropriate precautions and methods for access specified.
- d. Plant systems that should be managed to reduce the damage potential during a local fire and the location of local and remote controls for such management (e.g., any hydraulic or electrical systems in the zone covered by the specific fire fighting procedure that could increase the hazards in the area because of overpressurization or electrical hazards).
- e. Vital heat-sensitive system components that need to be kept cool while fighting a local fire. Particularly hazardous combustibles that need cooling should be designated.
- f. Organization of fire fighting brigades and the assignment of special duties according to job title so that all fire fighting functions are covered by any complete shift personnel complement. These duties include command control of the brigade, transporting fire suppression and support equipment to the fire scenes, applying the extinguishant to the fire, communication with the control room, and coordination with outside fire departments.
- g. Potential radiological and toxic hazards in fire zones.
- h. Ventilation system operation that ensures desired plant air distribution when the ventilation flow is modified for fire containment or smoke clearing operations.

火災の閉じ込めや煙除去などの操作が行われ、換気量が変化したとしても必要な空気をプラントに配分するための換気システム(→こんなのできるはずがない?)

- i. Operations requiring control room and shift engineer coordination or authorization.
- j. Instructions for plant operators and general plant personnel during fire.

*L. Alternative and dedicated shutdown capability.* 1. Alternative or dedicated shutdown capability provided for a specific fire area shall be able to (a) achieve and maintain subcritical reactivity conditions in the reactor; (b) maintain reactor coolant inventory; (c) achieve and maintain hot standby<sup>2</sup> conditions for a PWR (hot shutdown<sup>2</sup> for a BWR); (d) achieve cold shutdown conditions within 72 hours; and (e) maintain cold shutdown conditions thereafter. During the postfire shutdown, the reactor coolant system process variables shall be maintained within those predicted for a loss of normal a.c. power, and the fission product boundary integrity shall not be affected; i.e., there shall be no fuel clad damage, rupture of any primary coolant boundary, of rupture of the containment boundary.

2. The performance goals for the shutdown functions shall be:

- a. The reactivity control function shall be capable of achieving and maintaining cold shutdown reactivity conditions.
- b. The reactor coolant makeup function shall be capable of maintaining the reactor coolant level above the top of the core for BWRs and be within the level indication in the pressurizer for PWRs.
- c. The reactor heat removal function shall be capable of achieving and maintaining decay heat removal.
- d. The process monitoring function shall be capable of providing direct readings of the process variables necessary to perform and control the above functions.
- e. The supporting functions shall be capable of providing the process cooling, lubrication, etc., necessary to permit the operation of the equipment used for safe shutdown functions.

3. The shutdown capability for specific fire areas may be unique for each such area, or it may be one unique combination of systems for all such areas. In either case, the alternative shutdown capability shall be independent of the specific fire area(s) and shall accommodate postfire conditions where offsite power is available and where

offsite power is not available for 72 hours. Procedures shall be in effect to implement this capability.

4. If the capability to achieve and maintain cold shutdown will not be available because of fire damage, the equipment and systems comprising the means to achieve and maintain the hot standby or hot shutdown condition shall be capable of maintaining such conditions until cold shutdown can be achieved. If such equipment and systems will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. The number of operating shift personnel, exclusive of fire brigade members, required to operate such equipment and systems shall be on site at all times.

5. Equipment and systems comprising the means to achieve and maintain cold shutdown conditions shall not be damaged by fire; or the fire damage to such equipment and systems shall be limited so that the systems can be made operable and cold shutdown can be achieved within 72 hours. Materials for such repairs shall be readily available on site and procedures shall be in effect to implement such repairs. If such equipment and systems used prior to 72 hours after the fire will not be capable of being powered by both onsite and offsite electric power systems because of fire damage, an independent onsite power system shall be provided. Equipment and systems used after 72 hours may be powered by offsite power only.

6. Shutdown systems installed to ensure postfire shutdown capability need not be designed to meet seismic Category I criteria, single failure criteria, or other design basis accident criteria, except where required for other reasons, e.g., because of interface with or impact on existing safety systems, or because of adverse valve actions due to fire damage.

7. The safe shutdown equipment and systems for each fire area shall be known to be isolated from associated non-safety circuits in the fire area so that hot shorts, open circuits, or shorts to ground in the associated circuits will not prevent operation of the safe shutdown equipment. The separation and barriers between trays and conduits containing associated circuits of one safe shutdown division and trays and conduits containing associated circuits or safe shutdown cables from the redundant division, or the isolation of these associated circuits from the safe shutdown equipment, shall be such that a postulated fire involving associated circuits will not prevent safe shutdown.<sup>3</sup>

**M. Fire barrier cable penetration seal qualification.** Penetration seal designs must be qualified by tests that are comparable to tests used to rate fire barriers. The acceptance criteria for the test must include the following:

**M.ケーブル防火バリア貫通部シールの品質保証** 貫通部シールのデザインは、防火バリアのレイティングに用いられる試験に相当する試験によって品質保証されねばならない。試験の許容基準は以下のものを含まねばならない

1. The cable fire barrier penetration seal has withstood the fire endurance test without passage of flame or ignition of cables on the unexposed side for a period of time equivalent to the fire resistance rating required of the barrier;

ケーブル防火バリア貫通部シールは耐火試験でバリアに求められる時間と同等な時間、非加熱側への炎の通過もしくはケーブルの発火が無いことが求められる。

2. The temperature levels recorded for the unexposed side are analyzed and demonstrate that the maximum temperature is sufficiently below the cable insulation ignition temperature; and

3. The fire barrier penetration seal remains intact and does not allow projection of water beyond the unexposed surface during the hose stream test.

**N. Fire doors.** Fire doors shall be self-closing or provided with closing mechanisms and shall be inspected semiannually to verify that automatic hold-open, release, and closing mechanisms and latches are operable.

**N.防火扉** 防火扉は、自閉であるか、自動的に開放状態が維持され、保持が外れ、閉鎖する機構とラッチが働くことを、半年ごとに検査されねばならない閉鎖機構を有するものでなければならない。

One of the following measures shall be provided to ensure they will protect the opening as required in case of fire:

以下の対策のうちの一つが、火災の場合に、要求されたように開口部を守ることを保証するため用意されるべきである。

1. Fire doors shall be kept closed and electrically supervised at a continuously manned location;

防火扉は閉鎖状態で維持され、継続的に人がいる場所で電氣的に監視されねばならない。

2. Fire doors shall be locked closed and inspected weekly to verify that the doors are in the closed position;

防火扉は鍵をかけて閉鎖状態に、毎週閉鎖状態にあるかを検査する。

3. Fire doors shall be provided with automatic hold-open and release mechanisms and inspected daily to verify that doorways are free of obstructions; or

防火扉は、自動的に開放状態で保持され、保持が外れる機構であり、この場合、毎日、扉のところに障害物が無いことを確認しなければならない。

4. Fire doors shall be kept closed and inspected daily to verify that they are in the closed position.

防火扉は、閉鎖状態に保持され、毎日、扉は閉鎖状態にあるかどうかを評価するために検査されねばならない

The fire brigade leader shall have ready access to keys for any locked fire doors.

消防隊の長は、鍵のかかった防火扉では、鍵をすぐに入手できなければならない

Areas protected by automatic total flooding gas suppression systems shall have electrically supervised self-closing fire doors or shall satisfy option 1 above.

O. *Oil collection system for reactor coolant pump.* The reactor coolant pump shall be equipped with an oil collection system if the containment is not inerted during normal operation. The oil collection system shall be so designed, engineered, and installed that failure will not lead to fire during normal or design basis accident conditions and that there is reasonable assurance that the system will withstand the Safe Shutdown Earthquake.<sup>4</sup>

Such collection systems shall be capable of collecting lube oil from all potential pressurized and unpressurized leakage sites in the reactor coolant pump lube oil

systems. Leakage shall be collected and drained to a vented closed container that can hold the entire lube oil system inventory. A flame arrester is required in the vent if the flash point characteristics of the oil present the hazard of fire flashback. Leakage points to be protected shall include lift pump and piping, overflow lines, lube oil cooler, oil fill and drain lines and plugs, flanged connections on oil lines, and lube oil reservoirs where such features exist on the reactor coolant pumps. The drain line shall be large enough to accommodate the largest potential oil leak.

[45 FR 76611, Nov. 19, 1980; 46 FR 44735, Sept. 8, 1981, as amended at 53 FR 19251, May 27, 1988; 65 FR 38191, June 20, 2000; 77 FR 39907, Jul. 6, 2012]

<sup>1</sup> Alternative shutdown capability is provided by rerouting, relocating, or modifying existing systems; dedicated shutdown capability is provided by installing new structures and systems for the function of post-fire shutdown.

<sup>2</sup> As defined in the Standard Technical Specifications.

<sup>3</sup> An acceptable method of complying with this alternative would be to meet Regulatory Guide 1.75 position 4 related to associated circuits and IEEE Std 384-1974 (Section 4.5) where trays from redundant safety divisions are so protected that postulated fires affect trays from only one safety division.

<sup>4</sup> See Regulatory Guide 1.29—"Seismic Design Classification" paragraph C.2.

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