First Revision No. 63-NFPA 850-2013 [ Global Input ]

Change the number 1890 L/min to 1893 L/min throughout the document.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: [ Not Specified ]
State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Wed May 22 14:01:21 EDT 2013

Committee Statement

Committee Statement: Editorial
Response Message:
1.1 Scope.
This document provides recommendations for fire prevention and fire protection for electric generating plants and high voltage direct current converter stations, except as follows: Nuclear power plants are addressed in NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*; hydroelectric plants are addressed in NFPA 851, *Recommended Practice for Fire Protection for Hydroelectric Generating Plants*; and fuel cells are addressed in NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Systems*.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Mon Jun 03 10:08:27 EDT 2013

Committee Statement

Committee Statement: NFPA 851 has been withdrawn and incorporated into NFPA 850.
Response Message:

2.2 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 16 11:22:17 EDT 2013

Committee Statement
Committee Statement: Revised edition dates to comply with the manual of styles. Removed reference to NFPA 92A as it has been withdrawn and incorporated into NFPA 92. Added reference to NFPA 92 Standard for Smoke Control Systems. Removed reference to NFPA 251 as the document has been withdrawn and the industry now refers to ASTM E119 or UL 263. Removed reference to NFPA 851 as it has been incorporated into NFPA 850. Added reference to NFPA 96, 120, 501A and 1901 based on the incorporation of NFPA 851.

Response Message:
Public Input No. 11-NFPA 850-2012 [Section No. 2.2]

First Revision No. 7-NFPA 850-2013 [Section No. 2.3.2]

2.3.2 API Publications.
American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

API 500, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division II, 2002 2012.

API 505, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0 and Zone 2, 1997 2002.


Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Thu May 16 15:21:50 EDT 2013

Committee Statement

Committee Statement: Editorially revised reference dates to comply with the manual of style. Response Message:
First Revision No. 3-NFPA 850-2013 [ Section No. 2.3.3 ]

2.3.3 ASME Publications.
American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City:
State:
Zip:
Submittal Date: Thu May 16 14:12:09 EDT 2013

Committee Statement

Committee Statement: Editorially revised reference dates to comply with the manual of style.
Response Message:
2.3.4 ASTM Publications.
ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 16 13:56:46 EDT 2013

Committee Statement

Committee Statement: Editorially revised reference dates to comply with the manual of style.
Updated titles.
First Revision No. 4-NFPA 850-2013 [ Section No. 2.3.5 ]

2.3.5 IEC Publications.
International Electrotechnical Commission, 3, rue de Varembé, P.O. Box 131, CH-1211 Geneva 20, Switzerland.


Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submital Date: Thu May 16 14:18:08 EDT 2013

Committee Statement

Committee Statement: IEC TR 61400-24 has been withdrawn and therefore removed as a reference.

Response Message:
First Revision No. 5-NFPA 850-2013 [ Section No. 2.3.6 ]

2.3.6 IEEE Publications.
IEEE, Three Park Avenue, 17th Floor, New York, NY 10016-5997.
IEEE C37.20.7, Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for
IEEE 383, Standard for Type Test of Class IE Electric Cables, Field Splices and
IEEE 484, Recommended Practice for Installation Design and Installation of
Large Vented Lead-Acid Lead-Acid Storage Batteries for Generating Stations and
IEEE 634, Testing of Fire Rated Penetration Seals Standard for Cable-Penetration Fire

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu May 16 14:23:09 EDT 2013

Committee Statement

Committee Statement: Revised reference dates to comply with the manual of style. Updated titles.
First Revision No. 28-NFPA 850-2013 [Section No. 2.3.7]

2.3.7 UL Publications.
Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.


Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 08:18:24 EDT 2013

Committee Statement

Committee Statement: Add ANSI approval designation to ANSI/UL 790 and ANSI/UL 1709, and update referenced standards to most recent edition as indicated.
Response Message: Public Input No. 18-NFPA 850-2012 [Section No. 2.3.7]
# First Revision No. 29-NFPA 850-2013 [ Section No. 2.3.8 ]

## 2.3.8 U.S. Government Publications.


## Submitter Information Verification

<table>
<thead>
<tr>
<th>Submitter Full Name:</th>
<th>[ Not Specified ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization:</td>
<td>[ Not Specified ]</td>
</tr>
<tr>
<td>Street Address:</td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td></td>
</tr>
<tr>
<td>State:</td>
<td></td>
</tr>
<tr>
<td>Zip:</td>
<td></td>
</tr>
</tbody>
</table>

**Submittal Date:** Wed May 22 08:23:22 EDT 2013

## Committee Statement

**Committee Statement:** Revised reference dates to comply with the manual of style.

**Response Message:**

---

First Revision No. 6-NFPA 850-2013 [ Section No. 2.4 ]

2.4 References for Extracts in Recommendations Sections.


Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 16 14:42:32 EDT 2013

Committee Statement

Committee Statement: Revised reference dates to comply with the manual of style. Removed reference to NFPA 851 as it has been incorporated into NFPA 850.
Response Message:
First Revision No. 15-NFPA 850-2013 [ New Section after 3.3.2 ]

3.3.3 Combustible.
   Capable of undergoing combustion.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 14:13:53 EDT 2013

Committee Statement

Committee Statement: Definition of combustible has been incorporated from NFPA 851 into NFPA 850.

Response Message:
3.3.8 Fire Barrier.
A continuous membrane or a membrane with discontinuities created by protected openings with a specified fire protection rating, where such membrane is designed and constructed with a specified fire resistance rating to limit the spread of fire, that also restricts the movement of smoke. [101, 2009 2015]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 16 15:28:13 EDT 2013

Committee Statement

Committee Statement: Revised reference date to align with Chapter 2 reference.
Response Message:
3.3.9 Fire Loading.
The amount of combustibles present in a given area, expressed in Btu/ft\(^2\) (kJ/m\(^2\)).\[851, 2010]\
First Revision No. 9-NFPA 850-2013 [ Section No. 3.3.9 ]

3.3.10 Fire Point.
The lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame in accordance with ASTM D 92, Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester. [30, 2008 2015]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 17 07:54:24 EDT 2013

Committee Statement

Committee Statement: Revised reference date to align with Chapter 2 reference.
Response Message:
3.3.11 Fire Prevention.
Measures directed toward avoiding the inception of fire. [801, 20082014]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 17 07:56:25 EDT 2013

Committee Statement

Committee Statement: Revised reference date to align with Chapter 2 reference.
Response Message:
3.3.12 Fire Protection.
Methods of providing for fire control or fire extinguishment. [801, 2008 2014]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 17 07:57:02 EDT 2013

Committee Statement

Committee Statement: Revised reference date to align with Chapter 2 reference.
Response Message:
3.3.13 Fire Rated Penetration Seal.
An opening in a fire barrier for the passage of pipe, cable, duct, and so forth, that has been sealed so as to maintain a barrier rating. [851, 2010]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submitter Date: Fri May 17 07:58:13 EDT 2013

Committee Statement

Committee Statement: NFPA 851 has been withdrawn and incorporated into NFPA 850. Therefore, the extract reference is no longer needed.
Response Message:
First Revision No. 14-NFPA 850-2013 [Section No. 3.3.17 [Excluding any Sub-Sections]]

The exposed surfaces of walls, ceilings, and floors within buildings. \[5000, 2009\] [5000, 2015]

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 17 08:06:04 EDT 2013

Committee Statement

Committee Statement: Revised reference date to align with Chapter 2 reference.
Response Message:
3.3.24.2 Fire Resistance Rating.
The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as determined by the tests, or methods based on tests, as prescribed in *NFPA 5000, Building Construction and Safety Code*, [5000, 2015] established in accordance with the test procedures of *NFPA 251 : Standard Methods of Tests of Fire Resistance of Building Construction and Materials*, [251, 2009 2015].

Submitter Information Verification

**Submitter Full Name:** Chad Duffy  
**Organization:** National Fire Protection Assoc  
**Street Address:**  
**City:**  
**State:**  
**Zip:**  
**Submittal Date:** Thu Aug 01 14:55:01 EDT 2013

Committee Statement

**Committee Statement:** The definition for Fire Resistance Rating has been revised to align with the definition of NFPA 5000. This is due to NFPA 251 being withdrawn.

**Response Message:**
First Revision No. 62-NFPA 850-2013 [Section No. 4.1.5]

4.1.5

The DBD Fire Protection Design Basis Document should be a living document that will continue to evolve, as the plant design is refined, and it should be maintained and revised for the life of the plant. The Fire Protection Design Basis Document is key to the management of change process (see 17.4.3).

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 13:58:35 EDT 2013

Committee Statement

Committee Statement: Provides tie to the Management of Change process.
Response Message:
5.1.1.3*

Unless consideration of the factors of 5.1.1.2 indicates otherwise or if adequate spatial separation is provided as permitted in 5.1.1.5, it is recommended that fire area boundaries be provided to separate the following:

(1) Cable spreading room(s), and cable tunnel(s) and high voltage lead shafts from adjacent areas
(2) Control room, computer room, or combined control/computer room from adjacent areas
(3) Rooms with major concentrations of electrical equipment, such as a switchgear room and or relay room, from adjacent areas
(4) Battery rooms from associated battery chargers, equipment, and adjacent areas
(5) Maintenance shop(s) from adjacent areas
(6) Main fire pump(s) from reserve fire pump(s) where these pumps provide the only source of fire protection water
(7) Fire pumps from adjacent areas
(8) Warehouses from adjacent areas
(9) Emergency generators from each other and from adjacent areas
(10) Fossil fuel–fired auxiliary boiler(s) from adjacent areas
(11) Fuel oil pumping, fuel oil heating facilities, or both, used for continuous firing of the boiler from adjacent areas
(12) Storage areas for flammable and combustible liquid tanks and containers from adjacent areas
(13) Office buildings from adjacent areas
(14) Telecommunication rooms, supervisory control and data acquisition (SCADA) rooms, and remote terminal unit (RTU) rooms from adjacent areas
(15) Adjacent turbine generators beneath the underside of the operating floor
(16) Between the boiler house and the areas of the coal handling system above the bin, bunker, or silo
(17) Fan rooms and plenum chambers from adjacent areas [fire dampers might not be advisable in emergency ventilation ducts, (see Section 5.4)]
(18) Switchgear area and sulfur hexafluoride (SF6) switchyard area from adjacent areas

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Tue May 21 14:19:32 EDT 2013
### Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851.

Response Message:
5.1.4.2
Determination of the type of physical separation to be used between transformers, control equipment, and building structures should be based on consideration of a detailed analysis of the following:

(1) Type and quantity of oil in the transformer
(2) Size of a postulated oil spill (surface area and depth)
(3) Type of construction of adjacent structures
(4) Type and amount of exposed equipment, including high line structures, motor control center (MCC) equipment, breakers, other transformers, et cetera, and so forth.
(5) Power rating of the transformer
(6) Fire suppression systems provided
(7) Type of electrical protective relaying provided
(8) Availability of replacement transformers (long lead times)
(9) The existence of fast depressurization systems

Once this analysis has been completed, any decisions made as a result should be included as part of the Fire Protection Design Basis Document.
First Revision No. 17-NFPA 850-2013 [ Section No. 5.1.4.3 ]

5.1.4.3*

Unless consideration of the factors in 5.1.4.2 indicates otherwise, it is recommended that any oil-insulated transformer containing 500 gal (1890 L) or more of oil be separated from adjacent structures by a 2-hour-rated firewall or by spatial separation in accordance with Table 5.1.4.3. Where a firewall is provided between structures and a transformer, it should extend vertically and horizontally as indicated in Figure 5.1.4.3.

Table 5.1.4.3 Outdoor Oil-Insulated Transformer Separation Criteria

<table>
<thead>
<tr>
<th>Transformer Oil Capacity</th>
<th>Minimum (Line-of-Sight) Separation Without Firewall</th>
</tr>
</thead>
<tbody>
<tr>
<td>gal</td>
<td>ft</td>
</tr>
<tr>
<td>&lt;500</td>
<td>&lt;1,890</td>
</tr>
<tr>
<td>500–5000</td>
<td>25</td>
</tr>
<tr>
<td>&gt;5000</td>
<td>&gt;18,925</td>
</tr>
</tbody>
</table>

Figure 5.1.4.3 Illustration of Oil-Insulated Transformer Separation Recommendations.

Supplemental Information

File Name
FR17_NFPA_850_Table_5.1.4.3.docx

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: 
State: 

Committee Statement

Committee Recommended practice criteria incorporated from NFPA 851. Reference in the table Statement: has been updated to call out the section that references transformers of less than 500 gallons.

Response Message:
5.1.4.4

Unless consideration of the factors in 5.1.4.2 indicates otherwise, it is recommended that adjacent oil-insulated transformers containing 500 gal (1890 L) or more of oil be separated from each other by a 2-hour-rated firewall or by spatial separation in accordance with Table 5.1.4.3. When the oil containment, as shown in Figure 5.1.4.4, consists of a large, flat concrete containment area that holds several transformers and other equipment in it without the typical pit containment areas, specific containment features to keep the oil in one transformer from migrating to any other transformer or equipment should be provided. Subsection 5.5.7 can be used for guidance. Where a firewall is provided between transformers, it should extend at least 1 ft (0.31 m) above the top of the transformer casing and oil conservator tank and at least 2 ft (0.61 m) beyond the width of the transformer and cooling radiators, or to the edge of the containment area, whichever is greater. (See Figure 5.1.4.4 for an illustration of the recommended dimensions for a firewall.)

**Figure 5.1.4.4 Outdoor Oil-Insulated Transformer Separation Criteria.**

---

**Submitter Information Verification**

**Submitter Full Name:** [Not Specified]

**Organization:** [Not Specified]

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Tue May 21 14:27:39 EDT 2013

---

**Committee Statement**

**Committee**

Recommended practice criteria incorporated from NFPA 851. Provided clarification on how to design a large containment area with multiple transformers and equipment. In addition, the firewall needs to extend to the edge of the containment to avoid fire exposure to adjacent transformers and equipment.

**Response Message:**

---
5.1.4.6
For transformers with less than 500 gal (1890 L) of oil and where a firewall is not provided, the edge of the postulated oil spill (i.e., containment basin, if provided) should be separated by a minimum of 5 ft (1.5 m) from the exposed structure to prevent direct flame impingement on the structure.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 14:28:30 EDT 2013

Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851.
Response Message:
First Revision No. 32-NFPA 850-2013 [ New Section after 5.1.5.4 ]

5.1.6 General Substation Arrangement.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:05:45 EDT 2013

Committee Statement

Committee Statement: This section will contain the general arrangement of transformers and associated electrical equipment as it pertains to the electric generating facility switch yard.
Response Message:
5.2.2*
Structures should be classified as follows, as defined in NFPA 101, Life Safety Code:

(1) General areas should be considered as special purpose industrial occupancies.

(2) Open structures and underground structures (e.g., tunnels) should be considered as occupancies in special structures. Temporary occupancies and means of egress inside the structures and piers of large "bulb" hydroelectric units should be evaluated based on occupancies in special structures.

(3) General office structures should be considered as business occupancies.

(4) Warehouses should be considered as storage occupancies.

(5) Coal preparation and handling facilities (e.g., enclosed crusher houses, transfer houses, and conveyors) should be considered special-purpose industrial occupancies.

(6) Scrubber buildings should be considered as special-purpose industrial occupancies.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 14:33:14 EDT 2013

Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851.
Response Message:
First Revision No. 33-NFPA 850-2013 [ New Section after 5.2.3 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:17:06 EDT 2013

Committee Statement

Committee Emergency plans are developed for normal operating conditions. This new
Statement: recommendation takes into account the increased occupancy load associated with
an outage.

Response Message:
5.3.1
Construction materials being considered for electric generating plants and high-voltage
direct current converter stations should be selected based on the Fire Protection Design
Basis Document and on consideration of the following NFPA standards:

(1) NFPA 220, Standard on Types of Building Construction

(2) ASTM E 119 or ANSI/UL 263, Standard Test Methods for Fire Tests of Building
    Construction and Materials

(3) NFPA 253, Standard Method of Test for Critical Radiant Flux of Floor Covering
    Systems Using a Radiant Heat Energy Source

(4) NFPA 259, Standard Test Method for Potential Heat of Building Materials

(5) ASTM E 84, Standard Test Method for Surface Burning Characteristics of Building
    Materials, or ANSI/UL 723, Test for Surface Burning Characteristics of Building
    Materials

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 14:41:57 EDT 2013

Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851. ASTM E 119 and
UL 263 has been added as a replacement to NFPA 251.
Response Message:
First Revision No. 34-NFPA 850-2013 [ Section No. 5.3.2 ]

5.3.2 Construction materials used in the boiler, engine, or turbine-generator buildings or other buildings critical to power generation or conversion should meet the definition of noncombustible or limited combustible, except for the following:

(1) Roof coverings, which should be as outlined in 5.3.4
(2) Limited use of translucent reinforced plastic panels as allowed by the Fire Protection Design Basis Document

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Wed May 22 09:24:53 EDT 2013

Committee Statement

Committee Statement: Editorial
Response Message: 
5.4.1.3.2*
Separate smoke management or ventilation systems are preferred; however, smoke venting can be integrated into normal ventilation systems using automatic or manually positioned dampers and motor speed control. (See NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems; NFPA 92A, Standard for Smoke-Control Systems; Utilizing Barriers and Pressure Differences and NFPA 204, Standard for Smoke and Heat Venting.) Smoke venting also is permitted to be accomplished through the use of portable smoke ejectors. A smoke management system should be utilized to mitigate the effects of smoke and heat during the early stages of a fire.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 17:39:51 EDT 2013

Committee Statement

Committee Statement: Revised reference as NFPA 92A has been withdrawn.
Response Message:
At least one reliable water supply should be provided. The Fire Protection Design Basis Document should identify the need for multiple supply sources. Factors to consider should include the following:

1. Reliability of source
2. Capacity of source
3. Reliance on water-based fire protection systems
4. Availability of alternate and backup sources
5. Consequences of a loss, in terms of property and generation

Committee Statement

Committee Statement: Clarifies that one water supply can be a reliable source for the fire protection system(s).

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:27:24 EDT 2013
First Revision No. 38-NFPA 850-2013 [ Section No. 6.2.2.1 ]

6.2.2.1*
Potential sources to be considered can include tanks, ponds, rivers, municipal supplies, and cooling tower basins.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed May 22 09:54:42 EDT 2013

Committee Statement

Committee Statement: Annex material incorporated from NFPA 851.
Response Message:
6.2.3.1

If a single water supply is utilized, two independent connections should be provided. If a situation can arise in which the primary water supply can become unavailable (e.g., dewatering of penstocks), an auxiliary supply should be provided. Each supply should be capable of meeting the recommendations in 6.2.2.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:59:36 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendation from NFPA 851.
Response Message:
First Revision No. 39-NFPA 850-2013 [ Section No. 6.2.3 ]

6.2.3
Each water supply should be connected to the station supply main or yard main by separate connections arranged and valve controlled to minimize the possibility of multiple supplies being impaired simultaneously.

6.2.3.1

If a single water supply is utilized, two independent connections should be provided. If a situation can arise in which the primary water supply can become unavailable (e.g., dewatering of penstocks), an auxiliary supply should be provided. Each supply should be capable of meeting the recommendations in 6.2.2.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:55:30 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendation from NFPA 851.
Response Message:
6.2.5.2
Fire pumps should be automatic starting with manual shutdown, except as allowed in NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*. The manual shutdown should be at the pump controllers only. (See NFPA 20.)

**Submitter Information Verification**

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue May 21 15:45:46 EDT 2013

**Committee Statement**

Committee Statement: Recommended practice criteria incorporated from NFPA 851.
Response Message:
6.3 Valve Supervision.

All fire protection water supply and system control valves should be under a periodic inspection program (see Chapter 17) and should be supervised by one of the following methods:

1. Electrical supervision with audible and visual signals in the main control room or another constantly attended location.

2. Locking valves open. Keys should be made available only to authorized personnel.

3. Sealing valves open. This option should be followed only where valves are within fenced enclosures under the control of the property owners.

Committee Statement

Committee Statement: Editorial correction with the edition of new chapter 14.

Response Message:

6.4 Supply Mains, Yard Mains, Hydrants, and Building Standpipes.

6.4.1 Supply Mains, Yard Mains, and Hydrants.

Supply mains and outdoor fire hydrants should be installed on the plant site. (See NFPA 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.) Hydrant spacing in main plant areas should be a maximum of 300 ft (91.4 m). Hydrant spacing in remote areas such as long-term coal storage should be a maximum of 500 ft (152.4 m).
6.4.1.2
Remotely located plant-related facilities should be reviewed on an individual basis to determine the need for fire protection. If excessively long extensions of underground fire mains are necessary for fire protection at these locations, it can be permitted to supply this need from an available service main in the immediate area. Where common supply piping is provided for service water and fire protection water supply, it should be sized to accommodate both service water and fire protection demands.

6.4.1.3
The supply mains should be looped around the main power block and should be of sufficient size to supply the flow requirements determined by 6.2.1 to any point in the yard loop considering the most direct path to be out of service. Pipe sizes should be designed to encompass any anticipated expansion and future water demands.

6.4.1.4
Indicator control valves should be installed to provide adequate sectional control of the fire main loop to minimize plant protection impairments.

6.4.1.5
Each hydrant should be equipped with a separate shutoff valve located on the branch connection to the supply main.

6.4.1.6
Interior fire protection loops are considered an extension of the yard main and should be provided with at least two valved connections to the yard main with appropriate sectional control valves on the interior loop.

6.4.1.7
It might be necessary for the fire department to draft from a body of water adjacent to the plant. However, the terrain and elevation above the water supply can make it difficult for drafting. Consideration should be given to installing a dry hydrant with adequate fire apparatus access.

6.4.2  Standpipe and Hose Systems.

6.4.2.1
Standpipe and hose systems should be installed in buildings and structures where deemed necessary by the Fire Protection Design Basis. (See NFPA 14, Standard for the Installation of Standpipe and Hose Systems.) The standpipe and hose system is an extension of the yard fire main and hydrant system. The hose stations should be capable of delivering the hose stream demand for the various hazards in buildings.

6.4.2.2
Fire main connections for standpipes should be arranged so that a fire main break can be isolated without interrupting service simultaneously to both fixed protection and hose connections protecting the same hazard or area. Choice of Class I, Class II, or Class III systems should be determined by a Fire Protection Design Basis. (See NFPA 14, Standard for the Installation of Standpipe and Hose Systems.)

6.4.2.3
The standpipe piping should be capable of providing minimum volume and pressure for the highest hose stations.

6.4.2.4
Due to the open arrangement of these plants, the locations of hose stations should take into account safe egress for personnel operating hose lines.

6.4.3  Hose Nozzles.
Spray nozzles having shutoff capability and listed for use on electrical equipment should be provided on hoses located in areas near energized electrical equipment.
6.4.4 Hose Threads:
Hose threads on hydrants and standpipe systems should be compatible with fire hose used by the responding fire departments.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed May 22 10:01:43 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendation from NFPA 851.
Response Message:
First Revision No. 23-NFPA 850-2013 [ New Section after 6.4.1.6 ]

6.4.1.7

It might be necessary for the fire department to draft from a body of water adjacent to the plant. However, the terrain and elevation above the water supply can make it difficult for drafting. Consideration should be given to installing a dry hydrant with adequate fire apparatus access.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 15:53:48 EDT 2013

Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851 and editorially revised.

Response Message:
6.5 Portable Fire Extinguishers.

Portable fire For first aid fire protection, suitable fire extinguishers should be provided.
(See NFPA 10, Standard for Portable Fire Extinguishers.)

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Tue May 21 15:57:48 EDT 2013

Committee Statement

Committee Statement: Recommended practice criteria incorporated from NFPA 851.
Response Message:
6.6.1

Fire suppression systems and equipment should be provided in all areas of the plant as identified in Chapters 7 through 15 or as determined by the Fire Protection Design Basis Document. Fixed suppression systems should be designed in accordance with the following codes and standards unless specifically noted otherwise:

1. NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam
2. NFPA 12, Standard on Carbon Dioxide Extinguishing Systems
3. NFPA 13, Standard for the Installation of Sprinkler Systems
5. NFPA 16, Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems
6. NFPA 17, Standard for Dry Chemical Extinguishing Systems
7. NFPA 750, Standard on Water Mist Fire Protection Systems
8. NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City:
State:
Zip:
Submittal Date: Wed May 22 17:33:13 EDT 2013

Committee Statement

Committee: Aerosol Extinguishing systems are suitable for some suitable applications covered by this document, but there is no reference to allow use of the technology.
Response Message:
Public Input No. 12-NFPA 850-2012 [Section No. 6.6.1]
First Revision No. 25-NFPA 850-2013 [ Section No. 6.6.2 ]

### 6.6.2

The selection of an extinguishing agent or a combination of extinguishing agents should be based on the following:

1. The type of hazard
2. The effect of agent discharge on equipment
3. The health hazards

**Personnel hazards created by the discharge of CO\(_2\)** should be considered in the design of the system. The design should take into account the immediate release of CO\(_2\) into the protected area and the possibility of CO\(_2\) leakage, migration, and settling into adjacent areas and lower elevations of the plant. See NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, for hazards to personnel. At a minimum, if CO\(_2\) systems are provided, they should be provided with an odorizer for alerting personnel, and breathing apparatus should be provided for operators in areas that cannot be abandoned.

---

**Submitter Information Verification**

**Submitter Full Name:** [ Not Specified ]
**Organization:** [ Not Specified ]
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Tue May 21 15:59:57 EDT 2013

**Committee Statement**

**Committee Statement:** Recommended practice criteria incorporated from NFPA 851.

**Response Message:**
6.7.3
The fire-signaling system or plant communication system should provide the following:

(1) Manual fire alarm devices (e.g., pull boxes or page party stations) installed in all occupied buildings. Manual fire alarm devices should be installed for remote yard hazards as identified by the Fire Protection Design Basis Document.

(2) * Plant-wide audible fire alarm or voice communication systems, or both, for purposes of personnel evacuation and alerting of plant emergency organization. The plant public address system, if provided, should be available on a priority basis.

(3) Two-way communications for the plant emergency organization during emergency operations.

(4) Means to notify the public fire department.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 21 16:19:30 EDT 2013

Committee Statement

Committee Statement: The recommendation from NFPA 851, section 6.8.1.2 has been editorially revised for clarity and incorporated as annex language into NFPA 850.
First Revision No. 42-NFPA 850-2013 [ Section No. 7.2.1 ]

7.2.1*

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 10:20:54 EDT 2013

Committee Statement

Committee Statement: This change is intended to incorporate the TIA 10-2.
Response Message:
First Revision No. 55-NFPA 850-2013 [ Section No. 7.2.2 ]

7.2.2
The plant’s main and igniter natural fuel gas shutoff valve should be located near an exterior wall in a remote area and accessible under emergency conditions. The valve should be provided with both manual and automatic closing capabilities locally, and remote closing capability from the control room. The valve should be arranged to fail closed on the loss of power or pneumatic control.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 12:39:40 EDT 2013

Committee Statement

Committee Statement: Revised TIA 10-2 language to address where plants are not indoors.
Response Message:
First Revision No. 56-NFPA 850-2013 [ New Section after 7.2.3 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 12:46:33 EDT 2013

Committee Statement

Committee Statement: Incorporated from TIA 10-2
Response Message:

First Revision No. 58-NFPA 850-2013 [ New Section after 7.2.3 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 12:51:06 EDT 2013

Committee Statement

Committee Statement: Incorporated from TIA 10-2
Response Message:
First Revision No. 107-NFPA 850-2013 [ Section No. 7.4.1.3 ]

7.4.1.3
Where coal storage barns or domes are used to enclose storage piles, the fire detection, fire protection, fire alarm, dust collection, dust suppression, explosion venting, and housekeeping recommendations contained herein for coal handling areas and structures should be considered. The plant-specific features provided for the coal barn/dome should be as determined during the Fire Protection Design Process Document. (See Chapter 4.)

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 03 11:33:24 EDT 2013

Committee Statement

Committee Statement: Due to the potential for elements required for a dust explosion to exist within a coal storage barn or dome, explosion venting should be considered per NFPA 654.
Response Message:
7.4.2.5
Once spontaneous heating develops to the fire stage, it becomes very difficult to extinguish the fire short of emptying the bin, bunker, or silo. Therefore, provisions for emptying the bin, bunker, or silo should be provided. This unloading process might take the form of conveyors discharging to a stacking out pile. Another method would be to use flanged openings for removing the coal if adequate planning and necessary equipment have been provided. Removing hot or burning coal can lead to a dust explosion if a dust cloud develops. Proper pre-planning should be developed to prevent a dust cloud, such as covering the coal with a blanket of high-expansion foam, water mist, water spray with fire-fighting additives, dust suppression, or dust collection.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 03 11:35:01 EDT 2013

Committee Statement

Committee Statement: For consistency within the document, included bin, bunker, or silo so that the reader considers the potential hazards and methods to mitigate the hazards regardless of the shape or common name of the temporary storage container.

Response Message:
If fire occurs in a silo, it is necessary to initiate manual actions for suppression and extinguishment. The following fire-fighting strategies have been successfully employed (depending on the specific circumstances and type of coal used):

1. Use of fire-fighting additives such as Class A foams, penetrants, or micelle-encapsulating wetting agents and water additives

2. Injection of inert gas

3. Emptying the silo through the feeder pipe to a safe location (inside or outside the powerhouse) and trucking away the debris

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: [ Not Specified ]
State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Wed May 22 10:50:34 EDT 2013

Committee Statement

Committee Statement: The current FPRF project to evaluate water additives for Class A and Class B fires includes NFPA 18 Wetting Agents and NFPA 18A Water Additives. “Micelle-encapsulating” agents are a subset of these groups. The change was made to be generally refer to all agents being evaluated by the FPRF project.

Response Message:
7.4.2.6.1
The following fire-fighting strategies should be taken into consideration:

(1) Water has been successfully used to control bunker and silo fires. However, the possibility of an explosion exists under certain circumstances if the water reaches the coal in a hot spot. Therefore, water is not a recommended fire-fighting strategy for these types of fire events. The amount of water delivered to a silo in a stream can create structural support problems. However, use of fire-fighting additives with water can be highly effective for coal fires, especially Powder River Basin (PRB) sub-bituminous coal fires. This use of fire-fighting additives typically results in significantly less water being delivered into the silo due to the enhanced fire suppression properties of the agent and subsequent shorter delivery period.

(2) Steam-smothering has also been used to control bunker and silo fires on marine vessels. All openings need to be sealed prior to the introduction of steam, which is rarely possible at electric generating plants due to the relatively porous nature of the equipment. The use of steam introduces high temperature and moisture that could increase the possibility of spontaneous combustion; therefore, this strategy is not recommended.

(3) Locating silo hot spots and extinguishing them before the coal leaves the silo is an accepted practice. The coal hot spots are detected and extinguished. If, as the coal drops down through the silo, additional hot spots are detected, coal flow should be stopped and the hot spots extinguished. If the hot spots are exposed during the lowering of the coal, potential for dust explosions is increased.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 03 11:36:51 EDT 2013

Committee Statement

Committee Statement: PRB coal is commonly a reference to a geography area where sub-bituminous coal is mined. The intent is to focus on sub bituminous coal regardless of where it is mined but rather on the characteristics of this particular rank of coal.

Response Message:
First Revision No. 46-NFPA 850-2013 [ New Section after 7.4.2.8 ]

7.4.2.9
It might not be practical to install explosion vents on a coal bin, bunker, and silo. Typical silo designs do not have sufficient area above the coal level for properly designed explosion vents. Vents would present an exposure hazard to any personnel in adjacent areas. (see NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids). If explosion vents are considered, they should be designed in accordance with NFPA 68, Standard on Explosion Protection by Deflagration Venting.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:04:59 EDT 2013

Committee Statement

Committee: This provides guidance for the user in a recommended reference to NFPA 654.
Statement: 654.
Response Message:

First Revision No. 110-NFPA 850-2013 [ Section No. 7.4.3.4 ]
7.4.3.4
Dust collectors should be located outside. For dust collection systems provided for handling combustible dusts, see NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*. Other recommendations for reducing the probability of explosion and fire from coal dust are as follows:

1. Fans for dust collectors should be installed downstream of the collectors so that they handle only clean air.
2. For dust collectors vented to the outside, see NFPA 68, *Standard on Explosion Protection by Deflagration Venting*. Explosion suppression systems are permitted to be provided for dust collection systems that cannot be safely vented to the outside. (See NFPA 69, *Standard on Explosion Prevention Systems*.)
3. Dust collection hoppers should be emptied prior to shutting down dust removal systems to reduce the likelihood of collector fires originating from spontaneous heating in the dust hopper.
4. Dust collectors should not discharge into inactive coal storage bins, bunkers, or silos.
5. High-level detection with an annunciator alarm should be provided for the dust hoppers.
6. Monitoring and trending for carbon monoxide should be provided for dust collectors to detect spontaneous combustion.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 03 11:39:18 EDT 2013

Committee Statement

Committee Statement: Dust discharged from dust collectors into inactive coal storage bins, bunkers, or silos increase the risk for fire and explosions as it tends to remain for an extended period of time, spontaneously combust, and due to its fine particle size likely to become suspended in air increasing risk for explosion or flash fire. Carbon monoxide is amongst the earliest known methods to detect a coal related fire and the importance of trending to discover a potential developing concern soon rather than later so that actions can be taken to reduce severity.

Response Message:
### First Revision No. 111-NFPA 850-2013 [ Section No. 7.4.6.1 ]

#### 7.4.6.1

Automatic sprinkler or water spray fixed systems should be provided for coal handling structures that are critical to power generation and subject to accumulations of coal or coal dust. Sprinkler automatic sprinkler systems should be designed for a minimum of 0.25 gpm/ft\(^2\) (10.2 mm/min) density over a 2500 ft\(^2\) (232 m\(^2\)) area. If water spray fixed systems are used to protect structures, the same densities should be used.

### Submitter Information Verification

- **Submitter Full Name**: [Not Specified]
- **Organization**: [Not Specified]
- **Street Address**: [Not Specified]
- **City**: [Not Specified]
- **State**: [Not Specified]
- **Zip**: [Not Specified]
- **Submittal Date**: Mon Jun 03 11:46:30 EDT 2013

### Committee Statement

- **Committee Statement**: Editorial.
- **Response Message**:

---

---
Automatic sprinkler or water spray or sprinkler fixed systems should be provided for coal conveyors that are critical to continuous power generation. System coverage should include transfer points (tail dust hoods and head chutes). Sprinklers should be designed for a minimum of 0.25 gpm/ft\(^2\) (10.2 mm/min) density over 2000 ft\(^2\) (186 m\(^2\)) of enclosed area or the most remote 100 linear ft (30 m) of conveyor structure up to 2000 ft\(^2\) (186 m\(^2\)). For water spray design criteria, see NFPA 15, Standard for Water Spray Fixed Systems for Fire Protection. Water spray systems should be considered for enclosed conveyors that are inclined because of the greater potential for rapid fire spread.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City:
State:
Zip:
Submittal Date: Mon Jun 03 13:36:44 EDT 2013

Committee Statement

Committee Statement: Editorial.
Response Message:
7.4.6.5.1
Sprinklers for bag-type dust collectors should be designed for ordinary hazard systems. Sprinkler and water spray systems should be designed for a density of 0.20 gpm/ft$^2$ (8.1 mm/min) over the projected plan area of the dust collector. Use of fire-fighting additives should be considered for PRB sub-bituminous coal dust collectors.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Mon Jun 03 14:09:56 EDT 2013

Committee Statement

Committee: PRB coal is commonly a reference to a geography area where sub-bituminous coal is mined. The intent is to focus on sub-bituminous coal regardless of where it is mined but rather on the characteristics of this particular rank of coal.

Response Message:
First Revision No. 60-NFPA 850-2013 [ New Section after 7.5.2.2 ]

7.5.2.3
Pulverizer explosion mitigation methods to consider include inerting and temperature control.

7.5.2.4
Personnel warning systems should be considered during pulverizer startup, shutdown, and trip.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 13:35:19 EDT 2013

Committee Statement

Committee Statement: For life safety, a better practice is to mitigate the risk of explosion during probable times when the fuel ratio (coal and air) transition through an explosive range. In addition to mitigation systems such as inerting, temperature control, explosion suppression, is to warn personnel who may be in the area so that they evacuate during this time,

Response Message:

First Revision No. 47-NFPA 850-2013 [ New Section after 7.6.6 ]

7.6.7 Activated Carbon Injection Systems.

7.6.7.1 General.
Activated carbon injection (ACI) systems are used on some coal-fired plants to adsorb mercury from the flue gas. Powdered activated carbon (PAC) is stored in silos and pneumatically conveyed to the flue gas duct work and injected into the flue gas stream. Residual PAC (spent) is collected with fly ash in the baghouse ash hoppers.
**7.6.7.2** Types of Powdered Activated Carbon.

Powdered activated carbon (PAC) for use at power plants is typically a steam-activated carbon product. The feedstock varies by manufacturer, but steam-activated carbon is not subject to spontaneous heating. Chemically activated carbon products are subject to spontaneous heating and are not typically used at power plants. The activation method should be identified and considered in the Fire Protection Design Basis Document. PAC products might or might not be combustible or explosible, and testing is recommended for the PAC products specified for the plant-specific ACI system. If the product cannot be identified and tested prior to the design of the ACI system, then the Fire Protection Design Basis Document should consider a worst-case scenario.

**7.6.7.3** Storage of Powdered Activated Carbon.

PAC is typically stored in outdoor silos filled pneumatically by tank truck or rail tank car. Trucks connect to fill connections at grade, and PAC is transported into the top of the silos via a blower on the truck or at the rail car unloading station. In addition to fill piping and instrumentation, there is typically a bin vent filter at the top of the silo (not typically enclosed). The skirt area of the silo below the hopper might contain fluidizing air piping, PAC day bins, piping, instrumentation, etc. Depending on the PAC test results, enclosed areas should be evaluated for the plant’s combustible dust program in accordance with NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*.

**7.6.7.4** Effect of PAC on Fly Ash Properties.

Fly ash hoppers downstream of the PAC injection point will contain spent PAC in some percentage. The percentage depends on operating conditions, whether or not the PAC is injected downstream or upstream of an electrostatic precipitator, and whether or not the unit uses other inert materials in the process such as a dry sorbent. If the PAC is determined to be combustible and/or explosible (see 7.6.7.2), then the fly ash/spent PAC mixture in the collection points (e.g., baghouse hoppers) should be evaluated based on the worst-case operating conditions. This could require testing to determine if the mixture is combustible or explosible. The results should be considered in the Fire Protection Design Basis Document.

**7.6.7.5** Fire Protection.
Where fire detection is recommended by the Fire Protection Design Basis Document, carbon monoxide monitors should be located on the clean side of the silo bin vent filters. Upon receipt of an alarm, thermographic cameras should be used to confirm the presence of a fire in the silo.

Where fire protection is recommended by the Fire Protection Design Basis Document, one of the following methods of protection should be provided:

1. A fixed water-based (water, foam-water, water with wetting agents and/or water additives) system that is designed to protect a full silo. However, admitting water into a full PAC silo will create a sludge that is not likely to flow out of a drain connection. The silo design should accommodate removal of this sludge after a fire is suppressed. Structural design should accommodate the added weight of the water. The system could utilize a fixed water supply or be supplied via manual connections located remote from the silos. The silo should be equipped with access platforms for maintenance of nozzles.

2. A fixed water-based (water, foam-water, water with wetting agents and/or water additives) system that is designed to wash down a nearly empty silo. In this case, the silo design should accommodate removal of the PAC prior to activation of the wash down system. The wash down nozzles could be minimized (e.g., at the top only) to minimize the number of penetrations in the silo. This method minimizes the amount of sludge created by putting water on the PAC.

3. Low-pressure carbon dioxide (CO$_2$) can be used to inert the silo. This can be a fixed system with a low-pressure CO$_2$ storage tank, vaporizer, and distribution piping. The silo manufacturer should be consulted during design of the system to confirm that the silo design pressure is high enough for a CO$_2$ discharge, and to confirm how many nozzle locations are required to ensure that the CO$_2$ can permeate the dense PAC in the silo. As an alternate to the fixed low-pressure CO$_2$ storage tank, the system could utilize a dry-header and fixed vaporizer with connections for a CO$_2$ tank truck. The silo should be equipped with access platforms for maintenance of nozzles.

4. Other approved means.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:20:52 EDT 2013

Committee Statement

Committee ACI systems are increasingly common and recent testing of various PAC samples Statement: has determined that some products are combustible and explosible. Chapter 7 did not address ACI or PAC in previous editions.

Response
First Revision No. 48-NFPA 850-2013 [ New Section after 7.7.4.5 ]

7.7.4.6*
The use of a listed fire-resistant fluid as a turbine-generator lubricating oil (see 7.7.3.1) could eliminate the need for fire protection beneath the operating floor, at lubricating oil lines, lubricating oil reservoir, and turbine-generator bearings to mitigate the hazard posed solely by pool and three-dimensional fires involving lubrication oil.

Protection against pool and three-dimensional fires in accordance with 7.7.4.1 should be installed if the hydrogen seal oil system does not use listed fire-resistant fluids. Generator bearings for seal oil systems not using listed fire-resistant fluids should be protected in accordance with 7.7.4.2. Stakeholders should be involved in the decisionmaking process before eliminating fire protection for the turbine lubrication oil hazard.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:37:38 EDT 2013

Committee Statement

Committee Statement: Less flammable fluid use is addressed in other areas of the recommended practice, primarily for hydraulic fluids. Therefore, the use of less flammable fluids used in other applications may warrant the elimination of the fire protection if agreed by the stakeholders in the development of the fire protection design basis document.
7.8.1.3
Automatic sprinkler protection or automatic water mist fire protection systems for the computer or telecommunications rooms should be considered in the Fire Protection Design Basis Document. A preaction system can be used. In addition, total flooding gaseous fire extinguishing systems should be considered for areas beneath above and below raised floors that contain cables or for areas or enclosures containing equipment that is of high value or is critical to power generation. Individual equipment and cabinet protection could be considered in lieu of total flooding systems.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:53:55 EDT 2013

Committee Statement

Committee Statement: This edit reflects the latest NFPA 2001 which does not allow clean agent protection below the floor only. If clean agent protection is installed below the floor, 2001 now requires that protection also be installed above the floor.

Response Message:
First Revision No. 51-NFPA 850-2013 [ Section No. 7.8.5 ]

7.8.5* Battery Rooms.
Battery rooms should be provided with ventilation to limit the concentration of hydrogen to 1 percent by volume. For further information refer to ANSI/IEEE 484, Recommended Practice for Installation Design and Installation of Large Lead Storage Batteries for Generating Stations and Substations.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:59:35 EDT 2013

Committee Statement

Committee Statement: Explanatory material added to clarify our position relative to IEEE 484.
Response Message:
First Revision No. 54-NFPA 850-2013 [ Section No. 7.9.1.2.1 ]

7.9.1.2.1
Emergency generators located within main plant structures should be protected by automatic sprinkler, water spray, foam-water sprinkler, compressed air foam, or gaseous-type extinguishing systems. Sprinkler and water spray protection systems should be designed for a 0.25 gpm/ft\(^2\) (10.2 mm/min) density over the fire area. Compressed air foam systems should be designed and installed in accordance with NFPA 11, 37, Standard for Low-, Medium-, and High-Expansion Foam the Installation and Use of Stationary Combustion Engines and Gas Turbines, and their listing for the specific hazards and protection objectives specified in the listing.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed May 22 12:07:23 EDT 2013

Committee Statement

Committee Statement: NFPA 37 addresses stationary combustion engines and gas turbines, therefore 7.9.1.2.1 has been revised to reference NFPA 37 for fire protection.
Response Message:
7.9.4 Fire Pumps.

Rooms housing diesel-driven fire pumps should be protected by automatic sprinkler, water spray, foam-water sprinkler, or compressed air foam systems. If sprinkler and water spray protection systems are provided for fire pump houses, they should be designed for a density of 0.25 gpm/ft\(^2\) (10.2 mm/min) over the fire area. Compressed air foam systems should be designed and installed in accordance with NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam Installation of Stationary Pumps for Fire Protection, and their listing for the specific hazards and protection objectives specified in the listing.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Wed May 22 12:04:04 EDT 2013

Committee Statement

Committee Statement: This change provides a reference to NFPA 20 and deletes the previous (lower) density
First Revision No. 102-NFPA 850-2013 [ New Section after 7.9.7 ]

7.9.8

Submitter Information Verification

Submitter Full Name:[ Not Specified ]
Organization:[ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 31 08:21:07 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendation from NFPA 851.
Response Message:
8.2 Application of Chapters 4 through 7, 15, and 16.
The recommendations contained in Chapters 4 through 7, 16, and 17 can apply to combustion turbine electric generating units. The Fire Protection Design Basis Document will determine which recommendations apply to any specific CT and ICE electric generating units. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For large CT units or combined cycle plants, it is expected that most of the recommendations will apply, whereas for individual packaged CT and ICE units, many of the recommendations will not apply since the hazards described might not exist (e.g., small units might not have a cable spreading room or a warehouse).

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 30 11:35:55 EDT 2013

Committee Statement

Committee: Editorial. A new chapter 14 was added moving chapters 15 and 16 to 16 and 17.
Response Message:
### First Revision No. 66-NFPA 850-2013 [ New Section after 8.5.4.7 ]

| **8.5.4.8** Fixed Aerosol Fire Extinguishing Systems. |
| Where provided, fixed aerosol fire extinguishing systems should be installed in accordance with the requirements of NFPA 2010, *Standard for Fixed Aerosol Fire Extinguishing Systems*. |

### Submitter Information Verification

| Submitter Full Name: | [ Not Specified ] |
| Organization:       | [ Not Specified ] |
| Street Address:     |                  |
| City:               |                  |
| State:              |                  |
| Zip:                |                  |
| Submittal Date:     | Wed May 22 14:45:55 EDT 2013 |

### Committee Statement

| Committee Statement: | NFPA 2010 has been recognized as a new technology for providing fire protection. |
| Response Message:    |                                                |
First Revision No. 114-NFPA 850-2013 [ Section No. 9.2 ]

9.2 Application of Chapters 4 through 7, 15, and 16. The recommendations contained in Chapters 4 through 7, 15, and 16 can apply to alternative fuel–fired electric generating station units. The Fire Protection Design Basis Document will determine which recommendations apply to any specific alternative fuel–fired unit. This is done by evaluating the specific hazards that exist in the facility and determining the level of acceptable risk for the facility. It is expected that most of the recommendations will apply to all units, except as follows:

1. Where size and specific design eliminate certain hazards (e.g., H2 seal oil units, cable spreading rooms, or warehouses)

2. Where the Fire Protection Design Basis Document indicates a single source of water (e.g., a single tank) is considered adequate and reliable

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Jun 03 13:44:59 EDT 2013

Committee Statement

Committee Statement: Editorial.
Response Message:
First Revision No. 70-NFPA 850-2013 [Section No. 9.3.3.1]

9.3.3.1*
The tipping/receiving building should be provided with automatic sprinkler protection throughout. Systems should be designed for a minimum of 0.25 gpm/ft\(^2\) (10.2 mm/min) over the most remote 3000 ft\(^2\) (279 m\(^2\)) (increase by 30 percent for dry pipe systems) of floor area with the protection area per sprinkler not to exceed 130 ft\(^2\) (12 m\(^2\)). High-temperature sprinklers [250°F to 300°F (121°C to 149°C)] should be used. If the tipping/receiving floor is to be used as the charging storage area, additional protection should be provided in accordance with 9.3.3.2.2.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 15:31:35 EDT 2013

Committee Statement

Committee Statement: Sometimes the tripping/receiving floor is used as a charging storage area and therefore additional protection is recommended.

Response Message:
First Revision No. 67-NFPA 850-2013 [ Section No. 9.6.3 ]

9.6.3 Prevention of Fires and Explosions in Scrap Rubber Tires.
(Reserved)

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 14:55:14 EDT 2013

Committee Statement

Committee Statement: This topic is already covered in 9.6
Response Message:
10.2 Application of Chapters 4 through 7 and 16 and 17. The recommendations contained in Chapters 4 through 7, 16, and 17 can apply to wind generating facilities. The Fire Protection Design Basis Document should determine which recommendations apply to any specific wind generating facility. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For most wind generating facilities, it is expected that most of the recommendations will apply, although there could be particular wind turbines and output circuit designs for which some of the recommendations will not apply since the hazards described might not exist (e.g., no transformer in the wind turbine nacelle).

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 30 11:40:33 EDT 2013

Committee Statement

Committee Statement: Editorial. A new chapter 14 was added moving chapters 15 and 16 to 16 and 17.
Response Message:
First Revision No. 71-NFPA 850-2013 [ New Section after 10.3.2 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 15:52:04 EDT 2013

Committee Statement

Committee Statement: Provides guidance to address wildland fires and fire exposures.
Response Message:
10.5.2.2
For wind turbine generators, the following monitors and/or trip functions should be provided to safely monitor the operation of wind turbine generators safely, and initiate a safe shutdown of abnormal operating conditions or parameters:

1. Grid disturbance
2. Yaw errors or limits
3. Braking issues
4. Abnormal vibration
5. Overspeed (including wind conditions)
6. Temperature faults
7. Oil condition (gearbox/lubrication and hydraulic)
8. Motor protection
9. Loss of communication between modules or with control center
10. Blade angles and battery status
11. Activation of smoke and/or heat detectors within the nacelle

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 15:55:38 EDT 2013

Committee Statement

Committee Statement: Added additional safety features for shut down of abnormal operating conditions in order to remove power from electrical equipment so that the fire does not continue to burn.

Response Message:
10.5.2.9
Lightning protection for blades, nacelles, towers, power lines, transformers, and support structures should be provided in accordance with International Electrotechnical Commission (IEC) TR 61400-24, Wind Turbine Generator Systems — Part 24, Lightning Protection, NFPA 780, Standard for the Installation of Lightning Protection Systems, or IEC 62305, Protection Against Lightning.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed May 22 16:05:24 EDT 2013

Committee Statement

Committee Statement: IEC TR 61400-24 has been withdrawn therefore new reference material has been provided.
10.5.3.1.3
Due to the remote location of the majority of on-shore wind generating facilities and the lack of abundant water supplies, the use of water-based fire protection systems is unlikely. For off-shore facilities, the same is true because the construction of pumping and fire water distribution systems would be cost prohibitive. If the design of a particular facility does, however, permit the use of water suppression systems, these systems should follow the general recommendations in Chapter 7. If the Fire Protection Design Basis Document indicates a need for fire-fighting capability using water, NFPA 1142, Standard for Water Supplies for Suburban and Rural Fire Fighting, should be consulted.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 16:02:15 EDT 2013

Committee Statement

Committee Statement: A reference was needed to provide guidance for the user if a water source is needed in a remote location.

Response Message:
First Revision No. 75-NFPA 850-2013 [ New Section after 10.5.3.4.2 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submital Date: Wed May 22 16:13:18 EDT 2013

Committee Statement

Committee Statement: NFPA 2010 has been recognized as a new technology for providing fire protection.
Response Message:

First Revision No. 80-NFPA 850-2013 [ Sections 11.1, 11.2, 11.3 ]

11.1* General.
Chapter 11 covers fire hazards associated with solar thermal power generating stations. The process used in current commercial applications typically involves heating heat transfer fluid (HTF) in solar fields and using this fluid to generate steam to drive a steam turbine generator one of two basic technologies:

1. Concentrated solar power (CSP), which involves using solar radiation to heat a working fluid which, in turn, is used to generate steam to drive a steam turbine generator.

2. Photovoltaic (PV) solar power that is associated with the use of PV panels in various arrays to convert energy from the sun to dc electrical energy that is subsequently converted to ac power for delivery to the grid.

11.2 Application of Chapters 4 through 7, §5.16, and §6.17.
11.2.1
The recommendations contained in Chapters 4 through 7, 15 16, and 46 17 apply. The Fire Protection Design Basis Document should determine which recommendations apply to any specific facility. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. The remaining paragraphs in this chapter provide recommendations that are beyond the scope of other chapters in this recommended practice.

11.3* Risk Considerations.

11.3.1* Photovoltaic (PV) Power.
Major hazards associated with PV generating plants are as follows:

1. Electrical fires associated with failed PV module connections or string cabling
2. Hydraulic oil fires associated with the hydraulic oil systems used for multi-plane tracker positioning of the PV modules
3. Inverter, switchgear, and cable fires
4. Transformer failure fires
5. Wildland fires around arrays of PV modules and strings

11.3.2* Concentrated Solar Power.
The major hazards associated with concentrated solar generating plants are as follows:

1. Release of large quantities of combustible HTF
2. Shielded fires involving large quantities of HTF in the heater
3. Lubricating and control oil fires
4. Switchgear and cable fires
5. Transformer failure fires
6. Wildland fires around arrays of solar collection assemblies

11.3.3 Determination should be made with regard to damage that would be caused by a release of HTF. Spacing and design of critical equipment and structures should be such so as to limit damage in the event of a fire exposure in both the solar field and power generation areas.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 28 09:59:13 EDT 2013

Committee Statement
<table>
<thead>
<tr>
<th>Committee Statement:</th>
<th>Identifies and differentiates fire hazards of Photovoltaic power generating plants and concentrated solar power plants.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response Message:</td>
<td></td>
</tr>
</tbody>
</table>
First Revision No. 76-NFPA 850-2013 [Section No. 11.4.1.1]

11.4.1.1*
ANSI/ASME B31.1, Power Piping, should be followed in the design of HTF piping systems. Piping and fittings should be properly designed to resist an exposure fire until protection can be achieved by water spray. To reduce possible sources of leaks, use of rotating-ball-joint-type connections instead of flexible hose connections. Careful consideration should be given to the design, application, construction, and installation of connections (rotating ball joint, flexible hose, etc.) employed in areas such as the HTF loop connection connections of adjacent solar collector assemblies should be considered to prevent possible sources of HTF leaks. Gaskets and seals should be compatible with HTF. Flanges and piping connections on HTF systems should have guards.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 17:20:24 EDT 2013

Committee Statement

Committee Statement: Note: This Proposal originates from Tentative Interim Amendment 850-10-1 (TIA 982) issued by the Standards Council on August 5, 2010. The statement in the NFPA 850 documentation, “To reduce possible sources of leaks, consider use of rotating-ball-joint-type connections instead of flexible hose connections in areas such as the HTF loop connection of adjacent solar collector assemblies”, limits the utilization of new technologies. Emergency Nature: The proposed TIA intends to correct a circumstance in which the revised document has resulted in an adverse impact on a product or method that was inadvertently overlooked in the total revision process, or was without adequate technical (safety) justification for the action. Restricting usage of new technologies in parabolic trough is an emergency issue as the current version limits and discourages the utilization of new proven technologies. NTF connections are highly engineered devices. Fire accidents have occurred when careful consideration was not given to the design, application, construction and installation of the connections regardless of the connection type used.

Response Message:

Public Input No. 13-NFPA 850-2012 [Section No. 11.4.1.1]
11.4.1.7
HTF piping and component relief valves should discharge be positioned in such a way that discharges of either liquid or vapor occur at a location that will limit fire exposure to critical equipment and/or adjacent equipment or structures.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Tue May 28 10:38:45 EDT 2013

Committee Statement

Committee Statement: Provide guidance to reduce fire exposure from releases of HTF piping/component relief valves.
Response Message: 
**First Revision No. 82-NFPA 850-2013 [ New Section after 11.5.1 ]**

11.5.2

As solar generating stations are typically located in remote areas, NFPA 1142, Standard for Water Supplies for Suburban and Rural Fire Fighting, should be consulted if the design basis indicates the need for water-based fire protection.

**Submitter Information Verification**

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 28 10:43:44 EDT 2013

**Committee Statement**

Committee Statement: A reference was needed to provide guidance for the user if a water source is needed in a remote location.
Response Message:

**First Revision No. 83-NFPA 850-2013 [ Sections 11.5.3, 11.5.4 ]**

11.5.4

Consideration should be given to the placement of hydrants and monitors. Hydrants should be placed strategically about the solar field so as to provide strategic coverage of all HTF piping associated with solar collection assemblies and HTF supply and distribution piping. Based on the completed Fire Protection Design Basis Document, an alternative could be the use of fire/water trucks if the site water supply so dictates. This will help in early manual fire-fighting and exposure control and must be in coincidence with site environmental concerns and plans.
11.5.5
An automatic listed fire protection system should be provided for the following areas based on the Fire Protection Design Basis (where the hazard is lube oil or hydraulic oil, a listed fire-resistant fluid is an acceptable alternative to fixed fire protection):

Lubrication systems
Hydraulic control systems
Electrical equipment rooms, including control, computer, communications, cable trays, and tunnels, in accordance with Chapter 7

Particular care should be practiced with respect to adequate spatial separation and protection from wildland fires as well as the control of vegetation where fields of CSP solar collection assemblies or PV panels might be located. Guidance regarding vegetation clearance, separation distance, and emergency planning can be found in NFPA 1143, *Standard for Wildland Fire Management*, and NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fires*.

11.5.6
Per the completed Fire Protection Design Basis Document, an automatic listed fire detection and/or protection system should be provided for the following areas (where the hazard is lube oil or hydraulic oil, a listed fire-resistant fluid is an acceptable alternative to fixed fire protection):

1. Lubrication systems
2. Hydraulic control systems, including those associated with solar collector assembly and solar panel/module/string tracking systems
3. Electrical equipment rooms, including control, computer, communications, cable trays, and tunnels, in accordance with Chapter 7
4. Inverter cabinets and associated transformers, especially if the solar plant design features a significant concentration of inverters in one location

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Tue May 28 11:23:09 EDT 2013

Committee Statement

Committee Statement: Provide guidance for fire protection of solar generating plants including exposures associated with HTF piping systems, fireland fires, hydraulic control systems and inverter cabinets.

Response
First Revision No. 90-NFPA 850-2013 [ Section No. 12.2 ]

12.2 Application of Chapters 4 through 7, 15, 16, and 17.

12.2.1* The recommendations contained in Chapters 4 through 7, 15, 16, and 17 apply to all geothermal power plants (direct steam, flash steam, and binary). The Fire Protection Design Basis Document should determine which recommendations apply to any specific facility. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. The remainder of this chapter provides recommendations that are not included in other chapters in this recommended practice.

12.2.2 In general, risk considerations for direct steam and flash steam geothermal plants are the same as those for conventional steam turbine power plants. For binary plants, the differences are provided below in this chapter. The major hazards are as follows:

1. Lubricating and control oil fires
2. Combustible cooling tower construction
3. Switchgear and cable fires

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 30 11:42:35 EDT 2013

Committee Statement

Committee Statement: Editorial. A new chapter 14 was added moving chapters 15 and 16 to 16 and 17.

Response Message:
13.2 Application of Chapters 4 through 7, §5 16 , and §6 17.  
The recommendations contained in Chapters 4 through §7, §16, and §17 readily apply to IGCC facilities. With the addition of the different technologies involved in syngas production and the differences in syngas with respect to natural gas, the Fire Protection Design Basis Document should determine which recommendations apply to any specific IGCC facility. This determination is done by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For IGCC facilities, it is expected that most of the recommendations will apply, although there could be particular plants for which some of the recommendations will not apply since the hazards described might not exist (e.g., no air separation unit). The user is responsible for determining the properties of the materials used or generated in the facility (vapor density, ignition temperature, LFL, etc.). It is recommended that designers seek guidance from those having specialized experience to understand the unique characteristics of any particular fuel or technology in order to properly apply the appropriate portions of this and other applicable documents.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]  
Organization: [ Not Specified ]  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Thu May 30 11:43:25 EDT 2013

Committee Statement

Committee Statement: Editorial. A new chapter 14 was added moving chapters 15 and 16 to 16 and 17.

Chapter 14 Identification and Protection of Hazards for Hydroelectric Generating Plants

14.1 General.
14.1.1 Chapter 14 identifies fire and explosion hazards of hydroelectric generating stations. Such facilities include both dam-type facilities using penstocks to direct water to vertical-type hydro turbine generators and run-of-the-river facilities in which river water is channeled through axial-type hydro turbine generators. In addition, pumped-storage hydro facilities operate as normal vertical (upper storage to lower storage) hydro stations to produce electrical power and pump water from the lower storage to the upper storage. This chapter specifies recommended protection criteria for all three types of hydroelectric stations.

14.2 Application of Chapters 4 through 7 and 16 and 17. The recommendations contained in Chapters 4 through 7, 16, and 17 can apply to HVDC converter stations and SVC/SVG. The Fire Protection Design Basis Document will determine which recommendations apply to any specific HVDC or SVC/SVG facility. This determination is done by evaluating the specific hazards that exist in the facility and determining the level of acceptable risk for the facility. It is expected that most recommendations will apply to all HVDC, SVC/SVG, and VFT facilities.

14.3 General Design and Equipment Arrangement.

14.3.1 Adequate separation should be provided between the following, as determined by the Fire Protection Design Basis Document:

1. To separate the intake hoist housing from generator floor area and from adjacent areas
2. To separate dam and spillway hoists, including the main power and backup power bus, from adjacent areas such as spillway electrical distribution rooms
3. To separate the tailrace service gallery from turbine/generator floors and governor hydraulic equipment

14.3.2* Ventilation exhaust systems, particularly those for subsurface portions of underground facilities, should have fans able to operate continually to exhaust smoke and chemical fumes that can result from fires or from extinguishing of fires. The design and selection of the fans and other elements of the system should take into account additional ventilation needs for removing smoke and high-temperature gases. Therefore the fan and its associated components, along with any ductwork, should be capable of handling high temperatures without deforming. The specific weight and volume of the heated air during a fire and the climatic conditions should also be considered. Total fan capacity should be provided so that ventilation requirements can be met with the largest fan out of service.

14.3.3 Fire hazards should not be located in the principal access or air supply (e.g., conduits, shafts, tunnels) in order to avoid loss of fresh air in the event of a fire.

14.3.4 An emergency power supply should be provided for principal drainage pumps in areas where flooding would be dangerous.

14.4 Unattended Facilities.

14.4.1 Hydroelectric plants that are operated unattended or with minimal staffing present special fire protection concerns.
14.4.2 Consideration should be given both to the delayed response time of the fire brigade or public fire-fighting personnel (which can be several hours) and to the lack of personnel available to alert others on site to a fire condition.

14.4.3 The fire risk evaluation should address delayed response and lack of communication. This might establish the need to provide additional fire protection measures to prevent a major fire spread prior to the arrival of fire-fighting personnel. The delayed response by personnel to the site can necessitate automatic shutoff of fire pumps.

14.4.4 If automatic water-based fire suppression systems are utilized, a cycling deluge valve should be considered. The arrangement will depend on the type of system and the hazard protected. Thermal detection is recommended. System design should be in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, or NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.

14.4.5 Remote annunciation of the fire signaling panel to one or more constantly attended locations is critical for emergency response. The fire signaling panel should be located at the entry to the plant. Special consideration should be given to alerting personnel in confined spaces, such as in scroll/spiral cases or draft tubes, that a fire alarm system has been activated.

14.4.6 An emergency lighting system for critical operating areas that depends on batteries or fuel supplies should be manually operated from a switch at the entry to the plant. The emergency lighting can be permitted to consist either of fixed units or of portable lights (see 5.6.2).

14.4.7 It is important that the responding fire brigade or public fire-fighting forces be familiar with access, plant fire protection systems, emergency lighting, specific hazards, and methods of fire control. This should be reflected in the plant fire emergency plan (see 9.4.4).

14.4.8 The air supply and exhaust systems for the plant should be shut down automatically in the event of a fire. Manual override should be located at the entry to the plant so that emergency responders can activate these controls upon arrival.

14.5 Identification and Protection of Hazards.

14.5.1 General.

The identification and selection of fire protection systems should be based on the fire risk evaluation. This chapter identifies fire and explosion hazards in hydroelectric generating stations and specifies the recommended protection criteria unless the fire risk evaluation indicates otherwise.

14.5.2 Turbine-Generator Hydraulic Control and Lubricating Oil Systems.

14.5.2.1 Hydraulic Control Systems.

14.5.2.1.1 Hydraulic control systems should use a listed fire-resistant fluid.

14.5.2.1.2 Determination of the need for fire-resistant fluid should be based on the quantity of fluid involved in the system, whether or not equipment that utilizes this fluid will operate hot or be exposed to external sources of ignition, and whether exposure problems are created for adjacent equipment by the use of non-fire-resistant fluid.
14.5.2.1.3  
If a listed fire-resistant fluid is not used, hydraulic control equipment should be protected. Fire extinguishing systems, where installed for hydraulic control equipment, should include protection for reservoirs, other equipment, valves, and associated piping.

14.5.2.2  
Wherever possible, oil piping should be welded and flanged to minimize the possibility of an oil leak due to severe vibration.

14.5.2.3  
Oil piping should be routed away, or be shielded, from electrical equipment or other sources of ignition.

14.5.2.4*  
Fixed fire protection for this equipment, where provided, should be as follows:

1. Automatic wet pipe sprinkler protection systems utilizing a design density of 0.25 gpm/ft² (10.2 mm/min) for the entire hazard area

2. Automatic foam-water sprinkler systems providing a density of 0.16 gpm/ft² (6.5 mm/min)

3. Gaseous extinguishing systems of either the local application or total flooding types. Safety considerations associated with these systems should be evaluated prior to the selection of gas-type protection systems.

4. Compressed air-foam systems designed and installed in accordance with NFPA 11, Standard for Low-, Medium-, and High-Expansion Foam, and their listing for the specific hazards and protection objectives specified in the listing

14.5.2.5  
Consideration for protection of horizontal and vertical turbine bearings should be made based on the Fire Protection Design Basis Document.

14.5.2.6  
Curbs [minimum 6 in. (0.15 m) high], drains, or both should be provided for the oil storage and oil purification areas in accordance with Chapter 5.

14.5.2.7  
Fire extinguishing systems, where installed for lube oil systems employing combustible-type oil, should include protection for the reservoirs, pumps, and all oil lines, especially where unions exist on piping and beneath any shielded area where flowing oil can collect. Facilities not provided with curbs or drains should extend coverage for a distance of 20 ft (6 m) from the oil lines, when measured from the outermost oil line.

14.5.2.8  
Clean or dirty oil storage areas should be protected based on the fire risk evaluation. These areas generally represent the largest concentrated oil storage in the plant. The designer should consider, at a minimum, the installation of fixed automatic fire protection systems and the ventilation and drainage requirements in Chapter 5.

14.5.3  
Generator Pit and Windings.

14.5.3.1*  
Protection of generator windings consisting of materials that will not extinguish when de-energized should be provided by automatically actuated gaseous extinguishing systems, water spray rings, or both.
14.5.3.2 Fire detection in generator winding should be provided.

14.5.3.3 Protection of generator pits containing auxiliary circuits such as protection current transformers (CTs), neutral transformers, and grounding resistors that are associated with generator protection should be provided by an automatically actuated gaseous extinguishing system or water spray system.

14.5.3.4 Gaseous suppression systems should be actuated by protective relays, fire detection systems, or both.

14.5.3.5 Operation of water spray rings should be interlocked so that the unit will trip before the water spray system activates. Immediately after the generator has been sprayed with a water-based system, it should be mechanically run (electrically isolated and without excitation) for at least 24 hours to avoid creating stator ground faults on both types of winding materials.

14.5.4 Cable Concentrations.

14.5.4.1 Consideration should be given to the use of fire-retardant cable insulation such as those passing the flame propagation test in IEEE-1202, Standard for Flame-Propagation Testing of Wire and Cable.

14.5.4.2 Areas with significant concentrations of combustible cable jacketing or oil-filled cable should be protected with automatic sprinkler, water spray, or water mist systems. However, if water-type systems cannot be used, foam or gaseous extinguishing systems should be provided.

14.5.4.3 Sprinkler or water spray systems should be designed for a density of 0.30 gpm/ft$^2$ (12.2 mm/min) over 2500 ft$^2$ (232 m$^2$). This coverage is for area protection. Individual cable tray tier coverage could be required based on the fire risk evaluation.

14.6 Cable Tunnels.

14.6.1 Where protection is required by the fire risk evaluation, cable tunnels should be protected by automatic water spray, automatic wet pipe sprinkler, or foam-water spray systems. Automatic sprinkler systems should be designed for a density of 0.30 gpm/ft$^2$ (12.2 mm/min) over 2500 ft$^2$ (232 m$^2$) or the most remote 100 linear ft (30.5 m) of cable tunnel up to 2500 ft$^2$ (232 m$^2$).

14.6.2 Portable high-expansion foam generators can be permitted to be used to supplement a fixed fire protection system(s). (See NFPA 1901, Standard for Automotive Fire Apparatus.)

14.6.3 Ventilation and drainage should be provided for these areas in accordance with Chapter 5.

14.6.4 Indoor Oil-filled Electrical Equipment.

Automatic sprinkler, foam-water spray, water spray, and compressed air-foam systems should be considered for oil-filled electrical equipment. Where the hazard is not great enough to warrant a fixed fire suppression system, automatic fire detection should be considered (see 6.7.2).
14.6.5  Air Compressors.

Automatic sprinkler protection designed for a density of 0.25 gm/ft\(^2\) (10.2 mm/min) over the postulated oil spill or compressed air foam should be considered for air compressors containing a large quantity of oil. Compressed air foam systems should be designed and installed in accordance with NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, and their listing for the specific hazards and protection objectives specified in the listing. Where the hazard is not great enough to warrant a fixed-fire suppression system, automatic fire detection should be considered (see 6.7.2).

14.6.6  Hydraulic Systems for Gate and Valve Operators.

Hydraulic systems for gate and valve operators should be designed in accordance with 14.5.2.1. Where the hazard is not great enough to warrant a fixed fire suppression system, automatic fire detection should be considered (see 6.7.2).

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 28 15:00:08 EDT 2013

Committee Statement

NFPA 851 was incorporated into NFPA 850 to match how other means of electric generating facilities have been incorporated. Since the majority of the recommendations in NFPA 850 and NFPA 851 were the same where similar hazard were being addressed. Where there were recommendations that applied specifically to hydroelectric generating facilities, that criterion was included in the new chapter 14. The recommendations that are the same already exist in NFPA 850. Historically, there has been the same recommendation in one document that did not get changed during a revision. This provided for confusion and misunderstanding. The incorporation of the documents will address this situation. Existing chapters 15 and 16 are to be renumbered as chapters 16 and 17 including annex material.

Response Message:
First Revision No. 92-NFPA 850-2013 [Section No. 14.2]

15.2 Application of Chapters 4 through 7, 16 and 17. The recommendations contained in Chapters 4 through 7, 16 and 17 can apply to HVDC converter stations and SVC/SVG. The Fire Protection Design Basis Document will determine which recommendations apply to any specific HVDC or SVC/SVG facility. This determination is done by evaluating the specific hazards that exist in the facility and determining the level of acceptable risk for the facility. It is expected that most recommendations will apply to all HVDC, SVC/SVG, and VFT facilities.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: 
City:
State:
Zip:
Submittal Date: Thu May 30 11:44:05 EDT 2013

Committee Statement

Committee Statement: Editorial. A new chapter 14 was added moving chapters 15 and 16 to 16 and 17.
Response Message:

First Revision No. 94-NFPA 850-2013 [Section No. 15.3]

16.3 Site Clearing, Excavation, Tunneling, and Construction Equipment.
16.3.1 Site Clearing.
16.3.1.1 Prior to clearing forest and brush-covered areas, the owner should ensure that a written fire control plan is prepared and that fire-fighting tools and equipment are made available as recommended by NFPA 1143, Standard for Wildland Fire Management. Contact should be made with local fire and forest agencies for current data on restrictions and fire potential, and to arrange for necessary permits.
16.3.1.2 All construction vehicles and engine-driven portable equipment should be equipped with effective spark arresters. Vehicles equipped with catalytic converters should be prohibited from wooded and heavily vegetated areas.
16.3.1.3
Fire tools and equipment should be used for fire emergencies only and should be distinctly marked and maintained in a designated area.

16.3.1.4
Each site utility vehicle should be equipped with at least a portable fire extinguisher or backpack pump filled with 4 gal to 5 gal (15 L to 19 L) of water.

16.3.1.5
Cut trees, brush, and other combustible spoil should be disposed of promptly.

16.3.1.6
Where it is necessary to dispose of combustible waste by on-site burning, designated burning areas should be established with approval by the owner and should be in compliance with federal, state, and local regulations and guidelines. The contractor should coordinate burning with the agencies responsible for monitoring fire danger in the area and should obtain all appropriate permits prior to the start of work. (See Section 16.2.)

16.3.1.7
Local conditions can require the establishment of fire breaks by clearing or use of selective herbicides in areas adjacent to property lines and access roads.

16.3.2   Excavation and Tunneling.

16.3.2.1
Construction activities related to tunnels, shafts, and other underground excavations are strictly regulated by federal and state agencies. Fire prevention consists of adequate ventilation, good housekeeping, and limiting the types of fuel, explosives, and combustibles underground as well as adjacent to entrances and ventilation intakes. Inspections of site conditions and the testing of air quality should be assigned to qualified personnel specifically trained in the use of those instruments specified by the regulating agency.

16.3.2.2
Pre-excavation geologic surveys should include tests for carbonaceous or oil-bearing strata, peat, and other organic deposits that can be a source of combustible dusts or explosive gases.

16.3.2.3
The use of vehicles and equipment requiring gasoline, liquefied petroleum gas, and other fuels in excavations with limited air circulation should be restricted.

16.3.2.4
A general plan of action for use in times of emergency should be prepared for every underground excavation. (See Section 1.2.)

16.3.2.5   Construction Equipment.
Construction equipment should meet the requirements of NFPA 120, Standard for Fire Prevention and Control in Coal Mines.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: 
State: 

Global FR-93  Hide Deleted
Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
16.3.2 Excavation and Tunneling.

16.3.2.1 Construction activities related to tunnels, shafts, and other underground excavations are strictly regulated by federal and state agencies. Fire prevention consists of adequate ventilation, good housekeeping, and limiting the types of fuel, explosives, and combustibles underground as well as adjacent to entrances and ventilation intakes. Inspections of site conditions and the testing of air quality should be assigned to qualified personnel specifically trained in the use of those instruments specified by the regulating agency.

16.3.2.2 Pre-excavation geologic surveys should include tests for carbonaceous or oil-bearing strata, peat, and other organic deposits that can be a source of combustible dusts or explosive gases.

16.3.2.3 The use of vehicles and equipment requiring gasoline, liquefied petroleum gas, and other fuels in excavations with limited air circulation should be restricted.

16.3.2.4 A general plan of action for use in times of emergency should be prepared for every underground excavation. (See Section 1.2.)

16.3.2.5 Construction Equipment.

Construction equipment should meet the requirements of NFPA 120, Standard for Fire Prevention and Control in Coal Mines.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu May 30 13:22:18 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
16.4.2
Construction warehouses, offices, trailers, sheds, and other facilities for the storage of tools and materials should be located with consideration of their exposure to major plant buildings or other important structures. (For guidance in separation and protection, see NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, and NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*.)

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 30 13:31:54 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
16.4.3
Large central office facilities can be of substantial value and contain high-value computer equipment, irreplaceable construction records, or other valuable contents, the loss of which can result in significant construction delays. An analysis of fire potential should be performed. This analysis can indicate a need for automatic sprinkler systems or other protection, fire/smoke detection, or the desirability of subdividing the complex to limit values exposed by one fire, or a combination of the above.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 30 13:35:07 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
16.4.7
Construction camps comprised of mobile buildings arranged with the buildings adjoining each other to form one large fire area should be avoided. If buildings cannot be adequately separated, consideration should be given to installing fire walls between units or installing automatic sprinklers throughout the buildings.

16.4.7.1
Mobile buildings should be installed and located according to the requirements of NFPA 501A, Standard for Fire Safety Criteria for Manufactured Home Installations, Sites, and Communities. Insulating materials utilized in mobile buildings should be noncombustible.

16.4.7.2
Construction camp buildings should be designed and installed in accordance with NFPA 101, Life Safety Code.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Thu May 30 13:37:32 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
First Revision No. 98-NFPA 850-2013 [ New Section after 15.4.8 ]

16.4.8.1
The location for central alarm control should be provided with the following:

(1) Remote fire pump start button
(2) Manual siren start/stop button
(3) Provision for alerting the fire crew by radio, fire alert paging, and so forth
(4) Monitors for communication between security guard and fire crew at place of fire
(5) Radio link between security guards' office and the respective fire department

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City:
State:
Zip:
Submittal Date: Thu May 30 13:41:17 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
16.4.11
Construction kitchens should be protected in accordance with NFPA 96, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Fri May 31 07:47:51 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
Noncombustible or fire-retardant scaffolds, form work, decking, and partitions should be used both inside and outside of permanent buildings where a fire could cause substantial damage or delay construction schedules. Consideration should be given to providing sprinkler protection for combustible form work where a fire could cause substantial damage or construction delays.

Submitter Information Verification

- **Submitter Full Name:** [Not Specified]
- **Organization:** [Not Specified]
- **Street Address:**
- **City:**
- **State:**
- **Zip:**
- **Submittal Date:** Fri May 31 07:51:41 EDT 2013

Committee Statement

- **Committee Statement:** Incorporated recommendations from NFPA 851.
- **Response Message:**
First Revision No. 101-NFPA 850-2013 [ Section No. 15.7.3.2 ]

16.7.3.2
As fixed water extinguishing systems are completed, they should be Fixed systems should be provided as soon as construction allows, and placed in service, even when the available construction phase fire protection water supply is not adequate to meet the system design demand. The extinguishing system will at least provide some degree of protection, especially where the full hazard is not yet present. However, when the permanent hazard is introduced, the water supply should be capable of providing the designed system demand. When using construction water in permanent systems, adequate strainers should be provided to prevent clogging of the system by foreign objects and dirt.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 31 08:04:38 EDT 2013

Committee Statement

Committee Statement: Incorporated recommendations from NFPA 851.
Response Message:
First Revision No. 64-NFPA 850-2013 [ Section No. 16.2.2 ]

17.2.2
Proper preventative maintenance of operating equipment as well as adequate operator training are critical aspects of an effective fire prevention program. See Annex D for examples of operator errors causing significant property loss.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 14:05:49 EDT 2013

Committee Statement

Committee Statement: Emphasizes the importance of operator training in fire/loss prevention, and provides direction to see Annex for examples.
Response Message:

First Revision No. 65-NFPA 850-2013 [ Section No. 16.3 ]
17.3 Fire Risk Control Program.
A written plant fire prevention program should be established and as at a minimum should include the following:

(1) Fire safety information for all employees and contractors. This information should include, as at a minimum, familiarization with fire prevention procedures, plant emergency alarms and procedures, and how to report a fire. This should be included in employee/contractor orientation.

(2) Documented, regularly scheduled plant inspections including provisions for handling remedial actions to correct conditions that increase fire hazards.

(3) A description of the general housekeeping practices and the control of transient combustibles. Fire experience has shown that transient combustibles can be a significant factor during a fire situation, especially during outages.

(4) Control of flammable and combustible liquids and gases in accordance with appropriate NFPA standards.

(5) Combustible dust, as applicable, in accordance with NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*.

(6) Control of ignition sources including smoking, grinding, welding, and cutting. {See NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*.}


(8) Fire A fire report, including an investigation and a statement on the corrective action to be taken. {See see Annex B}.

(9) Fire hazards of materials located in the plant or storage areas identified in accordance with NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, and applicable material safety data sheets (MSDS).

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address: [Not Specified]
City: [Not Specified]
State: [Not Specified]
Zip: [Not Specified]
Submittal Date: Wed May 22 14:08:58 EDT 2013

Committee Statement

Committee: Provides additional item for consideration in the Fire Risk Control Program.
Statement: Program.
Response Message:
A.5.1.4.2(9)
Oil-filled transformers and fires can be prevented in some cases by the installation of a passive mechanical system designed to depressurize the transformer a few milliseconds after the occurrence of an electrical fault. This fast depressurization can be achieved by a quick oil evacuation triggered by the dynamic pressure peak generated by the short circuit. The protection technology activates within milliseconds before static pressure increases, therefore preventing transformer explosion and subsequent fire. However, since these devices do not eliminate a fire potential resulting from all forms of transformer failure (e.g., transformer bushing failure), they should be considered as a possible supplement to passive protection features such as physical barriers or spatial separation, not as an alternative to these features.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: 
City:
State:
Zip:
Submittal Date: Wed May 22 08:39:23 EDT 2013

Committee Statement

Committee Statement: Provides clarification that the fast depressurization system should not be a substitute for other criteria listed.
Response Message:
A.5.2.2

It generally is recognized that boiler and turbine buildings, protected in accordance with this document, meet the intent of NFPA 101, Life Safety Code, for additional travel distances for fully sprinklered facilities.

NFPA 101 allows additional means of egress components for special-purpose industrial occupancies. These areas can be permitted to be provided with fixed industrial stairs, fixed ladders (see ANSI A1264.1, Safety Requirements for Workplace Floor and Well Openings, Stairs, and Railing Systems, and ANSI A14.3, Standard for Safety Requirements for Fixed Ladders), or alternating tread devices (see NFPA 101). Examples of these spaces include catwalks, floor areas, or elevated platforms that are provided for maintenance and inspection of in-place equipment.

Spaces internal to equipment and machinery are excluded from the requirements of NFPA 101. Examples of these spaces include, but are not limited to, the internals of the following:

1. Boilers
2. Scrubbers
3. Pulverizers
4. Combustion turbine enclosures
5. Cooling towers
6. Bunkers, silos, and hoppers
7. Conveyor pulley take-up areas
8. Electrostatic precipitators

Examples of these spaces within hydroelectric plants include the following:

1. Turbine scroll cases
2. Generators
3. Access tunnels for dam inspections
4. Entry into draft tubes
5. Penstocks

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 06 08:36:27 EDT 2013

Committee Statement

Committee The recommendation for hydroelectric generating plants has been
First Revision No. 120-NFPA 850-2013 [ New Section after A.5.4.1.3.2 ]

A.5.5.1

For hydroelectric plants, draining the space above the turbine head cover by gravity might not be possible. Both ac and dc drainage pumps discharging into piping leading to the station sump are often provided with suctions in the well where the shaft first extends above the gland seal. In addition, gravity drainage might be impossible from some of the enclosed volumes of bulb units. In such cases, accumulated liquids from oil spills and from fire suppression should be pumped to sumps or to other containment volumes.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 05 10:55:47 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
A.5.5.2
Design discharge for the turbine building should be based on the expected time necessary to take the turbine off line and put it on turning gear, but not less than 10 minutes. The provisions are for drainage and any associated drainable facilities (pits, sumps, drains to downstream surge chamber and/or tail tunnels or tailrace, and sump pumps) for underground power plants.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 05 11:27:27 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
A.6.7.3(2)
Special consideration should be given to alerting personnel in remote spaces, such as in scroll/spiral cases or draft tubes.
A.6.2.2

A single water source could be designed to provide an acceptable level of reliability for the fire protection system(s). As an example, a single reliable water source could supply the fire pump(s). The need for multiple or a secondary water source is dependent on several factors and a detailed analysis of the facility, and the level of reliability needed should be part of the Fire Protection Design Basis Document.

The detailed analysis of the water supply reliability needed should include, but not be limited to, the following:

1. **Reliability of source** — under normal circumstances, not including a regional event, the water source is expected to operate as designed.

2. **Capacity of source** — meets all requirements pertinent to the applicable codes and standards for fixed fire protection and manual fire-fighting.

3. **Reliance on water-based fire protection systems** — if the facility relies completely on water-based fixed protection systems, then the water supply reliability is paramount to the success of the overall fire protection system design. A single, credible impairment should not eliminate the water supply from the fire protection system.

4. **Availability of alternate and back-up sources** — additional water sources such as connections to the public water supply, cooling tower basins, service water tanks, on-site reservoirs or ponds available for fire department pumper suction — should be available.

5. **Consequences of a loss, in terms of property and generation** — this can include the size of a facility from a values standpoint (values at risk) or amount of generation at risk in an owner’s generation scheme.

Submitter Information Verification

**Submitter Full Name:** [Not Specified]
**Organization:** [Not Specified]
**Street Address:**
**City:**
**State:**
**Zip:**
**Submittal Date:** Wed May 22 09:47:06 EDT 2013

Committee Statement

**Committee Statement:** Annex material has been provided to clarify that a single reliable water source may be acceptable and also to provide guidance on determining the need for multiple water sources.

**Response Message:**
A.6.2.2.1

Hydroelectric, wind, and solar generating plants are commonly located in remote areas and require special consideration with respect to water supplies and their usefulness as follows:

1. Hydroelectric plants are typically located adjacent to rivers or at the base of lakes. Fire protection water supplies can be permitted to be limited to the water from the river, lake, reservoir, or private tank(s). Consideration should be given to the special problems for this type of water supply (i.e., freezing, low flow, heavy sediment) associated with requirements for the fire protection systems, equipment, and installation.

2. Upstream water is frequently the fire protection water supply for hydroelectric facilities. Water for fire suppression should not be taken downstream from any closure device in a penstock, flume, or forebay.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 09:51:23 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
First Revision No. 43-NFPA 850-2013 [ New Section after A.6.2.1 ]

A.7.2.1

NFPA 54, "National Fuel Gas Code," provides guidance for the design, installation, and testing of applications operating at pressures less than gauge pressure of 125 psi and should be considered a good reference for these types of applications in power generating facilities (for example: hot water heaters, space heaters, cooking applications, auxiliary boilers, and emergency generators). NFPA 54 specifically excludes piping in electric utility power plants that supplies gas utilized directly as the fuel to generate electricity. These systems typically operate at pressures greater than gauge pressure of 125 psi, which are covered by NFPA 56, "Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems."

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 10:32:27 EDT 2013

Committee Statement

Committee Statement: This change is intended to incorporate the TIA’s 10-2.
Response Message:
Public Input No. 16-NFPA 850-2012 [New Section after A.6.2.1]
A.7.2.4

It is often recommended that oxidants like air be diluted by a nonreactive (inert) gas such as nitrogen, carbon dioxide, or argon to levels so that when a flammable gas is introduced, a flammable mixture is not generated. The reverse is also true: dilute the fuel before adding air. Flammability ranges for various fuels are noted as part of Table 4.4.2 of NFPA 497, *Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*. While this addresses fire hazards, the nonreactive gas is an asphyxiant, and proper cautions are to be followed. This best practice is discussed at length in CGA G-5.6, Section 8.11.3.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organzation: [Not Specified]
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Wed May 22 12:48:30 EDT 2013

Committee Statement

Committee Statement: Incorporated from TIA 10-2
Response Message:
A.7.2.5
Maintenance and repair of fuel gas piping should be performed in accordance with Section 9.8.2 of CGA G-5.6.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 12:53:29 EDT 2013

Committee Statement

Committee Statement: Incorporated from TIA 10-2.
Response Message:

First Revision No. 106-NFPA 850-2013 [ Section No. A.7.4.1.1 ]
The Powder River Basin (PRB) of Montana and Wyoming has the largest reserves of low-sulfur coal in the United States (76 percent). PRB coal from PRB is sub-bituminous coal, which has gained popularity as an alternative to expensive scrubbers required to meet emissions standards when burning high-sulfur coal. PRB sub-bituminous coal has one-half to one-sixth the sulfur content of most other coals. The following is a representative proximate analysis of PRB coals (ranges of PRB data published in “Guide to Coal Mines,” Burlington Northern and Santa Fe Railway, courtesy PRB Coal Users’ Group):

Sub-bituminous coal presents fire protection challenges due to spontaneous heating characteristics. Also, sub-bituminous coal is extremely friable, which contributes to higher levels of dusting and spillage. Housekeeping, preplanning, coal handling equipment design, and fire protection system design are integral components to minimizing the risks associated with a sub-bituminous coal fire. Table A.7.4.1.1(a) is a representative, proximate analysis of sub-bituminous coals.

Table A.7.4.1.1(a) Proximate Analysis of PRB Coals

<table>
<thead>
<tr>
<th>Property</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed carbon</td>
<td>32.06% – 40.00%</td>
</tr>
<tr>
<td>Volatile matter</td>
<td>27.70% – 32.66%</td>
</tr>
<tr>
<td>Moisture</td>
<td>23.80% – 31.80%</td>
</tr>
<tr>
<td>Ash</td>
<td>3.80% – 8.45%</td>
</tr>
<tr>
<td>Sodium as a percentage of ash</td>
<td>0.32% – 7.50%</td>
</tr>
<tr>
<td>Sulfur</td>
<td>0.20% – 0.80%</td>
</tr>
<tr>
<td>Btu/lb</td>
<td>8050 – 9500</td>
</tr>
<tr>
<td>Size</td>
<td>Nominal 2 in. × 0 in.</td>
</tr>
</tbody>
</table>

Ash fusion temperature/reducing atmosphere:

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Initial, °F</th>
<th>Initial, °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2050 – 2268</td>
<td>1121 – 1242</td>
</tr>
<tr>
<td>Fluid, °F</td>
<td>2142 – 2348</td>
<td></td>
</tr>
<tr>
<td>Fluid, °C</td>
<td>1172 – 1287</td>
<td></td>
</tr>
</tbody>
</table>


PRB coal presents fire protection challenges due to spontaneous heating characteristics. Also, PRB is extremely friable, contributing to higher levels of dusting and spillage. Housekeeping, preplanning, coal handling equipment design, and fire protection system design are integral components to minimizing the risks associated with a PRB coal fire.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City:
State:
Zip:
Committee Statement

Committee: PRB coal is commonly a reference to a geography area where sub-bituminous coal is mined. The intent is to focus on sub bituminous coal regardless of where it is mined but rather on the characteristics of this particular rank of coal.

Response Message:

First Revision No. 45-NFPA 850-2013 [Section No. A.7.4.2.6]

A.7.4.2.6
All signs of spontaneous combustion and fire must be eliminated prior to the movement of coal.

Manual Fire Suppression. Fire-fighting in coal silos is a long and difficult activity. Some fire-fighting operations have taken several days to completely extinguish a fire.

Smoldering coal in a coal bin, bunker, or silo is a potentially dangerous situation that depends on the location of the smoldering coal. There is a risk of a flash fire or explosion if the smoldering coal is disturbed. This risk should be considered in preplanning. Personnel responding to a coal fire should have proper personal protective equipment, including SCBA and turnout gear, and training in this hazard.

The area surrounding the smoldering coal should also be considered. The potential of developing an immediately dangerous to life and health (IDLH) atmosphere is possible. This should also be considered in preplanning.

Depending on the strategy selected, resource demands will be varied but challenging. Prefire planning is an important element in successful silo fire control and should be included in the Fire Protection Design Basis Document (see Chapter 4) and the fire emergency plan (see 17.4.4). Control room operators should be involved with the preplanning.

Use of Micelle-Encapsulating Agents Water Additives. Use of micelle-encapsulating agents has found success in recent years, especially for PRB coal fires. Application of this agent water additives is the preferred fire suppression method of the PRB Coal Users' Group for bunker, hopper, and silo fire protection (see the PRB Coal Users' Group Recommended Practice, Coal Bunker, Hopper & Silo Fire Protection Guidelines).

Baseline guides and procedures for preplanning and applying micelle-encapsulating agents water additives to these fires are included in the PRB Coal Users' Group document. These guides and procedures can be used as a starting point by the owner's structural fire brigade and local fire department to customize the approach for the specific facility. These fire-fighting activities are inherently dangerous and should not be performed by incipient fire brigades or other personnel. The document is available to members of the PRB Coal Users' Group online at www.prbcoals.com.

The application of micelle-encapsulating agents water additives can be enhanced by using an infrared camera to search for hot spots, either on the sides or top of the silo, to...
facilitate injection of the agent as close as possible to the fire area. The infrared imagery can be used to evaluate performance and monitor progress of the attack. The water/agent solution must penetrate to the seat of combustion to be effective. This penetration can be affected by the degree of compaction, voids, rate of application, evaporation rate, and so forth. Run-off must be drained through feeder pipe and will require collection, clean-up, and disposal. Micelle-encapsulating agents are designed to be environmentally friendly (non-corrosive, non-toxic, non-hazardous, and fully biodegradable).

Use of Class A Foams and Penetrants. Use of Class A foams and penetrants has found some success, but it has been difficult to predict the resources required for successful fire control. The agents generally require mixing with water prior to application, usually in the range of 1 percent by volume, mixed in a manner similar to Class B agents. While the typical application of Class A foam is to fight wildland fires at 1 percent, many plants have reported success with using Class A foams at 0.1 percent. This causes the agent to act as a surfactant. Higher proportions have caused excessive bubble accumulation that impedes penetration into the coal.

The application of foams and penetrants can be enhanced by using an infrared camera to search for hot spots, either on the sides or top of the silo, to facilitate injection of the agent as close as possible to the fire area. The infrared imagery can be used to evaluate performance and monitor progress of the attack. The water/agent solution must penetrate to the seat of combustion to be effective. This penetration can be affected by the degree of compaction, voids, rate of application, evaporation rate, and so forth. Run-off must be drained through feeder pipe and will require collection, clean-up, and disposal.

Use of Inerting Gas. Carbon dioxide and nitrogen have been used successfully as gaseous inerting systems. Carbon dioxide vapor, with a density of 1.5 times that of air, has proven to be effective in quickly establishing an inert atmosphere in the space above the coal, which prevents the creation of an explosive atmosphere in that space.

At the same time the CO\(_2\) vapor can be injected into the stored coal from the lower part of the silo, where fires are most likely to originate. This CO\(_2\) inerts the voids between the coal pieces while filling the silo from the bottom up with CO\(_2\) vapor. The CO\(_2\) vapor injection rate is that needed to exceed any losses at the bottom of the silo while pushing the inert gas up through the coal at a reasonable rate. (Very tall silos require intermediate injection points for the CO\(_2\) vapor between the top and bottom of the silo.)

Since carbon dioxide is stored as a compressed liquefied gas, it must be vaporized before injection into the silo. External vaporizers are used and sized to handle the maximum anticipated CO\(_2\) vapor flow rates.

It is common practice to monitor the carbon monoxide (CO) level while inerting with CO\(_2\). If the CO level does not decrease, the controls on the CO\(_2\) system are designed to allow for increasing the inerting rate. The flow can also be reduced to conserve the CO\(_2\) supply once fire control has been established.

A large imbedded coal fire provides a heated mass that will be extremely difficult to extinguish with CO\(_2\) alone. It is, however, important that supplemental fire fighting be done in an inert environment. The CO\(_2\) system's primary mission is to prevent the large fire from occurring by detecting the fire early by the CO detectors while it is still small and then inverting to contain and extinguish.

Bulk liquid CO\(_2\) units are generally used, but cylinders can be used for inerting smaller silos. (The bulk CO\(_2\) supply is frequently used for other applications such as pulverizer inerting, generator hydrogen purge, and some fire suppression system applications in the
turbine building.) The bulk CO₂ units have the capability of being refilled while they are being used. For the smaller silos, CO₂ vapor is withdrawn from manifolded cylinders without siphon tubes.

Carbon dioxide inerting has a beneficial effect as soon as it reaches the oxidizing coal. As the supporting oxygen level drops, less heat is generated, helping to limit fire spread. But to totally extinguish any large burning coal mass can require a very high CO₂ concentration held for a long time since the cooling capacity of the CO₂ is relatively small and the coal itself tends to retain heat.

The CO₂ system should be considered as a fire prevention/fire containment system. The system can be operated from a dedicated manual release station or by the plant programmable logic controller (PLC) from the control room. Plant personnel need not be involved except to adjust the CO₂ flow rates as needed to manage the inerting or fire suppression.

When carbon dioxide is used, there is a risk of oxygen depletion in the area above, around, or below a silo, bin, or bunker. Areas where gas could collect and deplete oxygen, which might include the tripper room and areas below the discharge feeder gate, should be identified with appropriate barriers and warning signs.

Nitrogen has been used successfully to inert silo fires. It is applied in a manner very similar to carbon dioxide. A notable difference is that nitrogen has about the same density as air (whereas carbon dioxide is significantly more dense). Therefore, it must be applied at numerous injection points around the silo to ensure that it displaces available oxygen, which results in the need for more injection equipment and a larger quantity of agent.

Emptying the Silo. The silo can be unloaded through the feeder pipe, but it is a dirty, messy operation. It is necessary to bypass the feeder belt and to dump the coal onto the floor of the power house at the feeder elevation. A hose crew should be available to extinguish burning coal as it is discharged from the silo. There is a risk that dust raised during this activity can ignite explosively. High-expansion foam can be applied.

Carbon monoxide produced during the combustion process will also tend to settle in the lower elevation and can be a hazard to the hose crew. Once spilled and extinguished, it is usually necessary to shovel the coal into a dump truck for transport back to the coal pile.

Manual Fire-Fighting. Regardless of the type of suppression approach selected, prefire planning is an important element of successful fire control and extinguishment. All necessary resources should be identified and in place prior to beginning fire suppression activities. If necessary materials are not stockpiled on-site, suppliers should be contacted in advance to ensure that equipment and supplies are available on relatively short notice.

The personnel requirements for this fire-fighting activity should be identified in advance. Personnel should be trained and qualified for fire-fighting in the hot, smoky environment that might accompany a silo fire. This training includes the use of self-contained breathing apparatus and personal protective equipment. Personnel engaged in this activity should be minimally trained and equipped to the structural fire brigade level as defined in NFPA 600, Standard on Industrial Fire Brigades. If station personnel are not trained in use of self-contained breathing apparatus, it will be necessary for the public fire department to perform fire-fighting in these areas. Station personnel are still needed to assist with operational advice and guidance. The public fire-fighting agency that responds to a fire at the facility should be involved in preplanning fire-fighting activities for silo fires. The public fire service might need specific instruction concerning operation and potential
hazards associated with coal silo fires as well as operation in the power plant environment. It is important that the responding fire service be supplied information and guidance at every opportunity.

The resources of the station and the local fire service need to work in concert, including working with control room operators and keeping them apprised of fire control operations. Preplanning should include administrative details such as chain of command, access, and so forth. Operations should be coordinated by an established incident command system in conformance with NFPA 1561, *Standard on Emergency Services Incident Management System*. All personnel should be familiar with and practice this system prior to the event.

Submitter Information Verification

**Submitter Full Name:** [Not Specified]

**Organization:** [Not Specified]

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Wed May 22 10:52:39 EDT 2013

Committee Statement

**Committee** The current FPRF project to evaluate water additives for Class A and Class B fires includes NFPA 18 Wetting Agents and NFPA 18A Water Additives. "Micelle-encapsulating" agents are a subset of these groups. The change was made to be generally refer to all agents being evaluated by the FPRF project.

**Response Message:**
Water spray systems should be considered for enclosed conveyors that are inclined because of the greater potential for rapid fire spread.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Thu May 23 11:01:15 EDT 2013

Committee Statement

Committee Statement: This information is better placed in the body of the document.
Response Message:
A.7.4.6.5
Water has been successfully used to control dust collector fires. However, the amount of water delivered to a dust collector can create structural support problems for the equipment itself and for the supporting structure or building. The use of fire-fighting additives with water can be highly effective for coal fires, especially Powder River Basin (PRB) sub-bituminous coal fires. This use of fire-fighting additives can typically result in less water being delivered into the dust collector due to the enhanced fire suppression properties of the agent, subsequently shortening the delivery period. A reduction in water can assist in minimizing the potential weight issues.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address: [ Not Specified ]
City: [ Not Specified ]
State: [ Not Specified ]
Zip: [ Not Specified ]
Submittal Date: Mon Jun 03 12:11:16 EDT 2013

Committee Statement

Committee PRB coal is commonly a reference to a geography area where sub-bituminous coal is mined. The intent is to focus on sub bituminous coal regardless of where it is mined but rather on the characteristics of this particular rank of coal.

Response Message:
First Revision No. 49-NFPA 850-2013 [ New Section after A.7.7.4.2.2 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 11:51:24 EDT 2013

Committee Statement

Committee Statement: Less flammable fluid use is addressed in other areas of the recommended practice, primarily for hydraulic fluids. Therefore, the use of less flammable fluids used in other applications may warrant the elimination of the fire protection if agreed by the stakeholders in the development of the fire protection design basis document.

Response Message:

First Revision No. 52-NFPA 850-2013 [ New Section after A.7.8.1.5 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 12:00:37 EDT 2013

Committee Statement

Committee Statement: Explanatory material added to clarify our position relative to IEEE 484.
Response Message:
First Revision No. 69-NFPA 850-2013 [Section No. A.9.3.3.1]

A.9.3.3.1

The requirements are based on storage heights not exceeding 20 ft (6.1 m).

The specified density was based on a composition of 34 percent paper, 17 percent food waste, 8 percent plastic and rubber, 10 percent glass, 11 percent metal, 14 percent leaves and grass. Solid pile storage to 20 ft (6.1 m) was used. This resulted in selecting a Class III commodity (.22/3000) for 20 ft. The decision was made to increase the density to .25/3000.

If the mix is different from above, consult NFPA 13, *Standard for the Installation of Sprinkler Systems*.

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 15:21:49 EDT 2013

Committee Statement

Committee Statement: Clarification was provided as to where the original density was derived.
Response Message:

First Revision No. 84-NFPA 850-2013 [Section No. A.10.5.1.2]

A.10.5.1.2

The wind turbine generators are typically supplied typically as a packaged unit with blades and hub mounted to a shaft that turns a gearbox and generator, all of which are installed within a nacelle that is, in turn, placed at the top of the wind turbine tower. The nacelle and a tubular tower form an all-weather housing. In addition to weather protection, the nacelles are designed to provide thermal and acoustical insulation. More recent designs employ a torque converter that allows the variable speed of the rotor and drive shaft to be converted to a constant speed for rotor rotation within the generator. Other designs feature direct-drive, permanent magnet type machines in which the rotor rotation is translated directly to the generator field so that a gearbox, with its weight and oil hazards, is not required.
Control cabinetry can be mounted in the nacelle or tower, or within a pad-mounted enclosure located adjacent to the tower, or in a combination of these. Power developed by the generator is routed through cabling down the tower and then onward to join in parallel the outputs of other units before power conditioning is applied and the facility’s power output voltage is stepped up for use on the grid. For large wind farms, power conditioning (i.e., harmonics, reactive and real power controls) is done in the power electronic module located at each individual wind turbine. Large wind farms have a significant effect on the stability of the power grid, so the wind turbine generator is required to exhibit voltage, power, and frequency stability at the generator terminal in a way that is similar to conventional generators.

The wind turbine tower foundation might include a concrete or steel vault through which power and control cabling is routed. Power conditioning needs and voltage step-up requirements will dictate what other structures or enclosures might be needed.

The major fire hazards associated with wind farms are as follows:

1. Flammable and combustible liquids
2. Electrical components and wiring
3. Combustible materials of construction

In the event of a pipe or fitting failure within the nacelle, significant amounts of oil could be released and ignite. In addition, faults in electrical cabinetry, and cabling, and transformers in the nacelle or tower could result in fires.

Figure A.10.5.1.2(a) shows a typical wind turbine, which has the following components:

1. **Anemometer.** Measures the wind speed and transmits wind speed data to the controller.
2. **Blades.** Most turbines have either two or three blades. Wind blowing over the blades causes the blades to “lift” and rotate.
3. **Brake.** A disc brake, which can be applied mechanically, electrically, or hydraulically to stop the rotor in emergencies.
4. **Controller.** The controller starts up the machine at wind speeds of about 8 to 16 mph (13 to 26 kph) and shuts off the machine at about 55 mph (89 kph). Turbines do not operate at wind speeds above about 55 mph (89 kph) because they might be damaged by the high winds.
5. **Gear box/torque converter.** Gears/torque converters connect the low-speed shaft to the high-speed shaft and increase the rotational speeds from typically less than 60 rotations per minute (rpm) to about 1000 to 1800 rpm, the rotational speed required by most generators to produce electricity. The gear box is a costly (and heavy) part of the wind turbine, and engineers are exploring wind turbine manufacturers have developed “direct-drive” generators that operate at lower rotational speeds and do not need gear boxes.
6. **Generator.** Usually an off-the-shelf induction generator that produces 60-cycle ac electricity.
7. **High-speed shaft.** Drives the generator.
8. **Low-speed shaft.** The rotor turns the low-speed shaft at typically less than 60 rotations per minute.
9. **Nacelle.** The nacelle sits atop the tower and contains the gear box, low- and high-speed shafts, generator, controller, and brake. Some nacelles are large enough for a helicopter to land on.
(10) **Pitch.** Blades are turned, or pitched, out of the wind to control the rotor speed and keep the rotor from turning in winds that are too high or too low to produce electricity.

(11) **Rotor.** The blades and the hub together are called the rotor.

(12) **Tower.** Towers are made from tubular steel [as shown in Figure A.10.5.1.2(a)], concrete, or steel lattice, or a combination thereof. Because wind speed increases with height, taller towers enable turbines to capture more energy and generate more electricity.

(13) **Wind direction.** The turbine in Figure A.10.5.1.2(a) is an “upwind” turbine, so-called because it operates facing into the wind. Other turbines are designed to run “downwind,” facing away from the wind.

(14) **Wind vane.** Measures wind direction and communicates with the yaw drive to orient the turbine properly with respect to the wind.

(15) **Yaw drive.** Upwind turbines face into the wind; the yaw drive is used to keep the rotor facing into the wind as the wind direction changes. Downwind turbines do not require a yaw drive; the wind blows the rotor downwind.

(16) **Yaw motor.** Powers the yaw drive.

See Figure A.10.5.1.2(b) for wind farm facility components.

**Figure A.10.5.1.2(a) Typical Wind Turbine Components.** [Courtesy of U.S. DOE Energy Efficiency and Renewable Energy (EERE).]

**Figure A.10.5.1.2(b) Typical Wind Farm Facility Components.**

---

**Submitter Information Verification**

Submitter Full Name: [ Not Specified ]

Organization: [ Not Specified ]
Committee Statement

Committee Statement: Provides a description of technology designs associated with wind turbine equipment and structures to assist document users of current technologies.

Response Message:
A.11.1 Solar Plants. Solar plants use the energy of the sun to produce electrical power. The process used in current commercial utility-scale applications typically involves one of two basic technologies:

1. Photovoltaic (PV) solar power that is associated with the use of PV panels in various arrays in which energy from the sun is converted to dc electrical energy in each of the panels that is subsequently converted to ac power for delivery to the grid.

2. Concentrated solar power (CSP) that involves the production of steam via a heat transfer mechanism and then using the steam to drive a steam turbine generator.

The process most commonly used in current commercial applications of solar generating technology involves the heating of HTF in the solar fields to temperatures above 700°F (371°C). The HTF is heated in a network of stainless steel tubes that are located at the focal point of the solar collection assemblies (SCAs). The SCAs consist of individually curved mirrors mounted on a steel truss frame and arranged in a parabolic shape. Each SCA could be as long as 80 ft (24.4 m) and up to 20 ft (6.1 m) wide. In a given solar field, there can be several hundred SCAs typically arranged in quadrants, with aisles between them.

The SCA mirrors are computer controlled. Each SCA has a solar sensor and an inclinometer. Computers in the control room calculate the angle of the sun, which is then relayed to the SCA controllers. These, in turn, adjust the position of the SCAs to match that of the sun and automatically track the sun as it moves across the sky in a westerly direction.

The HTF heating tubes are surrounded by a glass envelope with a vacuum in the interstitial space. The fluid is moved through a given field by HTF pumps that bring the heated fluid to the power plant where, in steam generators (heat exchangers with the HTF on the primary side and water/steam on the secondary side), the hot fluid then flashes water to steam. The steam is then used to drive one or more steam turbine generators. Other than the aforementioned heat exchangers, the steam side is similar to most traditional steam turbine-generator installations.

To augment the heating of the HTF, each solar generating unit is typically provided with auxiliary natural gas–fired HTF heaters. At the end of the day, as the amount of sunlight available decreases, or during cloudy days, the heaters are operated as needed to maintain adequate HTF temperatures. Solar plants also typically have an ullage system that is used for removing impurities and water from the HTF to a separate ullage vessel. This vessel is then emptied into a truck-mounted tank for later disposal.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 28 13:57:21 EDT 2013

Committee Statement
Committee Statement: This annex language provides document users with a description of PV and CPS solar plants to assist in understanding the common technologies used in these solar generating plants.

Response Message:

First Revision No. 86-NFPA 850-2013 [ New Section after A.11.3 ]

A.11.3.1 Photovoltaic (PV) technology involves the conversion of solar radiation into dc electricity using semiconductors that exhibit the photovoltaic effect. This conversion takes place in a PV solar cell that is made of various materials demonstrating photovoltaic properties and employing various technologies (e.g., crystalline silicon, thin film, etc.). Solar cells are assembled to form a solar panel, and multiple panels are put together to form a solar module. PV modules are installed on steel support structures arranged in long rows called strings that are adequately spaced to avoid “shading” of one from another. In the northern hemisphere, PV modules typically face south and are tilted according to the latitude of the PV site to maximize the solar radiation energy available to the module. Frequently, computer-controlled tracking systems are used to rotate the PV strings on a single axis as necessary to follow the movement of the sun throughout the day.

PV modules/strings are connected electrically in series and parallel and then connected by dc cabling to inverters that convert dc power into ac power. The number of inverters will depend on the size and layout of the PV site. The ac power produced in the inverters is then directed through a step-up transformer to a medium-voltage (e.g., 24 KV) ac cabling and delivered to a local substation where a plant step-up transformer raises the voltage to match that of the grid being served.

Concentrated photovoltaic (CPV) technology uses optic lenses/receptors to concentrate sunlight onto high-performance solar cells, thus increasing the electricity generated. The high-performance cells are then arranged on panels that are mounted to steel support structures that can be moved by dual-axis tracking systems to maximize the benefit of each ray of sunlight. Modules typically have their own inverter and are, otherwise, electrically connected in a manner similar to that employed in a flat-panel PV plant. The routing of electrical power out of a CPV plant is similar to that of a PV plant.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Tue May 28 14:08:10 EDT 2013
Committee Statement

Committee Statement: This annex language provides document users with a description of PV and CPS solar plants to assist in understanding the common technologies used in these solar generating plants.

Response Message:

First Revision No. 117-NFPA 850-2013 [ New Section after A.13.3 ]

A.14.5.3.1
Fires occurring where a generator is in operation are caused by an electrical fault in the generator. Not all faults result in fire. Electrical protection should quickly isolate the generator following detection of a fault. Generator fires are low-frequency events. Fires occurring in generators with thermoplastic insulation (i.e., asphalt, cloth ribbon, polyester) have resulted in self-supporting fires. Damage and downtime have been reduced by the use of fire suppression systems. Fires in generators with thermoset insulation (i.e., fiberglass, epoxy resin) have been less frequent. Incidents have been reported where self-sustaining fire did not occur and operation of a fire suppression system did not result in reduction of damage. There have been other incidents where generator protection schemes failed to isolate the unit electrically (the unit remained energized). This fault energy was high enough to result in a self-sustaining fire. The operation of a fire suppression system limited damage and reduced the amount of time the generator was out of service.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 05 10:46:16 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
A.14.3.2 When fire heats air and introduces products of combustion into the air in tunnels and in underground hydroelectric plants, the ventilation conditions that existed while the air was cold are altered. Frictional resistance to flow of heated air containing products of combustion is much greater than frictional resistance to flow of cold air that does not contain products of combustion. In the event of mild heating, increased resistance to flow would decrease the rate of ventilation. Then, after the fire is contained and the air is cooled, the air and smoke could be evacuated. Therefore, considerations for the health and safety of people underground should cause the designers to increase the rate of evacuating hot air containing smoke. As the fire underground increases the temperature of the air, ventilation flow can be reversed. The cooler ventilating air can flow in one direction occupying much of the lower spaces of tunnels while plumes of heated air flow rapidly outward from the area of the fire beneath the tunnel ceiling in the opposite direction from, and above, the mass of cooler air. The designer should then consider the stratification of air flow, the numerous nodes or junctures between tunnels and shafts, the likely frictional resistances with and without fire, and the placement and capacities of the fans and firestops. Some useful information is available in the proceedings of Session XI, *Fires*, of the 2nd International Mine Ventilation Congress. The designer is advised to be thoroughly familiar with Chapter 41, Fire and Smoke Control, in the *ASHRAE Handbook*.
**A.14.5.2.4**

When areas or rooms are located beneath areas protected by CO$_2$ (or other extinguishing gases), consideration should be given in the design for the possible settling of the gas to lower levels and its effect on personnel who might be in these areas.

**Submitter Information Verification**

**Submitter Full Name:** [Not Specified]

**Organization:** [Not Specified]

**Street Address:**

**City:**

**State:**

**Zip:**

**Submittal Date:** Wed Jun 05 10:49:00 EDT 2013

**Committee Statement**

**Committee Statement:** Incorporated from NFPA 851.

**Response Message:**
First Revision No. 119-NFPA 850-2013 [ New Section after A.15.8.1 ]

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Wed Jun 05 10:52:29 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
First Revision No. 123-NFPA 850-2013 [ New Section after D.2.12 ]

D.2.13  Hydroelectric Plant Generator.
In 2006, a generator fire occurred at a 1272 MW hydroelectric generating plant in Canada. Internal arcing occurred in a 106 MW generator used for base load and export power. Fuel for the fire was the electrical insulation. The generator was protected with smoke detection and a water deluge system. The ignition source was an electrical fault caused by the fracture of a stator top core clamping finger that fractured and exited from under the core clamping plate and bounced through the air gap. This resulted in electrical short circuits between the core and the windings and ignited the circuit ring bus and asphalt-insulated windings. The generator tripped by unit differential and split phase protection. Smoke detection operated and the water deluge system tripped, which extinguished the fire.

Physical damage was $1.2 million, which included 53 out of 600 stator coils that were severely damaged, in addition to several rotor field poles. The cost of lost production due to the outage was $7.8 million.

This incident illustrates the benefit of providing automatic deluge protection for generator windings with insulation that does not self-extinguish when de-energized.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 06 08:42:05 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:

First Revision No. 61-NFPA 850-2013 [ New Section after E.1 ]
E.2 Organization and Detail.

Where compliance to NFPA 850 is clear, only a brief description is needed. Where there is deviation from NFPA 850 guidance, more detail is required regarding the fire risk evaluation and decision process.

The following is a general heading index for an NFPA 850 Fire Protection Design Basis Document:

1. Executive summary
2. Stakeholder goals and objectives (4.2.2)
3. Assumptions, if applicable
4. Project description (4.3.2)
5. Codes and standards (4.3.1)
6. General arrangement/plant layout (5.1)

Fire areas, fire barriers/openings, hydrogen, transformers

1. Life safety (5.2)
2. Building construction materials (5.3)
3. Smoke and heat venting (5.4)
4. Containment and drainage (5.5)
5. Emergency lighting
6. Lightning protection
7. General fire protection (Chapter 6)

Water supply, pumps, tanks, underground, hydrants, standpipes, fire alarm systems, etc.

1. Hazard protection (Chapters 7 through 14)

Submitter Information Verification

Submitter Full Name: [Not Specified]
Organization: [Not Specified]
Street Address:
City:
State:
Zip:
Submittal Date: Wed May 22 13:56:23 EDT 2013

Committee Statement

Committee Statement: Provides guidance for the organization of the DBD and the level of detail needed.

Response Message:
First Revision No. 103-NFPA 850-2013 [ Section No. F.1.1 ]

F.1.1 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.


Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Fri May 31 13:42:26 EDT 2013

Committee Statement

Committee Statement: Revised edition dates to comply with the manual of styles
Response Message:
First Revision No. 125-NFPA 850-2013 [ New Section after F.1.2.2 ]

F.1.2.3  ASHRAE Publications.
ASHRAE, 1791 Tullie Circle, N.E., Atlanta, GA 30329-2305.

Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 06 08:46:05 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message:
F.1.2.11 Other Publications.


Submitter Information Verification

Submitter Full Name: [ Not Specified ]
Organization: [ Not Specified ]
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jun 06 08:44:08 EDT 2013

Committee Statement

Committee Statement: Incorporated from NFPA 851.
Response Message: