



NATIONAL FIRE PROTECTION ASSOCIATION

The leading information and knowledge resource on fire, electrical and related hazards

AGENDA

**NFPA Technical Committee on Electric Generating Plants (ECG-AAA)
NFPA 850 First Draft Meeting (F2025)
NFPA 853 Second Draft Meeting (F2024)**

June 4-6, 2024

8:00 a.m. – 5:00 p.m. (Eastern Daylight Time)

(Hybrid via Microsoft Teams)
Embassy Suites by Hilton Charlotte
4800 South Tryon Street
Charlotte, NC 28217

To join the meeting, please contact scaldwell@nfpa.org

- 1. Call to order.** Mark Boone.
- 2. Introductions.** See committee roster attached.
- 3. Chair report.** Mark Boone.
- 4. Staff liaison report.** Steve Kaitharath.
- 5. Previous meeting minutes.** May/June 2024, Charlotte, NC. See attached.
- 6. NFPA 850 First Draft.**
 - a. **Public Inputs.** See attached.
 - b. **Task group report(s).**
 - i. **Task Group 1.** Justin Perry.
 - ii. **Task Group 2.** Bob Taylor.
 - iii. **Task Group 3.** Larry Danner.
 - iv. **Task Group 4.** Dennis Mason.
 - v. **Task Group 5.** Paul Hayes.
- 7. NFPA 853 Second Draft.**
 - a. **No Public Comments Received.**
- 8. Other Business.**
- 9. Future meetings.**
- 10. Adjournment.**

Address List No Phone

05/21/2024
Thomas Harris
ECG-AAA

Electric Generating Plants

Mark S. Boone Chair AEGIS Insurance Services Limited Metropolitan Center 1 Meadowlands Plaza East Rutherford, NJ 07073 Alternate: Dennis P. Mason	I 03/02/2010 ECG-AAA	Naveed Anjum Principal Lalpir Power Limited Mahmoodkot Punjab, MUZAFARGARH 34200 Pakistan	U 08/23/2023 ECG-AAA
Denise Beach Principal FM Global 270 Central Avenue Johnston, RI 02919 Alternate: Todd E. Stinchfield	I 12/02/2020 ECG-AAA	Steven M. Behrens Principal Retired-AXA XL Risk Consulting/ Global Asset Protection Services, LLC Contractor 100 Constitution Plaza Hartford, CT 06103 Alternate: Larry Dix	I 08/23/2023 ECG-AAA
Daryl C. Bessa Principal F. E. Moran, Inc. Special Hazard Systems 2265 Carlson Drive Northbrook, IL 60062 Alternate: James Bouche	IM 7/26/2007 ECG-AAA	Stephan A. Billian Principal Nuclear Service Organization (NEIL) 1201 North Market Street Suite 1200 Wilmington, DE 19801 Alternate: Andrew J. Brady	I 12/02/2020 ECG-AAA
Donald C. Birchler Principal FP&C Consultants KC, LLC 1330 Burlington Street Suite 200 North Kansas City, MO 64116 Alternate: Brett W. Christianson	SE 1/1/1988 ECG-AAA	Stanley J. Chingo Principal NISYS Corporation 1759 Deerhaven Court Dacula, GA 30019 Alternate: Kevin E. Middleton	SE 1/1/1989 ECG-AAA
Larry M. Danner Principal GE Power 300 Garlington Road GTTC Room 200D Greenville, SC 29615-0648 Alternate: Luca Cortese	M 8/9/2011 ECG-AAA	Brian T. Ford Principal Tennessee Valley Authority 1101 Market Street, LP2N809 Chattanooga, TN 37402	U 08/11/2014 ECG-AAA
Eric Grein Principal Westinghouse Electric Company 178 Whitley Mills Road Fort Mill, SC 29708	U 08/08/2019 ECG-AAA	Paul Hayes Principal The Hiller Companies/American Fire Technologies 2120 Capital Drive Wilmington, NC 28405 Alternate: Don Frank Padgett	IM 08/03/2016 ECG-AAA

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Electric Generating Plants

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Robert Kopcinski	SE 12/07/2022	Jeronimo Lopez	U 04/17/2024
Principal Plants Fire Protection Engineering (PFPE) Zolkiewskiego 5/4 Lodzkie, KUTNO 99-300 Poland	ECG-AAA	Principal Luminant (Vistra Corporation) 558 Evergreen Drive Coppell, TX 75019	ECG-AAA
Regina M. Loschiavo	I 04/05/2016	Joseph L. Navarra	M 04/03/2019
Principal Hartford Steam Boiler (HSB) Munich Re 2950 Long Meadow Lane Durham, NC 27703 Alternate: Bill M. Gunter, Jr.	ECG-AAA	Principal Exelon Corporation/Pepco 701 Ninth Street, NW Washington, DC 20068	ECG-AAA
Justin A. Perry	U 12/6/2019	Eric Prause	M 12/06/2017
Principal Dominion Energy 120 Tredegar Street Richmond, VA 23219-3927	ECG-AAA	Principal Hyaxiom a Doosan Company 195 Governor's Highway South Windsor, CT 06074 Alternate: Kelvin Hecht	ECG-AAA
Scot Pruett	SE 10/6/2000	Karen I. Quackenbush	M 10/23/2013
Principal Black & Veatch Corporation 11401 Lamar Avenue Overland Park, KS 66211-1508 Alternate: Eric Dein	ECG-AAA	Principal Fuel Cell & Hydrogen Energy Association 1025 Connecticut Avenue NW Suite 1000 Washington, DC 20036 Alternate: Haboon H. Osmond	ECG-AAA
Ronald Rispoli	U 1/10/2002	Clifford C. Roberts	I 08/11/2020
Principal Entergy Corporation 2414 West 5th Street Russellville, AR 72801-5541 Alternate: Charles Heinzen	ECG-AAA	Principal Marsh Risk Consulting 15019 Eaglerise Drive Lithia, FL 33547	ECG-AAA
LaTanya Schwalb	RT 03/20/2023		
Principal UL Solutions 333 Pfingsten Road Northbrook, IL 60062 Alternate: Blake M. Shugarman	ECG-AAA		

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Eyüp Sami Soytekin Principal Enka Construction Balmumcu Mah Zincirlikuyu Yolu No:10 Enka 3. Bina İstanbul, ISTANBUL 34349 Turkey	SE 11/29/2023 ECG-AAA	Donald Struck Principal Siemens Fire Safety 2 Gatehall Drive Suite 200 Parsippany, NJ 07054 National Electrical Manufacturers Association	M 8/5/2009 ECG-AAA
Leo Subbarao Principal Fire Prevention Association of Massachusetts 258-15, 83rd Avenue Glen Oaks, NY 11004	U 04/11/2018 ECG-AAA	Robert D. Taylor Principal PRB Coal Users Group 4294 Martha Court Newburgh, IN 47630-0002	U 10/29/2012 ECG-AAA
Dan Wilder Principal Western States Fire Protection 4346 E. Elwood Street Suite 100 Phoenix, AZ 85040 National Fire Sprinkler Association Alternate: Justin Hoeppner	M 04/14/2021 ECG-AAA	Andrew Wolfe Principal JENSEN HUGHES 3610 Commerce Drive, Suite 817 Baltimore, MD 21227 Alternate: Andrew M. Buirch	SE 11/30/2016 ECG-AAA
Josh Zembrodt Principal American International Group, Inc. (AIG) 6435 Ridge Avenue Cincinnati, OH 45213	I 08/24/2021 ECG-AAA	James Bouche Alternate F. E. Moran, Inc. Special Hazard Systems 2265 Carlson Drive Northbrook, IL 60062 Principal: Daryl C. Bessa	IM 10/29/2012 ECG-AAA
Andrew J. Brady Alternate Nuclear Service Organization (NEIL) 210 Righter Parkway Suite 210 Wilmington, DE 19801 Principal: Stephan A. Billian	I 12/02/2020 ECG-AAA	Andrew M. Buirch Alternate Jensen Hughes 3 Lantern Lane Woodstown, NJ 08098 Principal: Andrew Wolfe	SE 08/23/2023 ECG-AAA

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Bill M. Gunter, Jr.	I 11/29/2023	Kelvin Hecht	M 3/21/2006
Alternate HSB Professional Loss Control 120 Hackberry Street Oak Ridge, TN 37830 Principal: Regina M. Loschiavo	ECG-AAA	Alternate Doosan Fuel Cell America 115 Reverknolls Avon, CT 06001 Principal: Eric Prause	ECG-AAA
Charles Heinzen	U 11/29/2023	Justin Hoeppner	M 04/12/2022
Alternate Entergy Corporation 1448 SR 333 Russellville, AR 72802 Principal: Ronald Rispoli	ECG-AAA	Alternate Shambaugh and Son, LP 7614 Opportunity Drive Fort Wayne, IN 46825 National Fire Sprinkler Association Principal: Dan Wilder	ECG-AAA
Dennis P. Mason	I 11/30/2016	Kevin E. Middleton	SE 12/07/2022
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Haboon H. Osmond	M 03/20/2023	Don Frank Padgett	IM 12/06/2019
Alternate Fuel Cell & Hydrogen Energy Association 13612 Big Boulder Road Herndon, VA 20171 Principal: Karen I. Quackenbush	ECG-AAA	Alternate Hiller Companies 2120 Capital Drive Wilmington, NC 28405 Principal: Paul Hayes	ECG-AAA

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Timothy Pope	M 03/05/2012	Blake M. Shugarman	RT 8/9/2011
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Todd E. Stinchfield	I 3/4/2009	Jerrold Weaver	U 03/20/2023
Alternate FM Global 33 Marian Lane Woonsocket, RI 02895 FM Global Principal: Denise Beach	ECG-AAA	Alternate Southern Company 3535 Colonnade Parkway Bin N 603 EC Birmingham, AL 35243 Edison Electric Institute Principal: Larry D. Shackelford	ECG-AAA
Thomas C. Clayton	O 1/1/1979	Leonard R. Hathaway	O 1/1/1979
Member Emeritus 9211 West 76th Terrace Overland Park, KS 66204	ECG-AAA	Member Emeritus 1568 Hartsville Trail The Villages, FL 32162	ECG-AAA
Thomas Harris	12/17/2021		
Staff Liaison National Fire Protection Association 1 Batterymarch Park Quincy, MA 02169-7471	ECG-AAA		



NATIONAL FIRE PROTECTION ASSOCIATION

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MINUTES

NFPA Technical Committee on Electric Generating Plants (ECG-AAA) NFPA 850 and 853 First Draft Meeting (F2024)

May 31 – June 2, 2023

8:00 am – 5:00 pm on First and Second Day (Eastern)

8:00 am – 1:00 pm on Final Day (Eastern)

Hybrid Meeting

(In-person – Charlotte, NC)

(Online – Microsoft Teams)

1. **Call to order.** Mark Boone, chair, called the meeting to order at 8:00 a.m. on May 31st, 2023.
2. **Introductions.** Attendees introduced themselves and identified their affiliation and NFPA staff took attendance.
3. **Chair report.** Mark Boone welcomed attendees and provided an overview of the meeting.
4. **Staff liaison report.** Tom Harris provided an overview of the standards development process and the revision cycle schedule.
5. **Previous meeting minutes.** The minutes from April 2019, Savannah, GA were approved without revision.
6. **NFPA 850 First Draft.**
 - a. **Review of Public Inputs.** The Technical Committee reviewed the Public Inputs and developed First Revisions and Committee Inputs as necessary. These will be available in the First Draft Report at www.nfpa.org/850.
 - b. **New task groups.** The following task groups were appointed to work subsequent to the meeting:
 - i. **Task Group 1.** TG Chair: Justin Perry. Members: Eric Grein, Dan Sheridan, Andrew Wolfe, Joe Navarra, LaTanya, Robert Kopcinski. Review Chapters 1 through 6.
 - ii. **Task Group 2.** TG Chair: Bob Taylor. Members: Ron Rispoli, Steve Behrens, Scot Pruett, James Bouche, Justin Hoepfner, Kevin Middleton, Stan Chingo, Luca Cortese, Andy Brady. Review Chapters 7 through 9.
 - iii. **Task Group 3.** TG Chair: Larry Danner. Members: Fred H, Gina Loschiavo, Brian Ford, Larry Dix, Dan Wilder. Review Chapters 10, 11, 15 through 17.

These minutes are considered preliminary until approved at the next committee meeting.

- iv. **Task Group 4.** TG Chair: Dennis Mason. Members: Larry Shackelford, Rickey Johnson, Eric P, Haboon Osmond, Steve Billian. Review Chapters 12 through 14 and 18 through 12.
- v. **Task Group 5.** TG Chair: Paul Hayes. Members: Denise Beach, Mark Boone, Don Birchler. Correlation and Consistency.

7. NFPA 853 First Draft.

- a. **Review of Public Inputs.** The Technical Committee reviewed the Public Inputs and developed First Revisions and Committee Inputs as necessary. These will be available in the First Draft Report at www.nfpa.org/853.

8. Other Business.

- 9. **Future meetings.** The next committee meeting will be in Q2 in 2024. A meeting notification will be posted at www.nfpa.org/850next, and www.nfpa.org/853next when the meeting is scheduled.

- 10. **Adjournment.** The meeting was adjourned at 1:00 p.m. on June 2nd, 2023.

Attendees

Committee Members:

✓	Boone, Mark	Chair	AEGIS Insurance Services Limited
✓	Beach, Denise	Principal	FM Global
✓	Bessa, Daryl	Principal	F. E. Moran, Inc. Special Hazard Systems
✓*	Billian, Stephan	Principal	NEIL Services
✓*	Birchler, Donald	Principal	FP&C Consultants KC, LLC
✓	Chingo, Stanley	Principal	NISYS Corporation
✓	Danner, Larry	Principal	GE Power
✓	Ford, Brian	Principal	Tennessee Valley Authority
✓	Grein, Eric	Principal	Westinghouse Electric Company
✓	Hayes, Paul	Principal	The Hiller Companies/American Fire
✓	Hildebrandt, Fred	Principal	Fire Suppression Systems Association
✓	Johnson, Rickey	Principal	Liberty International Underwriters
✓*	Kopcinski, Robert	Principal	Plants Fire Protection Engineering (PFPE)
✓	Loschiavo, Regina	Principal	Hartford Steam Boiler (HSB) Munich Re
✓	Navarra, Joseph	Principal	Exelon Corporation/Pepco
	Oliver, Eric	Principal	WSP
✓	Perry, Justin	Principal	Dominion Energy

✓	Prause, Eric	Principal	Hyaxiom a Doosan Company
✓	Pruett, Scot	Principal	Black & Veatch Corporation
	Quackenbush, Karen	Principal	Fuel Cell & Hydrogen Energy Association
✓	Rispoli, Ronald	Principal	Entergy Corporation
✓*	Roberts, Clifford	Principal	Marsh USA Inc.
✓	Schwalb, LaTanya	Principal	UL Solutions
✓	Shackelford, Larry	Principal	Edison Electric Institute
✓	Sheridan, Daniel	Principal	Sheridan Fire Equipment, Inc.
✓*	Struck, Donald	Principal	National Electrical Manufacturers
✓*	Subbarao, Leo	Principal	Fire Prevention Association of MA
✓	Taylor, Robert	Principal	PRB Coal Users' Group
✓*	Wilder, Dan	Principal	National Fire Sprinkler Association
	Zembrodt, Josh	Principal	American International Group, Inc. (AIG)
✓	Dix, Larry	Voting Alternate	Global Asset Protection Services, LLC
✓	Wolfe, Andrew	Voting Alternate	Jensen Hughes
✓	Bouche, James	Alternate	F. E. Moran, Inc.
✓*	Brady, Andrew	Alternate	NEIL Services
	Christianson, Brett	Alternate	FP&C Consultants KC, LLC
✓*	Cortese, Luca	Alternate	GE
	Dein, Eric	Alternate	Black & Veatch
	Ellis, Byron	Alternate	Entergy Corporation
	Hecht, Kelvin	Alternate	Doosan Fuel Cell America
✓	Hoeppner, Justin	Alternate	National Fire Sprinkler Association
✓	Mason, Dennis	Alternate	AEGIS Insurance Services
✓	Middleton, Kevin	Alternate	ENERCON Inc.
✓	Osmond, Haboon	Alternate	Fuel Cell & Hydrogen Energy Association
✓*	Padgett, Don	Alternate	American Fire Technologies
	Pope, Timothy	Alternate	Fire Suppression Systems Association
	Sharp, James	Alternate	National Electrical Manufacturers
	Shugarman, Blake	Alternate	UL Solutions
	Stinchfield, Todd	Alternate	FM Global
	Weaver, Jerrod	Alternate	Edison Electric Institute

	Clayton, Thomas	Member Emeritus	[Organization]
	Hathaway, Leonard	Member Emeritus	[Organization]
✓	Harris, Thomas	Staff Liaison	National Fire Protection Association

Guests:

Steven Behrens	AXA XL
Tom Goss	NFPA
Patrick Bakaj	NFPA
Chad Duffy	NFPA
Steve Kaitharath	NFPA

*Participated by teleconference

Total number in attendance: 43



Public Input No. 44-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 1]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter1_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 1 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

Submitter Information Verification

Submitter Full Name: regina.m.loschiavo@gmail.com
Organization: Hartford Steam Boiler (HSB) Mu
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 04 13:28:27 EST 2024
Committee: ECG-AAA

Chapter 1 Administration

1.1 Scope. [move para text to subsection]

1.1.1

This ~~document standard~~ provides ~~recommendations the requirements~~ for fire prevention and fire protection for electric generating plants and ~~high-high-voltage~~ direct current converter stations, ~~except as follows: Advanced light water reactor electric generating plants are addressed in NFPA 804; nuclear power plants are addressed in NFPA 805; and fuel cells are addressed in NFPA 853.~~

1.1.2

This standard ~~does not apply to the following items:~~

- (1) Advanced light water reactor electric generating plants ~~are addressed in (see NFPA 804)~~
- (2) Nuclear power plants ~~are addressed in (see NFPA 805)~~
- (3) Fuel cells ~~are addressed in (see NFPA 853)~~
- (4) Stationary energy storage systems ~~(see NFPA 855)~~

1.2 Purpose.

1.2.1

~~This document is prepared for the guidance of those charged with the design, construction, operation, and protection of electric generating plants and high voltage direct current converter stations that are covered by the scope of this document. The purpose of this standard is to provide the minimum fire protection requirements for the design, construction, installation, commissioning, operation, and maintenance of electric generating plants and high-voltage direct current converter stations.~~

1.2.2*

~~This document standard provides fire hazard control recommendations requirements for the safety of construction and operating personnel, the physical integrity of plant components, and the continuity of plant operations, and post-fire environmental considerations. Specific concerns are generalized and categorized as shown in 1.2.2.1 through 1.2.2.4.~~

A.1.2.2

Safety of Operating Personnel. Risk of injury and loss of life, in the event of fire, should be controlled. Specific criteria should be established for means of egress. When for plant safety and emergency response reasons personnel are not able to evacuate immediately, specific criteria for ensuring their safety until they can evacuate and safe passage to egress routes should be established.

Physical Integrity of Plant Components. The large capital costs of the structures, systems, and components for the facilities addressed in this recommended practice create financial risks for the owners, investors, and financiers. Specific criteria should be established for the mitigation of the risks from fires exposing these assets.

Commented [KS1]: SL: Chapter 1 should be either all "shall" statements or statements of fact. Since there are more of the latter, I have made changes accordingly (i.e., removing "shall" where used).

Commented [KS2]: Replaced semicolon w/colon and removed commas, "and," and period from list per MOS.

Also made changes to the list items so that they work grammatically with the lead-in.

Commented [ECG3]: No comments - Accepted

Commented [ECG4]: TG1 - Accepts

Commented [ECG5]: TG1 - Accepts

Continuity of Plant Operations. The ability of these facilities to generate and transmit electricity is important not only to the owners of the facilities but also to the consumers of that energy, including the public. Specific criteria for managing the effects of fire on the ability to generate and transmit power should be developed, based on economic and societal considerations.

Environmental Considerations. Fires in these facilities have the potential of creating environmental impact, by damaging pollution control systems and components and by creating unwanted releases to the environment from the fire and fire-fighting activities. Specific criteria should be established to control the impact of fire and fire-fighting activities on the environment.

1.2.2.1 Protection of Plant Personnel. [move text from subs to A.1.2.2]

~~Risk of injury and loss of life, in the event of fire, should be controlled. Specific criteria should be established for means of egress. When for plant safety and emergency response reasons personnel are not able to evacuate immediately, specific criteria for ensuring their safety until they can evacuate and safe passage to egress routes should be established.~~

1.2.2.2 Assets Protection.

~~The large capital costs of the structures, systems, and components for the facilities addressed in this recommended practice create financial risks for the owners, investors, and financiers. Specific criteria should be established for the mitigation of the risks from fires exposing these assets.~~

1.2.2.3 Business Interruption.

~~The ability of these facilities to generate and transmit electricity is important not only to the owners of the facilities but also to the consumers of that energy, including the public. Specific criteria for managing the effects of fire on the ability to generate and transmit power should be developed, based on economic and societal considerations.~~

1.2.2.4 Environmental Protection.

~~Fires in these facilities have the potential of creating environmental impact, by damaging pollution control systems and components and by creating unwanted releases to the environment from the fire and fire-fighting activities. Specific criteria should be established to control the impact of fire and fire-fighting activities on the environment.~~

1.3 Application.

1.3.1

This document standard is intended for use by persons knowledgeable in the application of fire protection for electric generating plants and high-high-voltage direct current converter stations.

1.3.2*

~~The recommendations contained in this document are intended for new installations, as the application to existing installations might not be practicable. However, the recommendations contained in this document represent good industry practice and should be considered for existing installations. The requirements contained in this standard apply to new facilities and modifications to existing facilities that introduce a different or increased hazard.~~

Commented [BM6]: Don't need... or move to an Appendix

Commented [ECG7]: TG1 - Move to Appendix. TG1 - Also implement statement for the "DBD" related to this analysis/criteria.

Commented [BM8]:

Commented [BM9]: Don't need... or move to an Appendix

Commented [ECG10]: TG1 - Move to Appendix. TG1 - Also implement statement for the "DBD" related to this analysis/criteria.

Commented [BM11]:

Commented [ECG12]: TG1 - Agree no changes

A.1.3.2

Changes that might introduce a different or increased hazard include, but are not limited to, fuel conversions, new technologies, new site buildings and structures, fuel handling system modifications, and dissimilar major equipment replacements.

1.3.3

It should be recognized that rigid uniformity of generating station design and operating procedures does not exist and that each facility will have its own special conditions that impact on the nature of the installation. Many of the specific recommendations herein might require modification after due consideration of all applicable factors involved. This modification should be made only after following the methodology described in Chapter 4 and documented in the Fire Protection Design Basis document.

1.4 Retroactivity.

The requirements of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time of issuance.

1.4.1

Unless otherwise specified, the requirements of this standard do not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the requirements of this standard are retroactive.

1.4.2

Where the authority having jurisdiction determines that an existing situation presents an unacceptable degree of risk, the authority having jurisdiction is permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3

The retroactive requirements of this standard are permitted to be modified if their application would be impractical in the judgment of the authority having jurisdiction, and only where it is clearly evident that a reasonable degree of safety is provided.

1.4.5* Equivalency.

1.4.1 [move text to main section]

Nothing in this recommended practice standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this recommended practice standard.

A.1.5

It should be recognized that rigid uniformity of generating station design and operating procedures does not exist and that each facility will have its own special conditions that impact on the nature of the installation. Many of the specific requirements contained herein might require modification after due consideration of all applicable factors involved. This modification should be made only after following the methodology described in Chapter 4 and documented in the fire protection design basis document (FPDBD).

Commented [BM13]: Annex for 1.3.1

Commented [ECG14]: TG1 - Annex to 1.5 Equivalency. Delete Section 1.3.3

Commented [KS15]: SL: Replaced "provisions" with "requirements" per NFPA style. Also simplified end of Section 1.4 para text and beginning of 1.4.2 text.

Commented [ECG16]: TG1 - Section 1.5 Agreed/added

Commented [KS17]: Replaced "may" with "might" per MOS. Also lowercased full term for FPDBD.

Commented [BM18]: Annex for 1.3.1

Commented [ECG19]: TG1 - Added Annex to 1.5 from 1.31

1.4.2

Equivalency should be demonstrated following the methodology described in Chapter 4 and documented in the Fire Protection Design Basis document.

1.5.1

Technical documentation is to be submitted to the authority having jurisdiction to demonstrate equivalency.

1.5.2

The system, method, or device is to be approved for the intended purpose by the authority having jurisdiction.

1.5.6 Units and Formulas.

Metric units in this document are in accordance with the International System of Units, which is officially abbreviated SI in all languages. For a full explanation, see ASTM SI10, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*.

1.6.1

The units of measure in this standard are presented in the US Customary (inch-pound units) followed by the International System (SI) units in parentheses.

1.6.2

Either system is acceptable for satisfying the requirements of this standard.

1.6.3

Users of this standard are to apply one set of units consistently and not alternate between units.

1.6.4

The values presented for measurements in this standard are expressed with a degree of precision appropriate for practical application or enforcement. It is not intended that the application or enforcement of these values be more precise than the precision expressed.

1.6.5

Where extracted text contains values expressed in only one system of units, the values in the extracted text have been retained without conversion to preserve the values established by the responsible technical committee in the source document.

Commented [ECG20]: TG1 - Agreed Incorporate

Commented [BM21]: Taken from NFPA 853

Commented [ECG22]: TG1 - Agree



Public Input No. 45-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 2]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter2_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 2 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

Submitter Information Verification

Submitter Full Name: regina.m.loschiavo@gmail.com
Organization: Hartford Steam Boiler (HSB) Mu
Street Address:
City:
State:
Zip:
Submittal Date: Thu Jan 04 13:39:15 EST 2024
Committee: ECG-AAA

Chapter 2 Referenced Publications

2.1 General.

The documents or portions thereof listed in this chapter are referenced within this [standard](#) ~~recommended practice~~ and ~~should shall~~ be considered part of the ~~recommendations~~ [requirements](#) of this document.

2.2 NFPA Publications.

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

NFPA 1, *Fire Code*, ~~2018~~ [2024](#) edition.

NFPA 2, *Hydrogen Technologies Code*, ~~2020~~ [2023](#) edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, ~~2018~~ [2022](#) edition.

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, ~~2016~~ [2024](#) edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, ~~2018~~ [2025](#) edition.

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, ~~2018~~ [2025](#) edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, ~~2019~~ [2025](#) edition.

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, ~~2019~~ [2024](#) edition.

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, ~~2017~~ [2022](#) edition.

~~NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2019 edition.~~

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, ~~2017~~ [2024](#) edition.

NFPA 18A, *Standard on Water Additives for Fire Control and Vapor Mitigation*, ~~2017~~ [2022](#) edition.

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, ~~2019~~ [2025](#) edition.

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, ~~2018~~ [2023](#) edition.

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, ~~2019~~ [2025](#) edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, ~~2020~~ [2023](#) edition.

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2018~~ [2024](#) edition.

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, ~~2018~~ [2024](#) edition.

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, ~~2020~~ [2024](#) edition.

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, ~~2018~~ [2024](#) edition.

Commented [KS1]: SL: Updated BP.

Commented [HT2]: Has been withdrawn, all information is now located in NFPA 11

Commented [JAP(63R2)]: Agree

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, ~~2019~~ [2024](#) edition.

NFPA 54, *National Fuel Gas Code*, ~~2018~~ [2024](#) edition.

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, ~~2020~~ [2023](#) edition.

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, ~~2020~~ [2023](#) edition.

NFPA 58, *Liquefied Petroleum Gas Code*, ~~2020~~ [2024](#) edition.

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*, ~~2019~~ [2023](#) edition.

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, ~~2018~~ [2023](#) edition.

NFPA 69, *Standard on Explosion Prevention Systems*, ~~2019~~ [2024](#) edition.

NFPA 70®, *National Electrical Code*®, ~~2020~~ [2023](#) edition.

NFPA 72®, *National Fire Alarm and Signaling Code*®, ~~2019~~ [2025](#) edition.

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, ~~2020~~ [2024](#) edition.

~~NFPA 77, *Recommended Practice on Static Electricity*, 2019 edition.~~

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, ~~2019~~ [2025](#) edition.

~~NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*, 2017 edition.~~

NFPA 85, *Boiler and Combustion Systems Hazards Code*, ~~2019~~ [2023](#) edition.

NFPA 86, *Standard for Ovens and Furnaces*, ~~2019~~ [2023](#) edition.

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, ~~2018~~ [2024](#) edition.

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, ~~2018~~ [2024](#) edition.

NFPA 92, *Standard for Smoke Control Systems*, ~~2018~~ [2024](#) edition.

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, ~~2017~~ [2024](#) edition.

NFPA 101®, *Life Safety Code*®, ~~2018~~ [2024](#) edition.

NFPA 110, *Standard for Emergency and Standby Power Systems*, ~~2019~~ [2025](#) edition.

~~NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*, 2025 edition.~~

NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*, ~~2020~~ [2023](#) edition.

NFPA 204, *Standard for Smoke and Heat Venting*, ~~2018~~ [2024](#) edition.

NFPA 214, *Standard on Water-Cooling Towers*, ~~2016~~ [2021](#) edition.

Commented [JAP(64)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [JAP(65)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [JAP(66)]: Was this added in a later Chapter?

NFPA 220, *Standard on Types of Building Construction*, ~~2018~~ 2024 edition.

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, ~~2019~~ 2022 edition.

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, ~~2017~~ 2022 edition.

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, ~~2019~~ 2023 edition.

NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, ~~2017~~ 2022 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, ~~2018~~ 2023 edition.

~~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*, 2017 edition.~~

~~NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2017 edition.~~

NFPA 501A, *Standard for Fire Safety Criteria for Manufactured Home Installations, Sites, and Communities*, ~~2017~~ 2025 edition.

NFPA 600, *Standard on Facility Fire Brigades*, ~~2020~~ 2025 edition.

NFPA 601, *Standard for Security Services in Fire Loss Prevention*, ~~2020~~ 2025 edition.

NFPA 652, *Standard on the Fundamentals of Combustible Dust*, 2019 edition.

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2020 edition.

NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*, 2020 edition.

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, ~~2019~~ 2023 edition.

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, ~~2017~~ 2022 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems*, ~~2019~~ 2023 edition.

NFPA 770, *Standard on Hybrid (Water and Inert Gas) Fire-Extinguishing Systems*, 2021 edition.

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, ~~2020~~ 2023 edition.

NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, ~~2020~~ 2025 edition.

NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, ~~2020~~ 2025 edition.

NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Systems*, ~~2020~~ 2025 edition.

Commented [JAP(67)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [HT8]: Will be consolidated into NFPA 660

Commented [JAP(69R8)]: Agree

Commented [KS10R8]: This can be done at SD.

Commented [HT11]: Will be consolidated into NFPA 660

Commented [JAP(612R11)]: Agree

Commented [KS13R11]: This can be done at SD.

Commented [HT14]: Will be consolidated into NFPA 660

Commented [JAP(615R14)]: Agree

Commented [KS16R14]: This can be done at SD.

Commented [HT17]: Were there any PI's to add this in a body section?

Commented [HT18R17]: PI 14 adds this reference in 5.4.1.2

Commented [JAP(619R17)]: Agree, leave reference in standard

~~NFPA 855, Standard for the Installation of Stationary Energy Storage Systems, 2023 edition.~~

~~NFPA 1140, Standard for Wildland Fire Protection, 2022 edition.~~

NFPA 1142, Standard on Water Supplies for Suburban and Rural Firefighting, 2017 2022 edition.

~~NFPA 1143, Standard for Wildland Fire Management, 2018 edition.~~

~~NFPA 1144, Standard for Reducing Structure Ignition Hazards from Wildland Fire, 2018 edition.~~

~~NFPA 1221, Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems, 2019 edition.~~

~~NFPA 1901, Standard for Automotive Fire Apparatus, 2016 edition.~~

~~NFPA 1225, Standard for Emergency Services Communications, 2022 edition.~~

~~NFPA 1900, Standard for Aircraft Rescue and Firefighting Vehicles, Automotive Fire Apparatus, Wildland Fire Apparatus, and Automotive Ambulances, 2024 edition.~~

~~NFPA 1962, Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances, 2018 edition.~~

~~NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting, 2018 edition.~~

~~NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services, 2019 edition.~~

~~NFPA 1982, Standard on Personal Alert Safety Systems (PASS), 2018 edition.~~

NFPA 2001, Standard on Clean Agent Fire Extinguishing Systems, 2018 2025 edition.

NFPA 2010, Standard for Fixed Aerosol Fire-Extinguishing Systems, 2020 2025 edition.

NFPA 5000[®], Building Construction and Safety Code[®], 2018 2024 edition.

~~NFPA Fire Protection Handbook, 2008, 20th 21st edition, 2023.~~

2.3 Other Publications.

2.3.1 API Publications.

American Petroleum Institute, 200 Massachusetts Avenue, NW, Suite 1100, Washington, DC 20001-5571 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, 2012.

API 505, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2, 2018.

API 537, Flare Details for Petroleum, Petrochemical, and Natural Gas Industries, 2017.

API 2218, Fireproofing Practices in Petroleum and Petrochemical Processing Plants, 2013.

Commented [JAP(620)]: Was this added in a later Chapter?

Commented [HT21]: Consolidated into NFPA 1140

Commented [HT22]: Consolidated into NFPA 1140

Commented [HT23]: Consolidated into NFPA 1225

Commented [HT24]: Consolidated into NFPA 1900

Commented [HT25]: Will be consolidated into NFPA 1930

Commented [HT26]: Will be consolidated into NFPA 1970

Commented [HT27]: Will be consolidated into NFPA 1970

Commented [PH28]: Per Mark cannot be referenced in Mandatory text, remove?

Commented [JAP(629R28)]: Need guidance from NFPA staff on how to incorporate handbook (used in Section 4.3.1)

Commented [KS30R28]: See my edits and suggestions in Chapter 4. This should be moved to the Info Refs annex.

API RP 521, *Guide for Pressure Relieving and Depressurizing Systems*, 2007.

API RP 941, *Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants*, 2016.

2.3.2 ASME Publications.

American Society of Mechanical Engineers, Two Park Avenue, New York, NY 10016-5990.

ASME B31.1, *Power Piping*, ~~2018~~ [2022](#).

ASME B31.3, *Process Piping*, ~~2018~~ [2022](#).

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*, 2018.

ASTM D448, *Standard Classification for Sizes of Aggregate for Road and Bridge Construction*, ~~2017~~ [2012](#), [reapproved 2022](#).

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, ~~2019a~~ [2023](#).

ASTM E108, *Standard Test Methods for Fire Tests of Roof Coverings*, ~~2017~~ [2020a](#).

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, ~~2018e1~~ [2022](#).

ASTM E136, *Standard Test Method for Behavior Assessing Combustibility of Materials in Using a Vertical Tube Furnace at 750°C*, ~~2019~~ [2022](#).

ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, [2013a](#), [reapproved 2017](#).

ASTM E1248, *Standard Practice for Shredder Explosion Protection*, [1990](#), [reapproved 2017](#).

[ASTM E1354, Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter, 2023.](#)

ASTM E1725, *Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components*, ~~2014e1~~ [2019](#).

ASTM SI10, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*, 2016.

2.3.4 IEC Publications.

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

IEC 62305, *Protection Against Lightning*, ~~2010~~ [2020](#).

2.3.5 IEEE Publications.

Commented [HT31]: Superseded by API STD 521, Pressure-relieving and Depressuring Systems, 2022.

Commented [JAP(632R31)]: Agree

Commented [PH33]: Per Mark cannot be referenced in Mandatory Text? Remove?

Commented [JAP(634R33)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [HT35]: Added in PI 23

IEEE, ~~Three Park Avenue, 17th Floor, New York, NY 10016-5997~~ [Operations Center, 445 Hoes Lane, Piscataway, NJ 08854-4141](#).

IEEE C2, *National Electrical Safety Code*, ~~2017~~ [2023](#).

IEEE C37.20.7, *Guide for Testing ~~Metal-Enclosed~~ Switchgear Rated Up to ~~38~~ [52](#) kV for Internal Arcing Faults*, ~~2007~~ [2017](#).

IEEE 484, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*, ~~2002~~ [2019](#).

IEEE 634, *Standard ~~for~~ Cable-Penetration Fire Stop Qualification Test*, 2004.

IEEE 979, *Guide for Substation Fire Protection*, 2012.

IEEE 980, *Guide for Containment and Control of Oil Spills in Substations*, ~~2013~~ [2021](#).

IEEE 1202, *~~Standard for~~ Flame-Propagation Testing of Wire and Cable*, 2006.

2.3.6 SFPE Publications.

Society of Fire Protection Engineers, 9711 Washingtonian Blvd, Suite 380, Gaithersburg, MD 20878.

Engineering Guide to Fire Risk Assessment, ~~2006~~ [2022](#).

SFPE Handbook of Fire Protection Engineering, 5th edition, 2015.

2.3.7 UL Publications.

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

[ANSI/UL 263](#), *~~Standard for~~ Fire Tests of Building Construction and Materials*, 2011, revised ~~2018~~ [2022](#).

[ANSI/UL 723](#), *Test for Surface Burning Characteristics of Building Materials*, ~~2008~~, revised ~~2018~~ [2023](#).

[ANSI/UL 790](#), *Tests ~~Methods~~ for Fire ~~Resistance-Tests~~ of Roof-Covering Materials Coverings*, 2004, revised ~~2014~~ [2022](#).

[ANSI/UL 900](#), *~~Standard for Safety Test Performance of~~ Air Filters ~~Units~~*, 2004, revised 2015, revised [2022](#).

[ANSI/UL 1479](#), *~~Standard for~~ Fire Tests of ~~Through~~-Penetration Firestops*, 2003, revised 2015, revised [2021](#).

[ANSI/UL 1709](#), *~~Standard for~~ Rapid Rise Fire Tests of Protection Materials for Structural Steel*, ~~2017~~ [2022](#).

2.3.8 US Government Publications.

US Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

~~OSHA-29 CFR Title 29, Code of Federal Regulations, Part 1910.146, "Permit Required Confined Space Standard," U.S. Department of Labor, 2010.~~

Title 29, ~~CFR Code of Federal Regulations~~, Part 1910.156, "Fire Brigades," ~~2008~~.

2.3.9 Other Publications.

Commented [PH36]: Remove

Commented [JAP(637R36)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [PH38]: Remove

Commented [JAP(639R38)]: RP's need to be evaluated by TG2-5 in their respective chapters to decide whether or not they should move to Annex material (allowed for an RP), or deleted

Commented [PH40]: Remove

Commented [JAP(641R40)]: Need guidance from NFPA staff on how to incorporate handbook (used in Section 4.3.1)

Commented [KS42R40]: See my edits and suggestions in Chapter 4. This should be moved to the Info Refs annex.

Merriam-Webster’s Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, ~~2003~~
2020.

2.4 References for Extracts in ~~Recommendations~~ Mandatory Sections.

NFPA 30, *Flammable and Combustible Liquids Code*, ~~2018~~ 2024 edition.

▲ NFPA 101®, *Life Safety Code*®, ~~2018~~ 2024 edition.

NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*, ~~2020~~ 2025 edition.

NFPA 5000®, *Building Construction and Safety Code*®, ~~2018~~ 2024 edition.

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Public Input No. 46-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 3]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter3_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 3 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

Submitter Information Verification

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Submittal Date: Thu Jan 04 13:41:09 EST 2024
Committee: ECG-AAA

Chapter 3 Definitions

3.1 General.

~~The definitions contained in this chapter apply to the terms used in this recommended practice. Where terms are not defined in this chapter or within another chapter, they should be defined using their ordinarily accepted meanings within the context in which they are used. Merriam-Webster's Collegiate Dictionary, 11th edition, is the source for the ordinarily accepted meaning.~~

3.1.1

The definitions contained in this chapter shall apply to the terms used in this ~~recommended practice~~ standard.

3.1.2

Where terms are not defined in this chapter or within another chapter, they ~~should~~ shall be defined using their ordinarily accepted meanings within the context in which they are used.

3.1.3

Merriam-Webster's Collegiate Dictionary, 11th edition, ~~is~~ shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

3.2.1* Approved.

Acceptable to the authority having jurisdiction.

3.2.2* Authority Having Jurisdiction (AHJ).

An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled.

Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

3.2.4* Listed.

Equipment, materials, or services included in a list published by an organization that is acceptable to the authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

3.2.5 Shall.

Commented [ECG1]: TG1 - Agree, incorporate

Commented [KS2]: SL: Updated per NFPA style.

Indicates a mandatory requirement.

3.2.6 Should.

Indicates a recommendation or that which is advised but not required.

3.2.7 Standard.

An NFPA standard, the main text of which contains only mandatory provisions using the word “shall” to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA manuals of style. When used in a generic sense, such as in the phrases “standards development process” or “standards development activities,” the term “standards” includes all NFPA standards, including codes, standards, recommended practices, and guides.

3.2.5 Recommended Practice.

A document that is similar in content and structure to a code or standard but that contains only nonmandatory provisions using the word “should” to indicate recommendations in the body of the text.

3.2.6 Should.

Indicates a recommendation or that which is advised but not required.

3.3 General Definitions.

3.3.1 Alternative Fuels.

Solid fuels such as municipal solid waste ~~(MSW)~~, refuse derived fuel ~~(RDF)~~, biomass, rubber tires, and other combustibles that are used instead of fossil fuels ~~(i.e., gas, oil, or coal)~~ in a boiler to produce steam for the generation of electrical energy.

3.3.2 Biomass.

A boiler fuel manufactured by means of a process that includes storing, shredding, classifying, and conveying of forest and agricultural byproducts ~~(e.g., wood chips, rice hulls, sugar cane)~~.

3.3.3 Combustible.

Capable of undergoing combustion.

3.3.4 Combustible Material.

A material that, in the form in which it is used and under the conditions anticipated, will ignite and burn; a material that does not meet the definition of noncombustible or limited-combustible.

3.3.5 Compressed Air Foam (CAF).

A homogenous foam produced by the combination of water, foam concentrate, and air or nitrogen under pressure.

3.3.6 Fast Depressurization System.

Commented [KS3]: SL: Updated to most recent version.

Commented [BM4]: From NFPA 853

Commented [ECG5]: TG1 - Agree, incorporate

Commented [PH6R5]: Confirm that it is required if not delete as problematic due to references to other standards

Commented [JAP(67R5)]: These appear in other NFPA standards (such as NPFA 13) and appear to be valid additions

Commented [KS8]: SL: Editorial suggestion.

Commented [KS9]: SL: Recommend moving examples to Annex A.

A passive mechanical system designed to depressurize oil-filled equipment such as transformers, current-limiting reactors, bushing cable boxes, or load tap changers a few milliseconds after the occurrence of an internal electrical arc.

3.3.7 Fire Area.

An area that is physically separated from other areas by space, barriers, walls, or other means in order to contain fire within that area.

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, 2018 2024]

Commented [KS10]: SL: Edits throughout to match NFPA definitions to their sources and edition years to those in Chapter 2.

3.3.9 Fire Loading.

The amount of combustibles present in a given area, expressed in Btu/ft² (kJ/m²).

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 D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*. [30, 2018 2024]

3.3.11 Fire Prevention.

Measures directed toward avoiding the inception of fire. [801, 2020 2025]

3.3.12 Fire Protection.

Methods of providing for fire control or fire extinguishment. [801, 2020 2025]

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 to maintain a barrier rating.

3.3.14 ~~Fire Risk Evaluation~~ Fire Protection Design Basis Document (FPDBD).

An evaluation of the plant-specific considerations regarding design, layout, and anticipated operating requirements. ~~The evaluation should result in a list of recommended fire prevention features to be provided based on acceptable means for separation or control of common and special hazards, the control or elimination of ignition sources, and the suppression of fires.~~

Commented [PH11]: We have a this definition but no Definition of a DBD Sometime used interchangeably. Consistency

Commented [PH12R11]: Delete this definitions - use of FPDBD as described in Chapter 4.

Commented [JAP(613R11)]: Concerns from the taskgroup exist around deletion of a definition of the FRE such that it is clear what this is and how it is different from FPDBD

Commented [PH14R11]: Open item for Discussion of Committee. Current document is reflective of FPDBD

Commented [KS15]: SL: Recommend move this additional text to Annex A.

3.3.15 Fluid.

3.3.15.1 Fire-Resistant Fluid.

A listed hydraulic fluid or lubricant that is difficult to ignite due to its high fire point and autoignition temperature and that does not sustain combustion due to its low heat of combustion.

3.3.15.2 Nonflammable Fluid.

A nonflammable dielectric fluid that does not have a flash point and is not flammable in air.

3.3.16 Fossil Fueled.

Fuel containing chemical energy, which has been formed from animal and plant matter over many years (i.e., oil, coal, and natural gas) that are used in a boiler to produce steam for the generation of electrical energy.

3.3.17 High-Voltage Direct Current (HVDC) Converter Station.

A facility that functions as an electrical rectifier (ac-dc) or an inverter (dc-ac) to control and transmit power in a high-voltage network. There are two types of HVDC valves — the mercury arc valve and the present-day technology solid state thyristor valve. Both types of valves present a fire risk due to high-voltage equipment that consists of oil-filled converter transformers, wall bushings, and capacitors in addition to various polymeric components.

3.3.18 Hybrid Fire-Extinguishing System.

A fire-extinguishing system capable of delivering hybrid media at the specified design rate and proportion.

3.3.19 Hybrid Media.

An extinguishing media created by the simultaneous discharge of water and an inert gas agent in a controlled proportion from a common discharge device that results in an oxygen concentration less than 18 percent.

3.3.20 Idling.

A condition of the flywheel energy system where the flywheel is rotating but not providing energy to external loads.

3.3.21 Interior Finish.

The exposed surfaces of walls, ceilings, and floors within buildings. [5000, ~~2018~~ 2024]

3.3.21.1 Class A Interior Finish.

Materials having a flame spread index of 0–25, and a smoke developed index of 0–450 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*. Includes any material with a flame spread index of 25 or less and with a smoke developed index of 450 or less when any element thereof, when tested, does not continue to propagate fire.

3.3.21.2 Class B Interior Finish.

Materials having a flame spread index of 26–75, and a smoke developed index of 0–450 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*. Includes any material with a flame spread index of 26 or more but not more than 75 and with a smoke developed index of 450 or less.

Commented [KS16]: SL: Recommend move this additional text to Annex A.

Also if HVDC is an acronym to be used throughout the doc, it should be consistent (it was not hyphenated in Chapter 1, which I fixed, and the acronym isn't indicated in parens).

Commented [KS17]: SL: Recommend move this additional text to Annex A.

Commented [KS18]: SL: Recommend move this additional text to Annex A.

3.3.22 Limited Combustible.

A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), where tested in accordance with NFPA 259 and complies with (1a) or (2b): (1a) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 0.127 in. (3.2 mm) that has a flame spread index not greater than 50; and (2b) materials, in the form and thickness used, other than as described in (1a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition are considered combustible.)

Commented [KS19]: SL: I think these should be 1 and 2, not a and b, given how we structure NFPA document lists.

3.3.23 Liquid.

3.3.23.1 Combustible Liquid.

Any liquid that has a closed-cup flash point at or above 100°F (37.8°C). (See NFPA 30.)

3.3.23.2 Flammable Liquid.

A liquid that has a closed-cup flash point that is below 100°F (37.8°C) and a maximum vapor pressure of 40 psia (2068 mm Hg) at 100°F (37.8°C).

3.3.23.3 High Fire Point Liquid.

A combustible dielectric liquid listed as having a fire point of not less than 572°F (300°C).

3.3.23.4 Less Flammable Liquid.

A combustible dielectric liquid listed as having a fire point of not less than 572°F (300°C).

3.3.24 Mass Burn.

A process in which municipal solid waste is hauled directly to a tipping floor or storage pit and then is used as a boiler fuel without any special processing.

3.3.25 Municipal Solid Waste (MSW).

Solid waste materials consisting of commonly occurring residential and light commercial waste.

3.3.26 Noncombustible.

Commented [KS20]: SL: Suggested edits.

A material that, in the form in which it is used and under the conditions anticipated, will not aid combustion or add appreciable heat to an ambient fire. Materials ~~when~~ tested in accordance with and conforming to the criteria contained in Section 7 of ASTM E136, Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C, ~~and conforming to the criteria contained in Section 7 of the referenced standard~~ are considered noncombustible.

3.3.27 Rating.

3.3.27.1 Fire Protection Rating.

The time, in minutes or hours, that materials and assemblies used as opening protection have withstood a fire exposure as established in accordance with test procedures of NFPA 252 and NFPA 257 as applicable.

3.3.27.2 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*. [5000, ~~2018~~ 2024]

3.3.28 Refuse Derived Fuel (RDF).

A boiler fuel manufactured by means of a process that includes storing, shredding, classifying, and conveying of municipal solid waste.

3.3.29* Spin Down.

Shutdown condition of the flywheel energy system, where energy is being dissipated and the flywheel rotor is slowing down to a stop.

3.3.30 Stakeholder.

An individual, a group of individuals, or an organization that is perceived to affect or be affected by the fire hazards associated with the facility being evaluated. Stakeholders include all those who have a financial, personnel safety, public safety, or regulatory interest in the fire risk, such as the public (e.g., neighbors, community groups, first responders), employees, owner/investor(s), operator, insurer, regulator(s), and design team.

3.3.31 Registered Design Professional.

An individual who is registered or licensed to practice fire protection engineering as defined by the statutory requirements of the professional registration laws of the jurisdiction in which the project is to be constructed, with experience in electric generating plants and high-voltage direct current converter stations and their respective safety systems.

3.3.32 Qualified/Competent Person.

An individual who has the skills, knowledge, training, and experience related to the construction, operation, and installations of electric generating plants and high-voltage direct current converter stations and has received training to recognize and eliminate the hazards involved.

Commented [KS21]: SL: Recommend move this additional text to Annex A.

Commented [PH22]: Requires mod to 4.1.1

Commented [JAP(623R22)]: This is a substantive change (should be a separate PI) that in conjunction with changes in 4.1.2 would require a PE and change the existing language. There is disagreement from Taskgroup that this change is necessary from a technical perspective

Commented [KS24]: SL: To match style of other defs.



Public Input No. 47-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 4]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter4_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 4 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 4 Fire Protection Design Basis Document (FPDBD) ~~Process~~

4.1 General.

4.1.1*

A fire protection design basis document (FPDBD) shall be required for the design of new facilities and modifications to existing facilities that introduce different or increased hazards and impact the purpose of this standard (see Section 1.2).

A.4.1.1

The creation of the ~~fire protection design basis~~ FPDBD should be initiated as early in the plant design process as practical to ensure that the fire prevention and fire protection ~~recommendations~~ requirements as described in this document have been evaluated in view of the plant-specific consideration regarding design, layout, and anticipated operating requirements.

~~4.1.2~~

The fire protection design process ~~should~~ shall be initiated under the direction of a registered design professional ~~someone experienced in the area of fire protection engineering and having extensive knowledge and experience in power plant operation of the type of plant under consideration.~~

~~4.1.2~~ [move text as A.4.1.1]

~~The creation of the fire protection design basis should be initiated as early in the plant design process as practical to ensure that the fire prevention and fire protection recommendations as described in this document have been evaluated in view of the plant specific consideration regarding design, layout, and anticipated operating requirements.~~

~~4.1.3~~ [move text as A.4.1.3]

~~Applicable process safety management (PSM) techniques should be considered.~~

4.1.43*

The ~~purpose of the Fire Protection Design Basis Document (FPDBD) is to~~ shall provide a record of the decision-making process in determining ~~the~~ fire prevention and fire protection for specific hazards.

A.4.1.3

Applicable process safety management (PSM) techniques should be considered.

4.1.54*

The ~~Fire Protection Design Basis Document should be a living document that continues to evolve, as the plant design is refined, and it should~~ FPDBD shall 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 5.4.3).~~

A.4.1.4

The FPDBD should be a living document that continues to evolve as the plant design is refined. FPDBDs should be revised when any modifications are made to the plant, even for a single modification or a portion of the plant. The FPDBD is key to the management of change process (see 5.4.3).

Commented [PH1]: Global change FPDBD from DBD - also change any mention of FRE to FPDBD

Commented [JAP(62R1)]: FRE is a defined part of FPDBD (FPDBD may contain FRE's)...unsure we can simply remove

Commented [KS3]: SL: Edits to this new para.

Commented [ECG4]: TG1 - Revised

Commented [ECG5]: TG1 - Agree Annex

Commented [PH6]: IF we change this is it still DBD? Need Definition?

Commented [ECG7]: TG1 - Revised

Commented [ECG8]: TG1 - Agree

Commented [ECG9]: TG1 - Agree

New facilities and new modifications to existing facilities introducing increased hazards impacting the purpose of this standard (Section 1.2).

[ALL NEW TEXT FOLLOWING 4.1]

4.2* ~~FPDBD~~ Team Members.

Members of the FPDBD team shall be identified early in at the start of the process and consist of a subset of stakeholders with an interest in the scope and applicability of the fire protection design.

A.4.2.1

Members of the FPDBD team would not include all stakeholders. Stakeholder involvement in the decision-making process is determined on a ~~site/project site- or project-~~specific basis.

FPDBD ~~Team Members~~ team members would typically include first responders, employees, the owner(s)/investor(s), the operator(s), the insurer(s), the regulator(s), and the project design team.

4.3 ~~Process Inputs to the FPDBD Process.~~

4.3.1* ~~General Inputs.~~

In addition to the requirements of this standard in this document, the following list shall be reviewed for applicability:

- (1) ~~Codes~~ State and local building and fire codes
 - (a) ~~Building codes — state and local~~
 - (b) ~~Fire codes — state and local~~
- (2) ~~Standards~~ Industry and utility company standards
- (3) Insurance requirements
- (4) Chapter 4 of NFPA 805
- (5) NFPA codes and standards (*see Chapter 2*)
 - (a) ~~Industry standards~~
 - (b) ~~Utility company standards~~
 - (c) ~~Insurance requirements~~
 - (d) ~~Applicable NFPA documents (See Chapter 2.)~~
- (6) ~~Regulations~~ Environmental and OSHA regulations
 - (a) ~~Environmental~~
 - (b) ~~OSHA~~
- (4) Other references
 - (a) ~~SFPE Handbook of Fire Protection Engineering and journals~~

Commented [ECG10]: TG1 - Need to align/configure per previous sections and technical committee discussions (Sections 1.3.2 & 4.1.2)

Commented [ECG11]: TG1 - Revised

Commented [KS12]: SL: This isn't a full sentence, and it also repeats what appears in 4.1.1. Can we delete? (If not, please complete sentence and also I suggest same edits I made in 4.1.1.)

Commented [KS13]: SL: I have taken FPDBD out of each section title for consistency (and its given in the chapter title so I think we're covered there).

Commented [KS14]: SL: We need to be specific here given that it's a requirement.

Commented [PH15]: Stockholder vs FPDBD Team member ?

Commented [JAP(616R15)]: Certain stakeholders (like your neighbors) may not be appropriate members of the FPDBD team. This was not an issue when this was an RP, but change needed if we are headed to a standard (do not want language that could be read to require neighbors to be on FPDBD team)

Commented [ECG17]: TG1 - Revised and Annex Material added to clarify stakeholders roles/responsibilities within the DBD Team.

Updated Section 4.2 Title from "Stakeholders" to "DBD Team Members"

Commented [ECG18]: TG1 - Agreed

Commented [KS19]: SL: This list can be simplified; see my edits.

Also I think everything under "other references" is largely nonmandatory in nature and can be moved to the annex; see edits. This also resolves the issue of referencing some nonmandatory references in Chapter 2.

~~(b) SFPE Engineering Guide to Fire Risk Assessment (Chapters 14 and 15)~~

~~(c) Best Practices: EEI, EPRI, IEEE~~

~~(d) NFPA Fire Protection Handbook~~

~~(e) NFPA 805 (Performance-Based Criteria in Chapter 4)~~

~~(75)~~ Design documents

~~(86)~~ Stakeholder inputs

A.4.3.1

Additional references that should be reviewed for applicability include the following:

(1) SFPE Handbook of Fire Protection Engineering and similar journals

(2) Chapters 14 and 15 of SFPE Engineering Guide to Fire Risk Assessment

(3) Best practices from EEI, EPRI, and IEEE

(4) NFPA's Fire Protection Handbook

4.3.2* Project-Specific ~~Inputs~~.

The project-specific inputs ~~utilized-used~~ in the FPDBD process shall include, but are not limited to, the following:

- (1) Base load/peaking unit
- (2) Personnel levels, as follows:
 - (a) Unattended
 - (b) Low level of occupancy
 - (c) High level of occupancy
- (3) Fuel types and volatility
- (4) Plant layout and geographic location
- (5) Equipment availability/redundancy
- (6) Availability of water supply
- (7) Capability of emergency responders
- (8) Storage configuration (short term and long term)
- (9) Historical loss information, ~~f~~ lessons learned, ~~f~~ and fire reports (See-see Annex B and Annex D-)

A.4.3.2

Commented [PH20]: Or FPDBD Team members?

Commented [JAP(621R20)]: Inputs can include stakeholders as well as team members, TG prefers to leave as is

Commented [ECG22]: TG1 - Agreed

Each facility will have its own special conditions that impact ~~on~~ the nature of the installation. Many of the specific criteria herein might require modification, due to the consideration of all project-specific factors involved.

Fire Protection Operation. With few exceptions, fire protection systems should be automatically actuated to ensure prompt operation. Manually activated systems could cause delays in response times unacceptable for most hazards.

~~The FPDBD 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.~~

Unattended Facilities. Facilities that are operated unattended present special fire protection concerns. ~~The delayed response time of the fire brigade or public firefighting personnel (which can be several hours) and the lack of personnel available to alert others to a fire condition should both be considered.~~

~~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 to a fire condition.~~

The FPDBD should address delayed response and lack of communication. This analysis can establish the need to provide additional fire protection measures to prevent a major fire spread prior to the arrival of ~~fire-~~ firefighting personnel. The delayed response by personnel to the site can necessitate automatic shutoff of fire pumps.

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 unattended plant.

It is important that the responding fire brigade or public ~~fire-~~ firefighting forces be familiar with access, plant fire protection systems, emergency lighting, specific hazards, and methods of fire control. This coordinating effort should be reflected in the plant fire emergency plan. (See Section 5.4.)

4.4 ~~FPDBD~~ Process.

4.4.1*

FPDBD ~~Team Members~~ team members shall establish personnel safety, financial, and public safety goals and objectives and evaluate whether the design decisions ~~made are adequate to~~ meet those goals and objectives.

A.4.4.1

The criteria established for the acceptability of the level of fire protection should consider the perspective of the various FPDBD team members.

4.4.2

The ~~general arrangement and~~ plant layout shall be provided to clearly reflect the separation of hazards.

4.4.3

~~Where the layout fails to meet the goals and objectives is not acceptable, the following shall occur:~~

(1) ~~A~~ a fire risk evaluation shall be developed to resolve the failure, ensure objectives are met, and then

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Commented [KS23]: SL: This is repeated again almost word-for-word. Can we condense to one spot?

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Commented [KS24]: SL: Combine paras.

Commented [ECG25]: TG1 - Included already in current revision of document in the Annex.

Commented [ECG26]: TG1 - Reconciled

Commented [ECG27]: Added from 4.2, reconcile when we reach this

Commented [ECG28]: TG1 - Revised to reference for "DBD Team" and configure to Section 1.2.2 for goals and objectives.

Commented [PH29]: Subjective statement

Commented [PH30]: Or FPDBD Team Members

(2) The layout shall be returned to the review process.

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4.4.4

Each hazard, ~~and hazard~~ area shall be reviewed against the goals and objectives and NFPA 850.

4.4.5

~~If Where~~ the level of hazard(s) control ~~fails to meet the goals and objectives-is not acceptable, the following shall occur:~~

~~(1) then a An~~ FPDBD shall be developed to ~~resolve the failure, ensure objectives are met, and~~
then

Commented [PH31]: Vs DBD?

(2) The layout shall be returned to the review process.

Commented [PH32]: Positive statement vs Negative. Subjective. Also FRE vs DBD

4.4.6

A FPDBD shall be developed.

Commented [JAP(633R32)]: Changed to Annex material.....team will manage goals / objections, stakeholders can be considered but wont make decisions

4.4.7

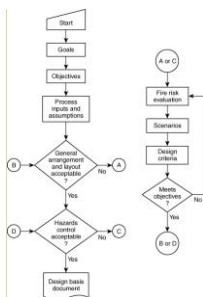
~~As the project evolves, the The~~ FPDBD shall be reviewed and updated as necessary ~~throughout the project~~ to incorporate changes and revisions. (See Figure 4.4.7.)

Commented [PH34R32]: Still needs to be updated?

Commented [KS35R32]: Tried to make changes to resolve subjectivity? I do see the issue with the FRE/FPDBD and repetition, though...

Figure 4.4.7 Fire Protection Design Basis Document Process Flow Chart.

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Commented [HT36]: Already stated in 4.1.2

Commented [ECG37R36]: TG1 - These reflect the steps in the below flow chart (Figure 4.4.5). Redundancy is acceptable.

Commented [HT38]: Repeat of 4.1.4

Commented [ECG39R38]: TG1 - These reflect the steps in the below flow chart (Figure 4.4.5). Redundancy is acceptable.

Commented [BS40]: G850-6

Commented [ECG41]: TG1 - Identified that the flow chart does not identify the "fire evaluation" step prior to decision blocks to make a decision related to "general arrangement and layout" and "Hazard control acceptability". This is outside of current TG1 scope, but concern is identified.

Commented [PH42R41]: TG to submit PI

4.5 Deliverables.

4.5.1*

The FPDBD shall establish the fire protection design criteria for the facility.

Commented [ECG43]: TG1 - Agree

A.4.5.1

The format of the document ~~is-should be~~ a statement on ~~the~~ general fire protection philosophy for the facility and a comparison of the facility fire protection features to the requirements and guidelines in the design chapters, ~~for example, (e.g.,~~ protection of oil hazards, and also addressing containment and drainage).

Commented [ECG44]: TG1 - Moved from A.4.5.6 to A.4.5.1 as in previous revision of the "Standard"

4.5.2*

The FPDBD shall be revised as necessary by the FPDBD team as the design progresses, ~~based on dialogue among the DBD Team.~~

Commented [ECG45]: TG1 - Agree

A.4.5.2

The development of the FPDBD will be an iterative process. ~~A-See Annex E for a sample table of contents for the FPDBD-is contained in Annex E.~~

4.5.3

Commented [ECG46]: TG1 - Agree

The FPDBD shall outline the fire protection or fire ~~/~~ prevention design basis for achieving the fire hazard control objectives agreed upon by the FPDBD team ~~Team~~, including the following:

- (1) Identify assumptions (including items in 4.3.2) ~~-~~
- (2) Identify source documents ~~-~~
- (3) Identify each hazard, identify which fire prevention ~~/~~ or fire protection features are to be provided or omitted, and summarize the decision-making process ~~-~~
- (4) Identify where operational and administrative controls are assumed to be in place to mitigate the need for fire protection features ~~-~~

4.5.4*

All assumptions shall be clearly identified and documented in the FPDBD.

A.4.5.4

During ~~the~~ various stages of the design development and ~~the FPDBD development-of the DBD~~, assumptions ~~will-might~~ be made when inadequate or insufficient information is available.

Commented [ECG47]: TG1 - Agree

4.5.5

As additional information becomes available, assumptions in the FPDBD shall be updated or replaced with the actual design information.

Commented [ECG48]: TG1 - Agree with revision

4.5.6

~~The DBD shall be revised as necessary to reflect the more definitive information.~~

Commented [ECG49]: TG1 - Updated "amended" to "revised" for consistency.

TG1 - Recommend review wording and descriptive context for clarity during 2nd draft.

Commented [ECG50]: TG1 - Moved A.4.5.6 to A.4.5.1

Commented [KS51]: SL: This seems repetitive of the subpara above.



Public Input No. 48-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 5]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter5_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 5 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 5 Fire Risk Control Program

5.1 General.

5.1.1

This chapter ~~provides recommended~~ shall provide the development criteria for ~~the development of a~~ fire risk control program ~~that contains containing~~ administrative procedures and controls necessary for the execution of the fire prevention and fire protection activities and practices for electric generating plants and ~~high-high~~ voltage direct current converter stations.

5.1.2

The fire risk control program ~~recommended in this chapter~~ should shall be reviewed annually and updated ~~periodically~~ when increased fire hazard risks are identified or changed due to modifications in the plant.

5.1.3

The ~~intent requirements~~ of this chapter ~~can shall~~ be met by incorporating the features of this chapter in the plant's operating procedures or ~~otherwise~~ as otherwise determined by plant management.

5.2* Management Policy and Direction.

5.2.1

Corporate management ~~should shall~~ establish a policy and institute a comprehensive fire risk control program to promote the conservation of property, continuity of operations, and protection of safety to life ~~by through~~ adequate fire prevention and fire protection measures at each facility.

A.5.2

Proper preventive maintenance of operating equipment and adequate operator training are critical aspects of an effective fire ~~prevention risk control~~ program. See Annex D for examples of operator errors causing significant property loss.

5.2.2 [move text to A.5.2]

~~Proper preventive maintenance of operating equipment and adequate operator training are critical aspects of an effective fire prevention program. See Annex D for examples of operator errors causing significant property loss.~~

[ALL NEW TEXT FOLLOWING 5.2]

5.3 Fire Prevention Program.

5.3.1

A written plant fire prevention program shall be established ~~that, at a minimum, addresses and includes the following:-~~

5.3.2*

~~The plant fire prevention program, at a minimum, shall include the following:~~

Commented [PH1]: Fire Risk Control program vs Fire prevention program - Diff? consistency

Commented [JAP(62R1)]: Fire Risk Control program is all items in Chapter 5, fire prevention program is one part. TG is OK as written

Commented [PH3]: Subjective term

Commented [JAP(64R3)]: The current language is direct from existing doc and TG is OK as written. Proposed change would be technical change and can be addressed by others as a new PI if they would like.

Commented [KS5]: SL: Combined new sentence with existing.

Commented [JAP(66)]: Correlates with sentence below, and doesn't reuse the title of Chapter 5

Commented [KS7]: SL: Combined.

(1) Fire safety information for all employees and contractors that is readily available and included during orientation training ~~including. This information would include~~, at a minimum, familiarization with fire prevention procedures, plant emergency alarms and procedures, and how to report a fire.

(2) Regularly scheduled and documented plant inspections to be conducted that include provisions for identifying conditions that increase the fire hazard and handling remedial actions to correct these conditions.

(3)* ~~A description of general~~ General housekeeping practices and the control of transient combustibles.

(4) Control of flammable and combustible liquids and gases in accordance with NFPA 30, NFPA 30B, and NFPA 55 and other standards, as applicable.

(5) Combustible dust, as applicable, in accordance with NFPA 652.

(6) Control of ignition sources including smoking, grinding, welding, and cutting in accordance with NFPA 51B

(7) Fire hazards of materials located in the plant or storage areas identified in accordance with NFPA 704 and applicable safety data sheets (SDS).

(8)* Fire prevention surveillance, as applicable.

(9)* ~~A fire~~ Fire reporting process, including a ~~post-post~~ incident investigation report that includes a statement on the corrective action to be taken

A.5.3.2(3)

~~(3) Fire~~ Past fire experience has shown that transient combustibles can be a significant factor during a fire situation, especially during outages.

A.5.3.2(8)

~~(7) Operational~~ Past operational experience has demonstrated that roving operators and other plant personnel have been key factors in detection of fires and unsafe conditions. It is important that they be properly trained to observe and react to incipient fire situations. These should be reported to the control room operator for evaluation to determine what action is to be taken.

A.5.3.2(9)

~~(8)~~ Refer to Annex B for a sample fire report.

5.3.23

A regular housekeeping program shall be established to maintain combustibles and other materials in designated storage areas.

5.4 Fire Protection Program.

5.4.1* Inspection, Testing, and Maintenance (ITM). ~~(IT&M)~~

Commented [PH8]: Subjective.

Commented [JAP(69R8)]: The current language is direct from existing doc and TG is OK as written. Proposed change would be technical change and can be addressed by others as a new PI if they would like.

Commented [PH10]: To include NFPA inspections?? Reference to section 5.4/5.4.1.1 shall include a fire protection program per section 5.4

Commented [JAP(611R10)]: These are plant rounds or oversight / review of plant (not IT&M). IT&M is covered in another section

Commented [JAP(612)]: Being revised into a combined NPFA 660, believe this is the right way to handle until a new document is approved

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Commented [JAP(613)]: Changed from (9) to improve flow

Commented [JAP(614)]: Standard for security services....work group has concerns that this standard should not be a "shall requirement"

Commented [PH15R14]: Committee discussion Spring Meeting?

Commented [PH16]: Annex notes? Not sure how these fit in?

Commented [JAP(617R16)]: Annex notes

Commented [JAP(618)]: Language is task specific (rather than qualified persons)

Commented [KS19]: SL: Seems like these were supposed to be annex material for individual list items? The one for (3) seemed obvious, as did (9), but I wasn't sure about (8)...?

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A fire protection IT&M program shall be established to ensure that periodic ~~inspection, testing, and maintenance~~ ITM is performed in accordance with applicable ~~national fire codes~~ National Fire Codes.

A.5.4.1

All fire protection systems and equipment should be inspected, tested, and maintained in accordance with applicable *National Fire Codes*. (See Table A.5.4.1 for guidance.) Where appropriate standards do not exist, inspection and test procedures outlined in manufacturers documentation or purchase and design specifications should be followed.

Table A.5.4.1 ITM Reference Guide for Fire Equipment ~~Inspection, Testing, and Maintenance~~

Item	~~Applicable NFPA Document No.~~
Supervisory and fire alarm circuits	<u>NFPA 72</u>
Fire detectors	<u>NFPA 72</u>
Manual fire alarms	<u>NFPA 72</u>
Sprinkler ~~water-water~~ flow alarms	<u>NFPA 25</u> , ~~NFPA 72~~
Sprinkler and water spray systems	<u>NFPA 25</u> , ~~NFPA 72~~
Foam systems	<u>NFPA 11</u> , ~~NFPA 16~~ , ~~NFPA 25~~
Halogenated agent, chemical, and CO ₂ systems	<u>NFPA 12</u> , ~~NFPA 12A~~ , ~~NFPA 17~~ , ~~NFPA 2001~~
Fire pumps and booster pumps	<u>NFPA 25</u> , ~~NFPA 72~~
Water tanks and alarms	<u>NFPA 25</u> , ~~NFPA 72~~
<u>Post indicator valves (PIVs)</u> and ~~OS&Y&Y~~ valves	<u>NFPA 25</u> , ~~NFPA 72~~
Fire hydrants and associated valves	<u>NFPA 13</u> , ~~NFPA 24~~
Fire hose and standpipes and hose nozzles	<u>NFPA 25</u> , ~~NFPA 1962~~
Water additives	<u>NFPA 18A</u>
Portable fire extinguishers	<u>NFPA 10</u>
Fire brigade equipment	<u>NFPA 1971</u> , ~~NFPA 1981~~ , ~~NFPA 1982~~

Commented [JAP(620)]: Committee should discuss whether or not this needs to be in place prior to operation

Commented [PH21R20]: PI or Committee discussion?

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Item	Applicable NFPA Document No.
Fire doors and dampers	NFPA 80, NFPA 90A
Smoke vents	NFPA 204
Emergency lighting	NFPA 110
Radio communication equipment	NFPA 1221
Audible and visual signals	NFPA 72
Water mist fire protection systems	NFPA 750

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5.4.1.1

Upon installation, all fire protection systems shall be preoperationally inspected and tested in accordance with the established fire protection IT&M program.

5.4.1.2

Testing, inspection, and maintenance (ITM) shall be documented with written procedures, results, and follow-up corrective actions recorded and tracked for closure.

Commented [JAP(622)]: Should to shall

5.4.2 Impairments.

5.4.2.1 Impairment Procedure

A written procedure shall be established to address impairments to fire protection systems and other plant systems that impact the level of fire hazard (e.g., dust collection systems, HVAC systems).

Commented [JAP(623)]: As a separate PI, we should consider whether shutdown of unit or operation should occur

A.5.4.2.1

Examples of impairments that might impact the level of fire hazard include dust collection systems and HVAC systems. As-At a minimum, this the written procedure should address the following:

Commented [PH24R23]: TG to submit PI

- (1) Identify equipment not available for service
- (2) Identify personnel to be notified (e.g., plant fire brigade leader, public fire department, plant fire protection coordinator, control room operator, insurance representative)
- (3) Increase fire surveillance as needed [see 5.3.1(6)]
- (4) Provide additional protected-protective measures as necessary (e.g., temporary water supplies, additional hose)

Commented [BM25]: Split ...needs to be renumbered

5.4.2.2* Impairment Planning & Restoration.

The written procedure shall include provisions for impairment planning and restoration.

A.5.4.2.2

Impairment Planning

Impairment Planning. Impairment to fire protection systems should be as short in duration as practical. If the impairment is planned, all necessary parts and manpower should be assembled prior to removing the protection system(s) from service. When an impairment is not planned, or when a system has discharged, the repair work or system restoration should be expedited.

~~If the impairment is planned, all necessary parts and manpower should be assembled prior to removing the protection system(s) from service.~~

~~When an impairment is not planned, or when a system has discharged, the repair work or system restoration should be expedited.~~

Restoration

Restoration. Proper restoration after maintenance or repair should be performed to ensure proper systems operation. Once repairs are complete, tests that will ensure proper operation and restoration of full fire protection equipment capabilities should be conducted. Following restoration to service, the parties previously notified of the impairment should be advised. The latest revision of the design documents reflecting as-built conditions should be available to ensure that the system is properly reinstalled (e.g., drawings showing angles of nozzles).

~~Once repairs are complete, tests that will ensure proper operation and restoration of full fire protection equipment capabilities should be made.~~

~~Following restoration to service, the parties previously notified of the impairment should be advised.~~

~~The latest revision of the design documents reflecting as-built conditions should be available to ensure that the system is properly reinstalled (e.g., drawings showing angles of nozzles).~~

Commented [JAP(626)]: Small change in verbiage

5.4.3* Management of Change.

A Management management of Change Program change program shall be implemented that would to ensure that the appropriate individual(s) with fire protection responsibility are-is made aware of new constructions, modifications to existing structures, changes to operating conditions, or-and other actions that could impact the fire protection of the plant.

A.5.4.3

The Fire Protection Design Basis Document FPDBD and the appropriate procedures and programs discussed in this chapter might need to be revised to reflect the impact of this action.

Commented [JAP(627)]: Move to annex, change terminology of DBD to reflect that used throughout

5.4.4 Fire Emergency Plan.

5.4.4.1* **General.**

A written fire emergency plan shall be developed.

A.5.4.4.1

This-The fire emergency plan should include the following:

- (1) Response to fire alarms and fire systems supervisory alarms

- (2) Notification of ~~identified~~ personnel ~~identified in the plan~~
- (3) Evacuation of employees and visitors not directly involved in ~~fire~~ ~~fire~~ fighting activities from the fire area
- (4) Coordination with security forces or other designated personnel to admit public fire department and control traffic and personnel
- (5) Fire preplanning ~~that defines defining~~ fire extinguishment activities and ~~identification of identifying~~ fire water application concerns on operating equipment
- (6) Drills to verify ~~plan~~ ~~viability of the plan~~
- (7) Control room operator(s) and auxiliary operator(s) activities during fire emergencies
- (8) Procedures for grounding, isolating, or discharging of energy sources
- (9) Procedures for maintaining appropriate clearances to high-voltage electrical systems
- (10) Timely communication of all fire events to the responding fire brigade and the fire department

Commented [PH28]: Subjective

Commented [JAP(629R28)]: Removed periodic

Commented [JAP(630)]: Moved to brigade section (as this was imposing training requirements better covered in that area)

5.4.4.2 Unattended or Minimally Staffed Facilities.

5.4.4.2.1*

The DBD and fire emergency plan shall address ~~Power~~ ~~power~~ generating facilities that are operated unattended or with minimal staffing.

A.5.4.4.2.1

Unattended or minimally staffed ~~power~~ ~~power~~ generating facilities have special fire protection concerns due to the delayed response time of the fire brigade or public ~~fire~~ ~~fire~~ fighting personnel (which can be several hours) and ~~to~~ the lack of personnel available to alert others on site to a fire condition.

Commented [JAP(631)]: One sentence in annex

5.4.4.2.2

The fire emergency plan shall include means to familiarize responding fire brigade or public ~~fire~~ ~~fire~~ fighting forces with access, plant fire protection systems, emergency lighting, specific hazards, and methods of fire control.

Commented [JAP(632)]: Circular reference, delete

5.4.5 Emergency Response Personnel.

5.4.5.1*

The size of the plant and its staff, the complexity of ~~fire~~ ~~fire~~ fighting ~~obstacles~~ ~~problems~~, and the availability of a public fire department shall determine the requirements for emergency response personnel or ~~the~~ fire brigade.

Commented [KS33]: SL: The word "problems" is a little vague. What about "obstacles"? Or "challenges" which is used later?

A.5.4.5.1

An emergency response team can ~~be provided to~~ facilitate response to emergencies such as fire. Activities can include incident command, incipient ~~fire~~ ~~fire~~ fighting, escorting fire department personnel, first aid, ~~HazMat~~ ~~First Responder and hazmat first responder~~ duties, ~~and so forth~~.

Commented [BM34]: Move to Annex for 5.4.5.1

5.4.5.2

The emergency response organization and responsibilities shall be clearly identified in a written fire emergency plan.

5.4.5.3*

If a fire brigade is provided, its organization and training shall be identified in written procedures.

A.5.4.5.3

Emergency preplanning for the fire brigade and the fire department should include manual ~~fire-fire~~fighting equipment utilization and deployment training. NFPA 600 and OSHA ~~standard~~ 29 CFR 1910.156, "Fire Brigades," should be consulted for determining operational limitations, among other issues.

Commented [JAP(635)]: Combine with annex material above

5.4.6* Unique Hazards and Special Firefighting-Fighting Challenges.

Electric generating plants with unique hazards and special ~~fire-fire~~fighting challenges shall provide special response information, considerations, and training to any operations and fire emergency personnel expected to respond.

A.5.4.6

Examples ~~are of firefighting challenges include~~ fires involving turbine lubricating oil, regenerative air heaters, scrubbers, electrostatic precipitators, cable trays, hydrogen systems, fuel storage and handling areas, coal pulverizers, ~~or~~ tunnels, ~~or as well as~~ any other unique hazards or special ~~fire-fire~~fighting conditions known or identified in the DBD.

~~Turbine Lubricating Oil Fires.~~

~~Turbine Lubricating Oil Fires.~~ A critical aspect of responding to turbine lubricating oil fires is minimizing the size and duration of the oil spill. The need for lubrication to protect the turbine-generator bearings and shaft should be balanced against the fire damage from allowing the oil leak to continue. The following steps can be useful in minimizing fire damage and should be considered during preplanning and training for emergency conditions:

- (1) Tripping the turbine
- (2) Breaking ~~the~~ condenser vacuum
- (3) Emergency purging of the generator
- (4) Shutting down main and backup oil pumps

Shutting down oil pumps can cause additional mechanical damage to the turbine, depending on rotating speed. However, it can be effective in mitigating the overall damage due to fire. (See Annex D.) When ac oil pumps are shut down, dc or backup pumps will start on low pressure. The dc or backup oil pumps will also have to be secured, which usually requires more than operating a switch.

~~Regenerative Air Heaters.~~

~~Regenerative Air Heater Fires.~~ Since laboratory tests and reported incidents indicated a rapid increase in temperature to the 2800°F ~~to~~ 3000°F (1537°C ~~to~~ 1648°C) range in an air preheater fire, great care should be ~~given to taken during~~ manual ~~fire-fire~~fighting. Large amounts of water will be needed to cool and extinguish a preheater fire. Fire preplanning should be accomplished to ensure ~~use of~~ an adequate number of access doors and safe ~~access passage~~ to the doors.

Commented [KS36]: SL: So "passage" isn't my ideal term, but I'm just trying to remove the repetition of "access" here...

Scrubbers—

Fire Protection—

Scrubbers. A fire protection system should be provided during outages for absorber vessels containing combustible packing or lining, ~~and should include the following:~~ The fire protection system can be the spray system designed for normal scrubber operation or a specially designed fire protection system. Water spray systems should be designed such that spray patterns cover the lining and packing. Where scrubber spray systems are used for fire protection, system components internal to the scrubber should be noncombustible. The water supply should be from a reliable source available during the outage.

A fire protection system should be provided in the duct systems during maintenance operations. A fixed protection duct system on the scaffolding is recommended. The duct system should be designed to protect the work platform and twice the area that can be reached by workers on the platform.

Due to the unique design and operating features of scrubbers, fire protection designers should consult the scrubber manufacturer for guidance as to material selection for internal fire protection systems and specific protection design features.

Standpipes should be provided such that 1½ in. (3.8 cm) hose is available at scrubber access hatches that are open during outages.

The introduction of combustible materials into the scrubber should be limited and controlled during maintenance and inspection outages.

~~(1) The fire protection system can be the spray system designed for normal scrubber operation or a specially designed fire protection system. Water spray systems should be designed such that spray patterns cover the lining and packing. Where scrubber spray systems are used for fire protection, system components internal to the scrubber should be noncombustible. The water supply should be from a reliable source available during the outage.~~

~~(2) A fire protection system should be provided in the duct systems during maintenance operations. A fixed protection duct system on the scaffolding is recommended. The duct system should be designed to protect the work platform and twice the area that can be reached by workers on the platform.~~

~~(3) Due to the unique design and operating features of scrubbers, fire protection designers should consult with the scrubber manufacturer for guidance as to material selection for internal fire protection systems and specific protection design features.~~

~~(4) Standpipes should be provided such that 1½ in. (3.8 cm) hose is available at scrubber access hatches that are open during outages.~~

~~(5) The introduction of combustible materials into the scrubber should be limited and controlled during maintenance and inspection outages.~~

During outages, ~~all of~~ the following should be done:

(1) ~~Cutting, welding, and other hot work is the most likely cause of ignition. (See also NFPA 51B.)~~ At a minimum, strict work controls should be enforced ~~since cutting, welding, and other hot work are the most likely causes of ignition. (See also NFPA 51B.)~~ Packing should be covered with fire-resistant blankets over sheet metal. Blankets should be kept wet. A charged hose and fire watch should be provided at the work area.

Commented [KS37]: SL: I don't see a reason for list structure here. The lead-in doesn't work with each item linearly as it was written. I think paragraphs works fine. Please reorganize/combine/break up as desired.

Commented [PH38]: Design professional or competent person

Commented [JAP(639R38)]: Not needed here (just telling you how to design nozzles)

Commented [PH40]: Same as above

Commented [JAP(641R40)]: This section is pushing the design to talk to scrubber mfg about incompatible materials, not sure it really matters who makes that call, TG wants to leave as is

Commented [PH42]: Design professional or competent person

Commented [JAP(643R42)]: Not needed here (just telling you how to design nozzles)

Commented [PH44]: Same as above

Commented [JAP(645R44)]: This section is pushing the design to talk to scrubber mfg about incompatible materials, not sure it really matters who makes that call, TG wants to leave as is

(2) The scrubber reservoir should be maintained full, if possible, or returned to service as quickly as possible during an outage.

(3) The absorber inlet and outlet damper should be closed during cutting, welding, or other hot work to reduce the induced draft. When the scrubber outlet damper is open, no hot work should be permitted in the downstream duct or stack.

Electrostatic Precipitators.

Electrostatic Precipitators. Once a fire is detected, the unit should go into emergency shutdown immediately. ~~It should be recognized.~~ Note that during operation, the atmosphere in the precipitator is oxygen-deficient and opening doors or running system fans following a fuel trip could cause conditions to worsen (i.e., increased potential for backdraft explosion). Once the flow of air and fuel to the fire has been stopped and the electrostatic precipitator has been shut down and de-energized, the precipitator doors can be permitted to be opened and water hoses employed if necessary.

Cable Trays.

Cable Trays. Cable tray fires should be handled like any fire involving energized electrical equipment. It might not be practical or desirable to de-energize the cables involved in the fire. Water is the most effective extinguishing agent for cable insulation fires but should be applied with an electrically safe nozzle. Some cables [polyvinyl chloride (PVC), neoprene, or Hypalon] can produce dense smoke in a very short time. In addition, PVC liberates hydrogen chloride (HCl) gas. Self-contained breathing apparatus should be used by personnel attempting to extinguish cable tray fires.

Hydrogen System.

Hydrogen Systems. Hydrogen has a relatively large flammability range (4 to 75 percent by volume) in air. The explosive range (for deflagrations and detonations) is narrower than the flammability range, but hydrogen explosions can occur inside turbine halls in the event of accidental release and delayed ignition. Under most conditions, it is safer to allow a hydrogen fire to burn in a controlled manner until ~~such time as~~ the gas source can be shut off. Extinguishing the fire while gas is still escaping could allow an explosive mixture to be generated. The ~~Fire Protection Design Basis Document (FPDBD)~~ should include provisions so that hydrogen supplies can be shut off from a readily accessible location outside the fire area if called for in an emergency situation.

Fuel Storage and Handling.

Fuel Storage and Handling. Once the location and extent of a fire in a solid-fuel storage pile have been determined, the fuel should be dug out and the heated fuel removed. Because moisture accelerates oxidation, water used for ~~fire~~-firefighting can aggravate the situation if the seat of the fire is not reached. Water additives should be considered, to break the water tension and improve penetration.

Clearly marked access panels in equipment should be provided for manual ~~fire~~-firefighting. Combustible dust presents both a fire and explosion hazard. Combustible, finely divided material is easily ignited. However, there is a possibility that a deep-seated hard-to-extinguish fire can occur. Application of an extinguishing agent that disturbs dust deposits could result in a dust explosion.

The facility personnel should ensure that fuel is continuously moved to the processing or storage areas. Vehicles loaded with fuel materials should not be parked in the building during idle periods.

Coal Pulverizers.

Coal Pulverizers.~~(See 9.5.4 of NFPA 85.)~~ Additional information can be obtained from published manufacturer's instructions. See also 9.5.4 of NFPA 85.

Commented [BM46]: Move 5.4.6.1 through 5.4.6.8 to Annex Material for 5.4.6.

Commented [JAP(647)]: Covered under item (7) in fire prevention plan



Public Input No. 49-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 6]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter6_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 6 based on work by Task Group 1 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 6 General Plant Design

6.1 Plant Arrangement.

A.6.1* ~~General Substation Arrangement.~~

The following documents should be considered for the arrangement and protection of substations and switchyards:

- (1) IEEE 979, *Guide for Substation Fire Protection*
- (2) IEEE 980, *Guide for Containment and Control of Oil Spills in Substations*

6.1.1 Fire Area Determination.

6.1.1.1

The electric generating plant and ~~the high-high~~ voltage direct current converter station shall be subdivided into separate fire areas as determined by the ~~Fire Protection Design Basis Document~~ FPDBD for the purposes of limiting ~~the~~ spread of fire, protecting personnel, and limiting ~~the~~ resultant consequential damage to the plant.

6.1.1.2*

The ~~Fire Protection Design Basis Document~~ FPDBD shall provide a determination of fire area boundaries based on ~~consideration of~~ the following:

- (1) Types, quantity, density, and locations of combustible material
- (2) Location and configuration of plant equipment
- (3) Consequence(s) of losing plant equipment
- (4) Location of fire detection and suppression systems

A.6.1.1.2*

Unless ~~consideration of~~ the factors of 6.1.1.2 ~~indicates-indicate~~ otherwise or if adequate spatial separation is provided as permitted in 6.1.1.5, ~~it is recommended that~~ fire area boundaries should 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 (e.g., such as a switchgear room, 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, combustion turbines, and other internal combustion engines 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 from beneath the underside of the operating floor

(16) ~~Between the~~ The boiler house ~~and from~~ the areas of the fuel 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 6.4*)]

(18) Switchgear area and sulfur hexafluoride (SF₆) switchyard area from adjacent areas

Where the control room and computer room are separated by a common wall, a fire resistance rating is not required.

~~Consideration should be given to Layout of~~ equipment ~~layout~~ that is adjacent to and in line with the planes of turbine and compressor disks or other rotating equipment that have a higher potential for damage from flying debris should be considered.

6.1.1.3

Where required by the FPDBD, fire areas shall be separated from each other by fire barriers, spatial separation, or other approved means.

6.1.1.4

Where provided, fire barriers separating fire areas shall be a minimum of 2-hour fire resistance rating.

Commented [JP1]: Potential change may be needed for offshore wind (Eric Oliver - WSP)

6.1.1.5 Outdoor Areas and Vegetation.

6.1.1.5.1

~~If Where~~ a fire area is defined as a detached structure, it shall be separated from other structures by ~~an appropriate a~~ distance ~~as~~ determined by NFPA 80A evaluation ~~and/or the~~ FPDBD.

Commented [JP2]: Do we need an NFPA 80A evaluation for any building, or can the DBD screen those that have little to no risk?

6.1.1.5.2

The FPDBD shall address spatial separation, control of vegetation, and protection from wildland fires.

A.6.1.1.5.2

Guidance regarding vegetation clearance, separation distance, and emergency planning can be found in NFPA 1143 and NFPA 1144.

6.1.2 Openings in Fire Barriers.

6.1.2.1*

All openings in fire barriers shall be provided with fire door assemblies, fire dampers, ~~through-through-~~penetration seals (fire stops), or other approved means having a fire protection rating consistent with the designated fire resistance rating of the barrier.

A.6.1.2.1

Listed penetration seals for large diameter piping might not be commercially available. In such instances, the design should be ~~similar-equivalent~~ to listed configurations.

Listed penetration seals for the internals of nonsegregated phase bus ducts and isolated phase bus ducts can be excluded.

6.1.2.2*

Windows in fire barriers (~~e.g., control rooms or computer rooms~~) shall be listed, and provided with a fire shutter or automatic water curtain.

A.6.1.2.2

Control room or computer room walls are examples of fire barriers that might have windows.

6.1.2.3*

~~Through-Through~~-penetration fire stops for electrical and piping openings shall be listed or meet the requirements for an “F” rating when tested in accordance with ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*.

A.6.1.2.3

Other test methods for qualifications of penetration seals, such as IEEE 634, *Standard for Cable-Penetration Fire Stop Qualification Test*, or UL 1479, *Standard for Fire Tests of Through-Penetration Firestops*, are permitted to be considered for this application.

6.1.2.4

Fire door assemblies, fire dampers, and fire shutters used in 2-hour-~~rated-rated~~ fire barriers shall be listed and approved for a minimum ~~1½-1½~~-hour fire rating. (See NFPA 80.)

A.6.1.2.4

See NFPA 80 for further guidance

6.1.3 Hydrogen Storage.

Hydrogen storage facilities shall be separated from adjacent areas. (See NFPA 2.)

A.6.1.3

See NFPA 2 for further guidance.

Commented [BM3]: Annex to 6.1.1.3

Commented [JP4R3]: Requirement for veg management stays in body, references have been moved to Annex

Commented [JP5]: Fire rated windows should not need the shutter or water curtain, this will need to be a separate PI

Commented [BM6]: Annex for 6.1.2.3

Commented [JP7R6]: Agree

Commented [JP8]: See comment above around 2 hour barriers....this may need to change as well

6.1.4 Outdoor Oil-Insulated Transformers.

6.1.4.1

Outdoor oil-insulated transformers shall be separated from adjacent structures and from each other by firewalls, spatial separation, or other approved means for the purposes of limiting the damage and potential spread of fire from a transformer failure.

6.1.4.2

~~Determination of the~~The type of physical separation to be used between transformers, control equipment, and building structures shall be ~~based on an~~ determined by an analysis documented in the FPDBD.

A.6.1.4.2

The ~~Fire Protection Design Basis Document~~ FPDBD should consider the following:

- (1) Type and quantity of oil in the transformer
- (2) Size of a postulated oil spill (topography, 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, and other transformers, ~~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 (e.g., long lead times)
- (9)* The existence of fast depressurization systems

~~A.6.1.4.2(9)~~ Oil-filled transformer explosions 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. An example is provided in D.2.14. This fast depressurization can be achieved by a quick oil evacuation triggered by the transient 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, because 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. The systems can include outflow devices that are located directly on the high-risk areas of the bushing turrets and oil-bushing cable boxes.

6.1.4.3*

Oil-insulated transformers, including the edge of the postulated oil spill, shall be separated from adjacent structures by a 2-hour-rated firewall or by spatial separation in accordance with Table 6.1.4.3 unless the FPDBD analysis in 6.1.4.2 indicates otherwise.

Commented [PH9]: First us in the annex

Commented [KS10]: SL: Can't have annex material for annex material.

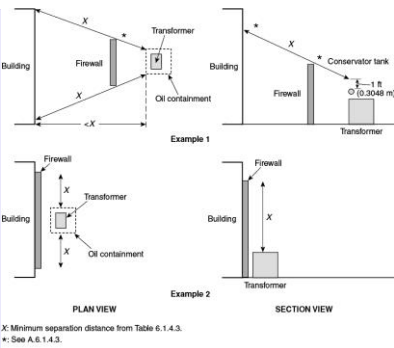
Table 6.1.4.3 Outdoor Oil-Insulated Transformer Separation Criteria

Transformer Oil Capacity		Minimum (Line-of-Sight) Separation Without Firewall	
		ft	m
gal	L		
<500	<1893	5	1.5
500–5000	1893–18,925	25	7.6
>5000	>18,925	50	15

6.1.4.3.1*

Where a firewall is provided between structures and a transformer, it shall extend vertically and horizontally and extend at least 1 ft (0.31 m) above the top of the transformer casing and oil conservator tank and at least the width of the transformer oil containment as indicated in Figure 6.1.4.3.1.

Figure 6.1.4.3.1 Illustration of Oil-Insulated Transformer Separation ~~Recommendations~~.



6.1.4.3.2

~~At a minimum, the firewall shall extend at least 1 ft (0.31 m) above the top of the transformer casing and oil conservator tank and at least the width of the transformer oil containment.~~

A.6.1.4.3.12

If columns supporting the turbine building roof at the exterior wall have a 2-hour fire-resistance rating above the operating floor, the firewall need not be higher than required to obtain line-of-sight protection to the height of the operating floor.

6.1.4.4

Adjacent oil-insulated transformers containing 500 gal (1893 L) or more of oil shall be separated from each other by a ~~2-hour-rated~~ ~~hour-rated~~ firewall or by spatial separation in accordance with Table 6.1.4.3 unless the FPDBD analysis in 6.1.4.2 indicates otherwise.

Commented [KS11]: SL: This should be the same measurement shown in the figure.

Commented [BM12]: Split ...needs to be renumbered

Commented [JAP(613)]: Fix reference for asterisk

Commented [JAP(614)]: Simplified to 6.1.4.5 below

6.1.4.5

Outdoor containment areas containing more than one oil-filled transformer shall be provided with means to prevent oil from one transformer migrating to another [\(see 6.5.6\)](#).

A.6.1.4.5

~~Section 6.5.6 can be used for guidance.~~

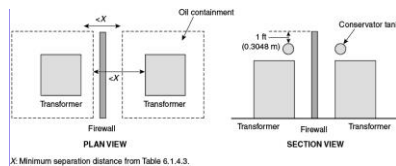
6.1.4.6

Where a firewall is provided between transformers, it shall 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, [as indicated in Figure 6.1.4.6](#) unless the FPDBD analysis in 6.1.4.2 indicates otherwise.

A.6.1.4.6

See Figure 6.1.4.6

Figure 6.1.4.4 Outdoor Oil-Insulated Transformer Separation Criteria.



Commented [KS15]: SL: If this contains the mandatory requirements from 6.1.4.6, it should appear in the mandatory text. Also the measurements in-text should match those in the figure.

Commented [JAP(616)]: Renumber figure

6.1.4.7*

Where ~~a firewall is provided~~, ~~it firewalls~~ shall be designed to withstand the effects of projectiles from exploding transformer bushings or lightning arresters.

A.6.1.4.7

A noncombustible shield extending above the firewall can be provided to protect against the effects of an exploding transformer bushing.

6.1.4.8

~~Outdoor~~ Outdoor transformers insulated with a less flammable liquid shall be separated from each other and from adjacent structures that are critical to power generation by firewalls or spatial separation based on ~~consideration of~~ the factors [provided](#) in 6.1.4.2 and 6.1.4.7.

6.1.5* Indoor Transformers and Other Oil-Filled Electrical Equipment.

A.6.1.5

This [sub](#)section addresses all types of transformers and ~~oil~~ oil-filled electrical equipment installed indoors.

Dry-type transformers and other non-oil-filled electrical equipment are preferred for indoor installations. Dry-type capacitors or capacitors filled with a less flammable liquid should be considered to minimize the fire risk associated with oil-filled equipment.

Commented [JAP(618)]: Removed, this section applies to oil filled and non oil filled transformers

Commented [BM19]: Annex material for 6.1.5

6.1.5.1*

Where required by the FPDBD, ~~Oil~~oil-insulated transformers or other oil-filled electrical equipment of greater than 100 gal (379 L) oil capacity installed indoors shall be separated from adjacent areas by fire barriers of 3-hour fire resistance rating.

A.6.1.5.2

Where multiple transformers of less than 100 gal (379 L) capacity each are located within close proximity, additional fire protection can be required ~~based on~~by the FPDBD.

For wind turbines, transformers are used to step-up the electrical power generated by the generator in the nacelle. These transformers can be located in the nacelle, in the tower, or on pads near the base of the tower. The plant design should include features that address the exposures posed by such transformers and, if the transformers are not dry type or filled with a listed less flammable fluid insulating oil, should ~~take into account~~consider transformer location; containment of oil; spacing from other objects, including the tower; and the use of barriers and fixed protection. The same principles should be applied to the step-up transformers used to connect a wind farm to the grid. The step-up transformer installations should reflect a proper evaluation of the exposure created with respect to other transformers as well as wind farm support structures. Appropriate physical separation should be observed, or barrier walls should be erected, where necessary, to control such exposures.

6.1.5.2

Where required by the FPDBD, ~~Transformers~~transformers having a rating greater than 35 kV, insulated with a less flammable liquid or nonflammable fluid, and installed indoors shall be separated from adjacent areas by fire barriers ~~of with a~~ 3-hour fire resistance rating.

6.1.5.3

Where transformers or other oil-filled electrical equipment are protected by an automatic fire suppression system, the fire barrier fire resistance rating shall be permitted to be reduced to 1 hour.

6.1.5.4

Where required by the FPDBD, ~~Automatic~~automatic sprinkler, foam-water spray, water spray, or compressed air foam systems shall be provided for oil-filled electrical equipment.

A.6.1.5.4

Where the hazard is not great enough, according to the hazard analysis in the FPDBD, to warrant a fixed fire suppression system, automatic fire detection should be considered (see 7.7.2).

6.2 Life Safety.

A.6.2

For life safety considerations for electric generating plants included in the scope of this document, see NFPA 101.

6.2.1*

Structures shall be classified as defined in NFPA 101, as follows, ~~as defined in NFPA 101~~:

Commented [JAP(620)]: Is the intent that this reduction can apply to 6.5.1.1 (oil insulated >100 gallons) and 6.5.1.2 (less flammable / non flammable >35kv)? Need some help from those on committee when this was written

(1) General areas shall be considered ~~as~~ special-purpose industrial occupancies.

(2)* Open structures and underground structures (~~e.g., tunnels~~) shall be considered ~~as~~ occupancies in special structures.

A.6.2.1(2)

An example of an underground structure is a tunnel.

(3) Temporary occupancies and means of egress inside the structures and piers of large “bulb” hydroelectric units shall be considered occupancies in special structures.

(4) General office structures shall be considered ~~as~~ business occupancies.

(5) Warehouses shall be considered ~~as~~ storage occupancies.

(6)* Fuel preparation and handling facilities (~~e.g., enclosed crusher houses, transfer houses, and conveyors~~) shall be considered special-purpose industrial occupancies.

A.6.2.1(6)

Examples of fuel preparation and handling facilities include enclosed crusher houses, transfer houses, and conveyors.

(7) Scrubber buildings shall be considered as special-purpose industrial occupancies.

A.6.2.1

It ~~generally~~ is recognized that boiler and turbine buildings, protected in accordance with this standard document, meet the intent of NFPA 101 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-Entries~~ into draft tubes
- (5) Penstocks

6.2.2*

Control facilities shall have a means of egress that is separated from other plant areas to facilitate a delayed egress.

A.6.2.2

In the event of a plant fire, egress of occupants in control facilities can be delayed due to emergency shutdown procedures. (See 40.2.5.1.2 of NFPA 101.)

Commented [BM21]: Annex material for this section

6.2.34

Evacuation plans and emergency plans shall ~~take into consideration~~ consider the increased occupancy load in areas during major plant maintenance and outage periods.

Commented [JP22]: May need a separate PI...why are we limiting this to period of fire / explosion or other condition?

6.3 Building Construction Materials.

6.3.1*

Construction materials being considered for electric generating plants and high-voltage direct current converter stations shall be selected based on the ~~FPDBD-Fire Protection Design Basis Document~~.

A.6.3.1

The following standards should also be considered ~~during selection of construction materials~~ consideration of the following standards:

- (1) NFPA 220
- (2) ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Standard Test Methods for Fire Tests of Building Construction and Materials*
- (3) NFPA 253
- (4) NFPA 259
- (5) ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*

6.3.2

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

- (1) Roof coverings as outlined in 6.3.3

(2)* Limited use of material, as allowed by the FPDBD, that does not meet the definition of *noncombustible* or *limited combustible* ~~as allowed by the Fire Protection Design Basis Document~~

A.6.3.2(2)

The use of material that does not meet the definition of *noncombustible* or *limited combustible*, such as translucent reinforced plastic panels, is permitted in limited applications ~~provided if the FPDBD Fire Protection Design Basis Document and~~ or an equivalent fire risk evaluation demonstrates that the material is acceptable.

6.3.3

Roof coverings shall be Class A in accordance with ASTM E108, *Standard Test Methods for Fire Tests of Roof Coverings*, or UL 790, *Tests for Fire Resistance of Roof Covering Materials*.

6.3.4

Metal roof deck construction, where used, shall be “Class I” or “fire classified.”

6.3.5 Interior Finish.

6.3.5.1

Cellular or foamed plastic materials ~~(as defined in NFPA 101)~~ shall not be used as interior finish.

6.3.5.2

Interior finish in buildings critical to power generation or conversion shall be Class A.

6.3.5.3

Interior finish in buildings not critical to power generation or conversion shall be Class A or Class B.

6.4 Smoke and Heat Venting, Heating, Ventilating, and Air Conditioning.

6.4.1* Smoke and Heat Venting.

6.4.1.1 General.

6.4.1.1.1*

Smoke and heat vents shall not be used to assist normal ventilation systems unless designed for dual usage.

A.6.4.1.1.1

Smoke and heat vents should not be normally left open unless they are designed for high wind conditions.

6.4.1.1.2

Smoke and heat vents shall be included in established fire protection ~~IT&M-ITM programs~~ to ensure availability in emergency situations.

6.4.1.1.3*

Commented [JP23]: May need duplicative....LaTanya will confirm

Commented [JP24]: Utilizes same IT&M language from Chapter 5

Where required by the FPDBD, ventilation exhaust systems, shall have fans ~~able to operate~~ capable of operating continually to exhaust smoke and chemical fumes that can result from fires or ~~from the~~ extinguishing of fires.

A.6.4.1.1.3

Continuous operation of fans is particularly important in the subsurface portion of underground facilities.

6.4.1.1.3.1

The design and selection of ~~the~~ fans and other elements of the, ventilation exhaust system shall ~~take into account~~ consider additional ventilation needs for removing smoke and high-temperature gases.

6.4.1.1.3.2

The fan and its associated components, along with any ductwork, shall be capable of handling high temperatures without deforming.

6.4.1.1.3.3

Total fan capacity shall be provided ~~so such~~ that ventilation requirements ~~can be are~~ met ~~with if~~ the largest fan is out of service.

6.4.1.1.3.4

~~The fan and its associated components shall be capable of handling the~~ specific weight and volume of the heated air during a fire and the climatic conditions ~~shall also be considered~~.

6.4.1.2 Heat Vents.

6.4.1.2.1

Where required by the FPDBD, heat vents shall be provided.

6.4.1.2.2

Where heat vents are provided, heat generated under fire conditions shall be vented from its place of origin directly to the outdoors.

A.6.4.1.2.1

Heat vents in the boiler and turbine building are permitted to be provided ~~through the use of~~ using automatic heat vents or windows at the roof eave line. Heat venting in areas of high combustible loading can reduce damage to structural components. (See NFPA 204.)

6.4.1.3 Smoke Vents.

6.4.1.3.1

Where required by the FPDBD, smoke vents shall be provided.

A.6.4.1.3.1

~~Consideration should be given to smoke~~ Smoke venting for the ~~following areas:~~ control room, cable spreading room(s), switchgear room, and sensitive electronic equipment rooms should be considered.

Commented [PH25]: Standard defined High temp?

Commented [PH26]: Not sure what considered is as a requirement?

Commented [KS27]: SL: Language to turn this into a requirements?

Commented [BM28]: Split ... needs to be renumbered.

Commented [BM29]: Move to annex for 6.4.1.2.1 first requirement.

Commented [BM30]: Move to annex for 6.4.1.3.1 first requirement

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, NFPA 92, and NFPA 204.)

Where a separate smoke management system is provided, it should be designed for areas that could be damaged indirectly in the event of a fire through either of the following two scenarios:

- (1) Exposure to smoke from a fire originating within the rooms themselves
- (2) Exposure to smoke in one room from a fire originating in the other room

A smoke management system (i.e., ventilation) should be designed to minimize the penetration of smoke into electrical equipment.

6.4.1.3.1.1

Where smoke venting is provided, smoke shall be vented from its place of origin in a manner that does not interfere with the operation of the plant.

A.6.4.1.3.1.1

Smoke venting also is permitted to be accomplished ~~through the use of~~ using portable smoke ejectors. A smoke management system should be ~~utilized~~ used to mitigate the effects of smoke and heat during the early stages of a fire.

6.4.1.3.1.2

In ~~the~~ areas with gaseous fire extinguishing systems, the smoke ventilation system shall be properly interlocked to ensure the operation of the gaseous fire extinguishing system.

6.4.1.3.1.3

Smoke removal system dampers, where installed, shall be normally operable only from an area immediately outside of, or immediately within the fire area served.

A.6.4.1.3.1.3

It is ~~desired~~ desirable to have entry into, and inspection of, the fire area by ~~fire~~ fire fighting personnel prior to restoring mechanical ventilation to the fire area. Smoke removal system dampers are permitted to be operable from the control room if provisions are made to prevent premature operation, which can be accomplished using thermal interlocks or administrative controls.

6.4.1.3.1.4

The fan power supply wiring and controls for smoke exhaust shall either be located external to the fire area served by the fan or be installed in accordance with the FPD BD.

6.4.2 Normal Heating, Ventilating, and Air-Conditioning Systems.

6.4.2.1

Normal heating, ventilating, and air-conditioning systems shall ~~meet~~ comply with NFPA 90A or NFPA 90B, as appropriate.

6.4.2.1.1

Commented [BM31]: Split ... needs to be renumbered.

Commented [BM32]: Move to annex for 6.4.1.3.1 first requirement.

Commented [BM33]: Move to annex material for 6.4.1.3.1 first requirement.

Air conditioning for the control room shall provide a pressurized environment to preclude the entry of smoke in the event of a fire outside the control room.

6.4.2.1.2*

Plastic ducts, including listed fire-retardant types, shall not be used for ventilating systems.

A.6.4.2.2

Listed plastic fire-retardant ducts with appropriate fire protection are permitted to be used in areas with corrosive atmospheres.

6.4.2.1.3

The fresh air supply intakes to all areas shall either be located ~~so as to~~ minimize the possibility of drawing products of combustion into the plant, or be provided with automatic shutdown or closure on detection of smoke.

Commented [PH34]: Subjective term

6.4.2.1.4

~~Separation Systems shall be separated~~ from exhaust air outlets, smoke vents from other areas, and outdoor fire hazards ~~shall all be considered.~~

Commented [PH35]: Requirement or guidance?

6.4.2.1.5

For unattended or hydroelectric generating stations, manual override shall be located at the entry to the plant so that emergency responders can activate these controls upon arrival.

6.4.2.1.6*

Fire hazards shall 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.~~

Commented [PH36]: Better wording?

A.6.4.2.1.6

Fire hazards located in principal access or air supply can cause loss of fresh air in the event of a fire. Examples of such locations include conduits, shafts and tunnels.

6.4.2.2

Fire dampers (i.e., doors) compatible with the rating of the barrier shall be provided at the duct penetrations in accordance with NFPA 90A to the fire area unless the duct is protected throughout its length by a fire barrier equal to the rating required of the fire barrier(s) penetrated.

6.4.2.3

~~Smoke dampers, where~~ Where installed, smoke dampers shall be installed in accordance with NFPA 90A.

6.5 Containment and Drainage.

6.5.1*

Where containment and/or drainage is required by the FPDBD, the ~~following minimum provisions requirements provided in 6.5.1.1 through 6.5.1.4~~ shall be ~~made met~~ in all fire areas of the plant for

removal of liquids directly to safe areas or for containment in the fire area without flooding of equipment ~~and without or~~ endangering other areas.

Commented [JP37]: This information is not just in the Annex (body of document as well)

A.6.5.1

NFPA 15 provides additional guidance for drainage and containment.

Additional precautions should be taken for ~~below below~~grade areas to prevent damage of equipment due to water buildup.

Commented [BM38]: Split...needs to be numbered.

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 suction 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.

6.5.1.1

Drainage and prevention of equipment flooding shall be accomplished by one or more of the following:

- (1) Floor drains
- (2) Floor trenches
- (3) Open doorways or other wall openings
- (4) Curbs for containing or directing drainage
- (5) Slopes for directing drainage
- (5) Equipment pedestals
- (6) Pits, sumps, and sump pumps
- (7) Porous ground surfaces such as stone or soil
- (8) Other means as approved by the ~~authority having jurisdiction-AHJ~~

Commented [JP39]: Separate PI

A.6.5.1.1

A means to direct leaking flammable fluid away from important equipment and structures should be provided. ~~Sloping the ground to channel leaking fluid to safe areas and curbs to prevent flow toward equipment are some methods that can be used.~~

Commented [HT41]: Consider moving to annex material

Commented [BM42]: Remove unnecessary wording

6.5.1.2*

The provisions for containment and/or drainage shall be sized to accommodate all of the following for fire protection:

Commented [KS43]: SL: This is included in the list above; don't need to repeat here.

- (1) The spill of the largest single container of any flammable or combustible liquids in the area
- (2) The maximum expected number of fire hose operating for a minimum of 10 minutes
- (3) The maximum design discharge of fixed fire suppression systems operating for a minimum of 10 minutes

A.6.5.1.2

Design discharge for the turbine building should be based on the expected time necessary to take the turbine ~~off-off~~line and put it on turning gear, but should not be 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.

6.5.1.3 Water Discharge.

6.5.1.3.1

The drainage system shall be sized to handle the ~~larger~~-water discharge requirements of either the fire protection system or the ~~wash-wash~~-down system, whichever is larger.??

6.5.1.3.2

If the maximum water introduced by the wash-down system- exceeds the drainage required for fire protection, ~~it-the wash-down system~~ shall govern the sizing of the drainage system.

6.5.1.4

An emergency power supply shall be provided for principal drainage pumps in areas where flooding would be ~~hazardous-dangerous~~.

6.5.2*

The drainage system for continuous fuel oil-fired boilers shall consist of curbs, gutters, steel plating, sheet metal drip pans, or other means that are arranged to confine the area of potential fuel oil discharge.

A.6.5.2

~~Consideration also should be given to providing~~ Providing the same measures for any boilers using oil for ignition should be considered.

Walking surfaces in the vicinity of burners should be made impervious to oil leakage by ~~the use of using~~ checkered steel plate, sheet metal drip pans, or other means. Curbs in passageways should have ramps or steps or be otherwise constructed to present no obstacle to foot traffic. Gutter outlet pipes and all other drains should be trapped to prevent the passage of flames and permit the flow of oil.

A clearance between the boiler front and the walk structure is required for the differential movement where the heated boiler elongates. This clearance space in the vicinity of the burners should be flashed and counter-flashed with sheet metal or otherwise arranged to allow movement and to redirect dripping oil, which can impinge on the boiler face.

6.5.3

Floor drainage from areas containing flammable or combustible liquids shall be trapped to prevent the spread of burning liquids beyond the fire area.

6.5.4

Commented [PH44]: Subjective - DBD determined impact ?

Commented [BM45]: Annex material

Commented [JAP(646R45)]: Agree

Where gaseous fire suppression systems are installed, either floor drains shall be provided with adequate seals, or the fire suppression system shall be sized to compensate for the loss of fire suppression agent through the drains.

6.5.5*

~~Drainage facilities shall be provided for outdoor~~ Outdoor oil-insulated transformers, shall comply with one of the following:

~~(1) Drainage facilities shall be provided.~~

~~(2) The~~ The ground shall be sloped such that oil spills will flow away from buildings, structures, and adjacent transformers.

A.6.5.5

Unless drainage from oil spills is accommodated by sloping the ground around transformers away from structures or adjacent equipment, ~~consideration should be given to~~ providing curbed areas or pits around transformers should be considered. The pit, ~~or~~ drain system, or both should be sized in accordance with 6.5.1.1. If a layer of uniformly graded stone is provided in the bottom of the curbed area or pit as a means of minimizing ground fires, the following should be addressed:

- (1) Sizing of the pit should allow for the volume of the stone, keeping the highest level of oil below the top of the stone.
- (2) The design should address the possible accumulation of sediment or fines in the stone.
- (3) Overflow of the containment pit and/or curbing should be considered in reviewing drainage pathways away from critical structures. Common containment pits for multiple transformers should be avoided.

Rock-Filled Pits.

Rock-Filled Pits. Where rock-filled pits are used, the rock should periodically be loosened and turned as necessary to prevent filling of void spaces by dirt, dust, or silt. The frequency is dependent on area of the country and location near manufacturing facilities that generate dust or fly ash.

~~The frequency is dependent on area of the country and location near manufacturing facilities that generate dust or fly ash.~~

Open Pits.

Open Pits. Where an open pit is used, one of the following forms of protection should be provided:

- (1) ~~Automatic~~ An automatic sprinkler or water spray protection ~~should be~~ provided for the pit area, designed to a discharge density of 0.15 gal/min-ft² (6 mm/min) over the area of the pit.
- (2) A 12 in. (30 cm) thick layer of rock ~~— 1.5 in. (3.8 cm) or larger washed and uniformly sized (size No. 2, ASTM D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction) —~~ located between steel grating ~~should be~~ provided at the top of the pit. ~~The rock used should be 1.5 in. (3.8 cm) or larger washed and uniformly sized rock (size No. 2, ASTM D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction).~~

6.5.6

Commented [BM47]: Annex for 6.5.5

Commented [BM48]: Annex material

Commented [KS49]: SL: I don't understand what this sentence is saying. Is it "area of the country and location" or "area of the country" and "location near manufacturing facilities", or something else?

Commented [BM50]: Annex material

Commented [JAP(651)]: Moved all to annex....if we changed to a "shall", new material would need to be added to address transformers that don't present an exposure (otherwise you would have rock or spray systems on every transformer containment regardless of location)

For facilities consisting of more than one generating unit that are not separated by a fire barrier [see 6.1.1.3(15)], ~~provisions such as~~ a sloped floor, curb, or trench drain shall be provided on solid floors where the potential exists for an oil spill, such that oil released from an incident in one unit will not expose an adjacent unit.

Commented [JAP(652)]: Check at end

6.5.7*

The FPDDB shall address liquid discharges resulting from oil spills or operation of a fire suppression system.

A.6.5.7

For environmental reasons, the liquid discharge ~~may~~might have to be treated or separated.

6.6* Emergency Lighting.

A.6.6

~~The e~~Emergency lighting ~~can be~~is permitted to consist ~~either of~~ either fixed units or ~~of~~ portable lights.

Commented [BM53]: Annex material for 6.6.2

Commented [JAP(654)]: Could apply to 6.6.1 or 6.6.2, so moved to A.6.6

6.6.1

Emergency lighting shall be provided for means of egress.

6.6.2*

Emergency lighting shall be provided for critical plant operations areas.

A.6.6.2

For a normally unattended site, ~~the an~~ emergency lighting system for critical operating areas that depends on batteries or fuel supplies ~~may~~might be manually operated from a switch at the entry to the plant.

6.7 Lightning Protection.

Lightning protection shall be provided for those structures having a risk index (~~R~~) of 4 or greater when evaluated in accordance with NFPA 780.



Public Input No. 50-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 7]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter7_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 7 based on work by Task Group 2 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 7 General Fire Protection Systems and Equipment

7.1 General.

All fire protection systems, equipment, and installations should be dedicated to fire protection purposes.

7.1.1

This chapter shall apply to general fire protection systems and equipment where provided or as required by the FPDBD.

7.1.2

All fire protection systems, equipment, and installations ~~should~~ shall be dedicated to fire protection purposes.

[ALL NEW TEXT FOLLOWING 7.1]

7.2 Water Source.

7.2.1*

The water source shall be capable of supplying the required demands of the fire protection systems ~~s and sufficient to provide a hose stream demand of not less than 500 gpm (1893 L/min).~~

A.7.2.1

The water source should ~~take into consideration~~ consider the need for multiple supply sources ~~through by~~ evaluating factors such as ~~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

7.2.2*

The water supply for permanent fire protection installations shall ~~be based on providing~~ provide a minimum ~~of~~ 2-hour supply.

A.7.2.2

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

Consideration of water quality can prevent long-term problems relating to fire protection water supply. For example, ~~in some rivers and tributaries~~ the existence of microorganisms ~~in some rivers and tributaries~~ limits the use of raw water for fire protection without treatment. Demineralized water and ash water should not be considered ~~for use~~ as a fire protection water source due to excessive corrosion and erosion characteristics.

7.2.2.1

Commented [KS1]: SL: The addition of text to this title was way too long. I have proposed putting that info in as the first subpara to 7.1 General (see edits).

Commented [KS2]: SL: This is repeated further down.

Commented [BT3]: Consider moving to DBD section or annex

Commented [BT4]: Review NFPA 409 for annex material

Commented [BM5]: Move to Annex for 7.2.2

Commented [BM6]: Annex material for 7.2.2

The water supply shall be sufficient to supply the largest single fixed fire suppression system demand.

7.2.2.2*

The water supply shall be sufficient to supply the combined demands of a fixed fire suppression system ~~combined demands~~ that could ~~reasonably~~ be ~~expected~~ required to operate simultaneously during a single event ~~such as turbine underfloor protection in conjunction with other fire protection system(s) in the turbine area, coal conveyor protection in conjunction with protection for related coal handling structures during a conveyor fire, adjacent transformers not adequately separated according to 6.1.4.~~

Commented [PH7]: Subjective, better term?

Commented [KS8R7]: I agree; let's just remove.

Commented [KS9]: SL: Move examples to Annex A. See edits.

A.7.2.2.2

Examples of combined demands of a fixed fire suppression system include the following:

(1) Turbine underfloor protection in conjunction with another fire protection system(s) in the turbine area

(2) Coal conveyor protection in conjunction with protection for related coal handling structures during a conveyor fire

(3) Adjacent transformers not adequately separated according to 6.1.4

7.2.2.3

The water supply shall be sufficient to provide a hose stream demand of not less than 500 gpm (1893 L/min).

Commented [BM10]: reworded

7.2.3

Each water supply shall be connected to the facility supply main or yard main by separate connections arranged and ~~valve-valve~~ controlled to minimize the possibility of multiple supplies being impaired simultaneously.

7.2.3.1

When a single water supply is ~~used-utilized~~, two independent connections shall be provided.

7.2.3.1.1*

~~If a situation can arise in which the primary water supply can become unavailable (e.g., dewatering of penstocks), an~~ An auxiliary supply shall be provided where a risk of the primary water supply becoming unavailable exists.

A.7.2.2.2

An example of such a risk leading to unavailability of the primary water source would be the dewatering of penstocks.

7.2.3.1.2

Each water supply shall be capable of meeting the ~~recommendations-requirements~~ in 7.2.2.

7.2.4 Fire Pumps.

7.2.4.1

All fire pumps shall be ~~automatic-automatic~~-starting type with manual shutdown at the pump controllers only, except as allowed ~~in by~~ NFPA 20.

7.2.4.2

Multiple fire pump installations shall not be subject to a common electrical or mechanical failure, ~~electrical or mechanical~~.

7.2.4.3

Multiple fire pump installations shall ~~be of sufficient have~~ capacity sufficient to meet the fire flow requirements determined by 7.2.1 with the largest pump out of service.

7.2.5 Water Supply Tanks.

7.2.5.1

If tanks are ~~of dual-purpose use~~, a standpipe or similar arrangement shall be provided to dedicate the amount determined by 7.2.1 for fire protection use only. (See NFPA 22.)

7.2.5.2*

Where ~~tanks are used~~, they tanks shall be filled from a source capable of replenishing the 2-hour supply for the fire protection requirement in an 8-hour period.

A.7.2.5.2

The 8-hour ~~(time)~~ requirement for refilling can be permitted to be extended if the initial supply exceeds the minimum storage requirement on a volume per time ratio basis. It ~~normally~~ is preferred for the refilling operation to be accomplished on an automatic basis.

Commented [BM11]: Annex material

7.3* Valve Supervision.

~~7.3.1~~

Valves on connections to water supplies, sectional control and isolation valves, and other valves in supply pipes to sprinklers and other fixed water-based fire suppression systems shall be supervised by one of the following methods:

- (1) ~~Central-station~~, proprietary, or remote station signaling service
- (2) Local signaling service that will ~~cause the sounding of sound~~ an audible signal at a constantly attended point
- (3) Valves locked in the correct position
- (4) Valves located within fenced enclosures under the control of the owner, sealed in the open position, and inspected weekly as part of an approved procedure

A.7.2.5.2

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

~~Locking Valves Open.~~ Keys should be made available only to authorized personnel.

Commented [BM12]: Annex material

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

Commented [BM13]: Annex material

~~7.3.2~~

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

Commented [KS14]: SL: Subsection 7.3.2 is an incomplete sentence, and 7.3.3 and 7.3.4 don't contain requirements (therefore we can't have any annex material). I've moved all of the text to become annex material for Section 7.3 but it needs work/context.

If we want to retain the original structure, then 7.3.2 needs to be made into a requirement and we need to have a requirement(s) in 7.3.3 and 7.3.4.

~~7.3.3 *Locking Valves Open.~~

~~A.7.3.3~~

~~Keys should be made available only to authorized personnel.~~

Commented [BM15]: Annex material

~~7.3.4 *Sealing Valves Open.~~

~~A.7.3.4~~

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

Commented [BM16]: Annex material

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

7.4.1 Supply Mains, Yard Mains, and Hydrants.

7.4.1.1*

Supply mains, yard mains, and outdoor fire hydrants shall be installed on the plant site. (See NFPA 24.)

A.7.4.1.1

Where ~~it is expected that~~ the fire department ~~may-might~~ draft from a body of water adjacent to the plant and access ~~may-might~~ be difficult due to terrain and elevation ~~and where required by the FPDDB~~, a dry hydrant with adequate fire apparatus access ~~shall-should~~ be installed.

Commented [KS17]: SL: This is a requirement. Needs to be put in mandatory text, or changes to annex language. I have made edits to make it suitable for Annex A.

7.4.1.1.1*

Hydrant spacing in main plant areas shall ~~be a maximum of-not exceed~~ 300 ft (91.4 m).

A.7.4.1.1.1

Hydrant and monitor spacing in plant areas containing flammable or combustible liquids should be done strategically to ensure adequate coverage of all areas the flammable or combustible liquids are contained or could flow as evaluated in the FPDDB.

7.4.1.1.2*

Hydrant spacing in remote areas shall ~~be a maximum of-not exceed~~ 500 ft (152.4 m).

A.7.4.1.1.2

~~Consideration should be given to the placement~~ Placement of hydrants and monitors about the area to provide strategic coverage of all flammable or combustible liquids piping ~~should be considered~~. Based on the

completed FPDBD-Fire Protection Design Basis Document, an alternative could be ~~the use of fire/ or~~ water trucks use if the site water supply so dictates.

Commented [BM18]: Annex material

7.4.1.2

The supply mains shall be looped around the main power generating area.

7.4.1.2.1*

The supply mains shall be ~~of sufficient size to~~ supply the flow requirements determined by 7.2.1 to any point in the yard loop considering with the most direct path to be out of service.

A.7.4.1.2.1

Pipe sizes should be ~~designed for~~ any anticipated expansion and future water demands.

Commented [PH19]: By design professional or competent person?

7.4.1.3

Indicator control valves shall be installed to provide adequate sectional control of the fire main loop to minimize facility fire protection impairments.

7.4.1.4

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

7.4.1.5

Interior fire protection legs ~~is an extension of the yard main and~~ shall be provided as an extension of the yard main with at least two valved connections ~~to the yard main~~.

7.4.1.5.1

Sectional control valves shall be provided on the interior legs to minimize plant protection impairments.

7.4.2 Standpipe and Hose Systems.

7.4.2.1*

Standpipe and hose systems shall be installed in buildings and structures ~~where deemed necessary as required~~ by the FPDBD- and in accordance with NFPA 14.

A.7.4.2.1

~~The A~~ standpipe and hose system is an extension of the yard fire main and hydrant system.

7.4.2.1.1

The standpipes and hose stations shall be capable of delivering the hose stream demand for ~~the various anticipated hazards~~ in buildings.

Commented [PH20]: Subjective

Commented [KS21R20]: Better?

Commented [BM22]: Annex

7.4.2.2

Fire main connections for standpipes shall be arranged so that a supply main break can be isolated, without interrupting service, simultaneously to both fixed protection and hose connections protecting the same hazard or area.

7.4.2.3

~~The standpipe~~ Standpipe piping shall be capable of providing minimum volume and pressure for the hydraulically most demanding hose stations.

7.4.3 Hose Nozzles.

Spray nozzles having shutoff capability and listed for use on electrical equipment shall be provided on hoses located in areas near energized electrical equipment.

7.4.4 Hose Threads.

Hose threads on hydrants and standpipe systems shall be compatible with fire hose used by the responding fire departments.

7.5 Portable Fire Extinguishers.

Portable fire extinguishers shall be provided as determined by the FPD BD and in accordance with NFPA 10.

7.6 Fire Suppression Systems and Equipment — General Requirements.

7.6.1*

Where provided, fixed suppression systems shall be designed, installed, and commissioned in accordance with the manufacturer's recommendations and the following codes and standards unless specifically noted otherwise:

- (1) NFPA 11
- (2) NFPA 12
- (3) NFPA 13
- (4) NFPA 15
- (5) NFPA 17
- (6) NFPA 18A
- (7) NFPA 20
- (8) NFPA 24
- (9) NFPA 25
- (10) NFPA 214
- (11) NFPA 855
- (12) NFPA 750

Commented [PH23]: Subjective

Commented [KS24R23]: Agree. Specify distance.

Commented [PH25]: By who?

(13) NFPA 770

(14) NFPA 2001

(15) NFPA 2010

A.7.6.1

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

- (1) ~~The type~~ Type of hazard
- (2) ~~The effect~~ Effect of agent discharge on equipment
- (3) ~~The health~~ Health hazards and ability to remove the agent, the toxic gases, and the combustion products from these structures following system actuation
- (4) Need for and ability to minimize agent leakage by sealing of electrical enclosures as well as room integrity; ~~and~~ automatic closing of ventilation dampers and doors, as applicable; ~~and~~ automatic shutdown of fans
- (5) ~~Extinguishing agent discharge should be based on maintaining~~ Maintaining concentration while hazard is above the autoignition temperature
- (6) Potential for causing flooding or environmental damage

7.6.2*

Personnel hazards created by the discharge of the extinguishing agent selected shall be considered in the design of the system. ~~See NFPA 12 for CO₂ hazards to personnel.~~

A.7.6.2

See NFPA 12 for CO₂ hazards to personnel.

~~If CO₂ systems are~~ Where provided, ~~they~~ CO₂ systems should be provided with an odorizer for alerting personnel, and breathing apparatus should be provided for operators in areas that cannot be abandoned.

The design shall ~~take into account~~ consider the immediate release of the extinguishing agent selected into the protected area and the possibility of leakage, migration, and settling into adjacent areas and lower elevations of the plant.

7.6.3 Automatic Sprinkler and Water Spray Systems.

7.6.3.1

Where provided, automatic sprinkler and water spray systems, including systems with water additives, shall be designed, installed, and commissioned ~~per~~ shall in accordance with NFPA 13 and NFPA 15.

7.6.3.1.1*

If permitted by the turbine configuration, water spray nozzles provided to protect the combustion turbine power bearing housings behind the exhaust duct shall be directed based on unit geometry to avoid possible water damage.

Commented [BM26]: Annex material for first requirement

Commented [PH27]: Design Professional? Common clarification- Look at Chapter 3 TG 1 for new definitions.

A.7.6.3.1.1

Depending on unit packaging arrangement, ~~consideration should be given to~~ closing the fuel valves automatically ~~on upon~~ water flow should be considered. This action should be taken for ~~Internal Combustion Engine (ICE)~~ internal combustion engines (ICEs) except for emergency power supply systems.

7.6.3.1.2

~~Turbochargers~~ Protection shall be provided for turbochargers on internal combustion engines (ICEs) ~~constitute a part of the hazard, and protection shall be provided.~~

Commented [BM28]: Annex material or move to another section

7.6.4* Total Flooding Gaseous Systems.

Where ~~total flooding gaseous agent systems are~~ provided, ~~the system~~ total flooding gaseous agent systems shall be ~~designed, installed, and commissioned in accordance with NFPA 12, NFPA 12A, or NFPA 2001,~~ and the manufacturer's installation procedures.

7.6.4.1*

~~Where total flooding gaseous systems are used, the~~ The enclosure for the total flooding gaseous system shall ~~be arranged for minimum~~ minimize leakage by automatically shutting down ~~shutdown of~~ fans and automatically closing ~~of~~ doors, ventilation dampers, and other openings.

Commented [PH29]: Subjective.

A.7.6.4.1

CT or ICE compartments are designed to be capable of nominally airtight closure. During operation, ~~however,~~ there is, ~~however,~~ a need for substantial amounts of secondary cooling (i.e., compartment ventilation) air. This air can be moved through the compartments by fans or venturi action from the CT or ICE air. This air flow will not stop immediately upon shutdown, and, therefore, ~~it~~ should be considered in the extinguishing system design.

Commented [KS30]: SL: Combustion turbine?

Maintenance of total flooding systems is critical. The integrity of the enclosure to be flooded and the interlocks between the fire system and associated equipment, such as the ventilation system dampers, should be maintained. The enclosure's integrity should be verified whenever it has been disassembled or modified. This can be done by a door fan test or other quantified means of detecting leakage. The leakage test should be conducted at least every 5 years. Maintenance and testing of the fire protection system should be conducted as defined in the applicable suppression standard.

Commented [BM31]: Annex material 7.6.6.1

It should be noted that deep-seated fires, such as those caused by oil-soaked insulation, can be present and will require manual extinguishment after the gaseous system soak time.

Commented [BM32]: Annex material 7.6.6.1

Commented [BM33]: Annex material 7.6.6.1

7.6.4.21.1

Provisions ~~shall be made to for~~ safely ~~remove removing~~ the gas and potential toxic combustion ~~by~~ products from the enclosure following gaseous system actuation shall be provided.

7.6.5 Total Flooding Water Mist Systems.

7.6.5.1

Where ~~total flooding water mist systems are~~ provided, ~~the system~~ total flooding water mist systems shall be designed, installed, and commissioned per in accordance with NFPA 750. ~~And and the~~ manufacturer's instructions. ~~requirements~~

7.6.5.2*

The enclosure ~~for the total flooding water mist systems~~ shall ~~be arranged for minimum~~ minimize leakage by automatically ~~shutting down shutdown of~~ fans and automatically closing ~~of the~~ doors, ventilation dampers, and other openings.

Commented [PH34]: Subjective - Typical

A.7.6.5.2

~~Where if~~ air flow ~~will can~~ not stop immediately upon equipment shutdown due to ~~a~~ need for secondary cooling (e.g., compartment ventilation) air, ~~this shall be considered in~~ the extinguishing system should consider this in its design.

7.6.6 Hybrid Fire-Extinguishing Systems.

7.6.6.1

Where ~~hybrid fire-extinguishing systems are~~ provided, ~~the system~~ hybrid fire-extinguishing systems shall be designed, installed, and commissioned ~~per in accordance with~~ NFPA 770.

7.6.6.2*

The enclosure ~~for the hybrid fire-extinguishing system~~ shall ~~be arranged for minimum~~ minimize leakage by automatically ~~shutting down shutdown of~~ fans and automatically closing ~~of the~~ doors, ventilation dampers, and other openings.

A.7.6.6.2

~~Where if~~ air flow ~~will can~~ not stop immediately upon equipment shutdown due to ~~a~~ need for secondary cooling (e.g., compartment ventilation) air, ~~this shall be considered in~~ the extinguishing system should consider this in its design.

7.6.7 Local Application Extinguishing Systems.

7.6.7.1*

Where provided, a local application extinguishing system- shall be designed, installed, and commissioned ~~per in accordance with the~~ applicable NFPA standard and ~~the~~ manufacturer's requirements.

A.7.6.7.1

~~Where~~ hazards are not enclosed and a first level of protection ~~is desired~~ that will operate before sprinklers is desired, or where sprinklers are not installed, a local application extinguishing system might be appropriate.

Commented [BM35]: Annex material for 7.6.9.1

7.6.7.2

Discharge rates and duration shall ~~be function~~ such that cooling and shutdown occur to prevent reignition of the fire.

7.6.7.2.1

System operation shall be arranged to close fuel valves.

7.6.7.3

~~The positioning of local~~ Local application nozzles shall be positioned such that maintenance access to the protected equipment is not obstructed.

7.6.8 High-Expansion Foam Systems.

Where provided, high-expansion foam systems shall be designed, installed, and commissioned ~~per~~ in accordance with NFPA 11 and the manufacturer's instructions-requirements.

7.6.9 Compressed Air Foam Systems.

Where provided, compressed air foam systems shall be designed, installed, and commissioned ~~per in~~ in accordance with NFPA 11 and the manufacturer's instructions-requirements.

7.6.10 Fixed Aerosol Fire-Extinguishing Systems.

Where provided, fixed aerosol fire extinguishing systems shall be designed, installed, and commissioned ~~per in accordance with~~ NFPA 2010 and the manufacturer's instructions-requirements.

7.7 Fire Alarm Systems.

7.7.1

Fire alarm initiating devices and notification appliances shall be designed, installed, and commissioned ~~per in accordance with~~ NFPA 72 and the manufacturer's instructions-requirements.

Formatted: Font: Italic

7.7.2

Fire alarm control panels shall be equipped with local audible and visual signaling and annunciation ~~per~~ in accordance with NFPA 72.

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7.7.3

Where provided, fire-signaling systems shall include the following:

- (1)* Manual fire alarm devices ~~(e.g., pull boxes or page party stations)~~ installed in all occupied buildings.

A.7.7.3(1)

Examples of manual fire alarm devices include pull boxes or page party stations.

- (2)* Manual fire alarm devices installed for remote ~~yard-hazards or in other special cases (e.g., confined spaces, scroll/spiral cases, draft tubes)~~ to alert personnel that a fire alarm system has been activated.

A.7.7.3(2)

Examples of remote hazards include remote yards, confined spaces, scroll/spiral cases, and draft tubes.

- (3) Plant-wide audible or visual fire alarm, for the purposes of personnel evacuation.
- (4) Means to notify the public fire department.

Commented [PH36]: Never liked this statement as a contractor. All buildings? All yards? At the fence line? Possible PI committee issue?

7.7.4

~~The Annunciation of fire~~Fire-signaling systems shall annunciate to a constantly attended location ~~is required~~ for emergency notification and response.

Commented [PH37]: Tie back to UL or 72 requirements?

7.7.5

The location and design of fire-signaling systems, including emergency shutdown stations and their interfaces, shall be incorporated with facility control and information systems.

7.7.6 Vapor or Gas Detection.

Commented [PH38]: UL 2075 listing or NFPA 72 reference?

7.7.6.1*

Vapor or gas detection shall be provided ~~to allow early warning for equipment subject to leaks of flammable fluid or vapors so corrective action can be taken.~~

A.7.7.6.1

Detection systems allow early warning for equipment subject to leaks of flammable fluid or vapors so corrective action can be taken quickly.

7.7.6.~~21-1~~*

~~Where provided detection~~Detection systems shall alarm at a constantly attended location.

A.7.7.6.~~21-1~~

~~vapor~~Vapor or gas detection should- be provided for automatic shutdown and notification at unattended plants.

7.7.7 Facility Communications Systems.

~~7.7.7.1~~

Facility communications systems ~~per~~shall comply with NFPA 1600 and NFPA 1616.

7.8 Commissioning and Maintenance.

~~7.8.1~~

Commissioning, inspection, ~~Maintenance~~maintenance, and testing of the fire protection system and equipment shall be conducted as defined in the applicable standard.



Public Input No. 51-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 8]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter8_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 8 based on work by Task Group 2 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 8 Fire Protection for the Construction Site

8.1 ~~Introduction~~General.

8.1.1* [move current text as annex, 1st para]

~~Although many of the activities on electric generating plant and HVDC converter station construction sites are similar to the construction of other large industrial plants, an above average level of fire protection is justified due to life safety consideration of the large number of on-site personnel, high value of materials, and length of the construction period. Fire protection during construction shall provide for life safety, protection of property, and potential delays in construction schedules and facility startup.~~

Commented [KS1]: SL: Edits OK?

A.8.1.1

~~Although many of the activities on electric generating plant and HVDC converter station construction sites are similar to the construction of other large industrial plants, an above average level of fire protection is justified due to life safety consideration of the large number of on-site personnel, high value of materials, and length of the construction period.~~

Commented [BM2]: Annex material for 8.1.1

~~Major construction projects in existing plants-facilities present many of the hazards associated with new construction while presenting additional exposures to the existing facility. The availability of the existing plant facility fire protection equipment and the reduction of fire exposure by construction activities are particularly important.~~

Commented [BT3R2]: Task group agrees

8.1.2 [move text as to A.8.1.1, 2nd para]

~~Major construction projects in existing plants present many of the hazards associated with new construction while presenting additional exposures to the existing facility. The availability of the existing plant fire protection equipment and the reduction of fire exposure by construction activities are particularly important.~~

Commented [BM4]: Annex material for 8.1.1

Commented [BT5R4]: Task group agrees

~~8.1.3~~2

~~For fire protection for plants and areas under construction, see NFPA 241. Chapter 8 shall not apply to power plants and related areas under construction. addresses concerns not specifically considered in NFPA 241.~~

A.8.1.2

~~See NFPA 241 for requirements on power plants and related areas under construction.~~

Commented [KS6]: SL: We need to make this requirement about this document, not about NFPA 241. We can state what Chapter 8 will not apply to, and then put NFPA 241 in the annex.

Commented [KS7]: SL: We must have a title here if there won't be any para text.

8.2 Administration.

8.2.1 [title]

~~The responsibility for fire prevention and fire protection for the entire site during the construction period should be clearly defined. The administrative responsibilities should be to develop, implement, and periodically update the internal program as necessary using the measures outlined in this chapter and NFPA 241.~~

Commented [BM8]: Split ... needs numbering

Commented [BT9R8]: Task Group agrees

8.2.1.1

The responsibility for fire prevention and fire protection responsibilities for the entire site during the construction period ~~should~~ shall be clearly defined.

8.2.1.2

The administrative responsibilities ~~should~~ shall be to develop, implement, and periodically update the internal program as necessary using the measures outlined in this chapter and NFPA 241.

8.2.2 [title]

~~The responsibility for fire prevention and fire protection programs among various parties on site should be clearly delineated. The fire protection program that is to be followed and the owner's right to administration and enforcement should be established.~~

8.2.2.1

The responsibility for fire prevention and fire protection program responsibilities among various parties on site ~~should~~ shall be clearly ~~defined~~ delineated.

8.2.2.2

The fire protection program ~~that is to be followed~~ and the owner's right to administration and enforcement ~~should~~ shall be established.

8.2.3

The fire prevention and fire protection program ~~should~~ shall include an ~~Fire Protection Design Basis Document~~ FPDBD of the construction site and construction activities. (See Chapter 4.)

8.2.4

Written procedures ~~should~~ shall be established for the new construction site, including major construction projects in existing plants. ~~Such procedures shall be in accordance with Sections 5.3 and 5.4, and 5.4.2, 5.4.4, and 5.4.5.~~

8.2.5*

Security guard service, ~~including recorded rounds, should or other means of monitoring shall~~ be provided through all construction areas ~~of construction~~ during times when construction activity is not in progress. (See NFPA 601.)

A.8.2.5

The first round should be conducted ~~one-half hour~~ 30 minutes after the suspension of work for the day. Thereafter, rounds should be made every hour.

Where partial construction activities occur on second and third shifts, the ~~guard-surveillance~~ service rounds are permitted to be modified to include only unattended or sparsely attended areas.

In areas where automatic fire detection or extinguishing systems are in service, areas with alarm annunciation at a constantly attended location, or ~~in~~ areas of limited combustible loading, rounds are permitted to be omitted after the first round ~~indicated in 8.2.5.1.~~

8.2.5.1 [move text to A.8.2.5, 1st para]

Commented [BM10]: Split ... needs numbering

Commented [BT11R10]: Task Group agrees

Commented [KS12]: SL: We must have a title here if there won't be any para text.

Commented [PH13]: Look at Stack holders and FPDBD team as set up by TG 1

Commented [BM14]: Split ... needs numbering

Commented [PH15]: Look at Stack holders and FPDBD team as set up by TG 1

Commented [BM16]: Split ... needs numbering

Commented [KS17]: SL: Section 5.4 includes all of these subs so there's no point in stating them separately.

Commented [BM18]: Reworded and added other means of monitoring

Commented [BT19R18]: Agree

Commented [BT20R18]: Task group agrees

Commented [BM21]: Annex material

Commented [BM22]: Annex material for 8.2.5

Commented [BM23]: Annex material for 8.2.5

~~The first round should be conducted one-half hour after the suspension of work for the day. Thereafter, rounds should be made every hour.~~

Commented [BM24]: Annex material

8.2.5.2 [move text to A.8.2.5, 2nd para]

~~Where partial construction activities occur on second and third shifts, the guard service rounds are permitted to be modified to include only unattended or sparsely attended areas.~~

Commented [BM25]: Annex material for 8.2.5

8.2.5.3 [move text to A.8.2.5, 3rd para]

~~In areas where automatic fire detection or extinguishing systems are in service, with alarm annunciation at a constantly attended location, or in areas of limited combustible loading, rounds are permitted to be omitted after the first round indicated in 8.2.5.1.~~

Commented [BM26]: Annex material for 8.2.5

8.2.6

Construction schedules ~~should~~ shall be coordinated so that planned permanent fire protection systems are installed and placed in service as soon as practical but possible, at least prior to the introduction of any major fire hazards identified in Chapter 9.

8.2.7*

~~In-service fire detection and fire extinguishing systems provide important protection for construction materials, storage, and so forth, even before the permanent hazard is present. Temporary fire protection systems can be warranted during certain construction phases. The need and type of protection should shall be determined by the FPDBD or the individual responsible for fire prevention and fire protection.~~

A.8.2.7

~~In-service fire detection and fire extinguishing systems provide important protection for construction materials, and storage, and so forth, even before the permanent hazard is present.~~

Commented [BM27]: Annex for 8.2.7

~~Temporary fire protection systems can be warranted during certain construction phases.~~

Commented [BM28]: Annex for 8.2.7

8.2.8

Construction and installation of fire barriers and protective opening devices (i.e., fire doors, and dampers) ~~should~~ shall be given priority in the construction schedule.

[ALL NEW TEXT FOLLOWING 8.2]

Commented [KS29]: SL: If these are the only two options, "i.e." is appropriate and the comma should be replaced with "and". If they are just two examples, "e.g." would be appropriate however I'd rather put the examples in Annex A.

8.3 Site Clearing, Excavation, Tunneling, and Construction Equipment.

8.3.1 Site Clearing.

8.3.1.1

Prior to clearing forest and brush-covered areas, the owner shall ensure the following that:

(1) ~~a~~ A written fire control plan is prepared.

(2) ~~fire~~ Firefighting tools and equipment are made available ~~as recommended by~~ in accordance with NFPA 1143.

8.3.1.2

Contact shall be made with local fire and forest agencies ~~for to obtain~~ current data on restrictions and fire potential, and to arrange for necessary permits.

8.3.1.32

All construction vehicles and engine-driven portable equipment shall be equipped with ~~effective~~ spark arresters.

Commented [PH30]: Subjective.

8.3.1.4

Vehicles equipped with catalytic converters shall be prohibited from wooded and heavily vegetated areas.

8.3.1.53

Fire tools and equipment shall comply with the following ~~be~~:

- (1) ~~used~~ They shall be used for fire emergencies only.
- (2) ~~distinctly~~ They shall be distinctly marked and maintained in a designated area.

8.3.1.64

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

8.3.1.75

Cut trees, brush, and other combustible spoil shall be properly removed from all construction areas ~~disposed of promptly~~.

Commented [PH31]: Subjective

8.3.1.86*

The contractor shall obtain all appropriate permits prior to the start of work and coordinate burning with the agencies responsible for monitoring fire danger in the area. *(See Section 8.2.)*

A.8.3.1.6

Where it is necessary to dispose of combustible waste ~~by through~~ on-site burning, designated burning areas should be established with approval by the owner and ~~should be in compliance~~ comply with federal, state, and local regulations and guidelines.

Commented [BM32]: Annex for 8.3.1.6

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.

Commented [BM33]: Annex for 8.3.1.6

8.3.2 Excavation and Tunneling.

8.3.2.1 Site Conditions.

8.3.2.1.1*

Inspections of site conditions and ~~the~~ testing of air quality shall be assigned to qualified personnel specifically trained in the use of those instruments specified by the regulating agency.

Commented [KS34]: SL: A title is necessary for 8.3.2.1 since there is no para text. If we keep the title for 8.3.2.5, we need titles for the subparas in between (I have provided some but modify as desired). If no titles are desired, remove the ones I've added and the one for 8.3.2.5.

A.8.3.2.1.1

Construction activities related to tunnels, shafts, and other underground excavations are strictly regulated by federal and state agencies.

Commented [BM35]: Annex for 8.3.2.1 first sentence

8.3.2.1.2

Fire prevention shall consist of adequate ventilation, good housekeeping, and limiting the types of fuel, explosives, and combustibles underground as well as and adjacent to entrances and ventilation intakes.

Commented [PH36]: Separate into two sections

8.3.2.2 Geological Surveys.

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

8.3.2.3 Fuel-Powered Vehicles.

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

Commented [PH37]: Define?

8.3.2.4 Emergency Plan.

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

8.3.2.5 Construction Equipment.

Construction equipment shall meet the requirements of NFPA 120.

8.4 Construction Warehouses, Shops, and Offices.

Commented [KS38]: SL: Same issue here re: titles and 8.4.1-8.4.8.

8.4.1 General.

8.4.1.1*

All structures that are to be retained as part of the completed plant shall be in accordance with the FPDBD for the completed plant.

A.8.4.1.1

~~Construction~~ The location of construction warehouses, offices, trailers, sheds, and other facilities for the storage of tools and materials shall be located with consideration of ~~should consider~~ their exposure to major plant buildings or other important structures. For guidance in separation and protection, see NFPA 80A and NFPA 1144.

Commented [PH39]: Per the FPDBD?

Commented [BM40]: Annex material

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 analyzed should be performed~~. This analysis can indicate a need for automatic sprinkler systems or other protection, fire or smoke detection, subdividing the complex to limit values exposed by one fire, or any combination ~~thereof the above~~.

Warehouses that contain high value equipment (as defined by the individual responsible for fire prevention and fire protection), or where the loss of or damage to contents would cause a delay in startup dates of the completed plant, should be arranged and protected as indicated in 8.4.4 through 8.4.10. Although some of

these structures are considered ~~to be~~ “temporary” and will be removed upon completion of the plant, the fire and loss potential should be thoroughly evaluated and, where warranted, protection should be provided where warranted.

Building construction materials should be noncombustible or limited combustible. (See Chapter 6.)

Commented [BM41]: Annex material for 8.4.1 part 2

8.4.1.2*

All structures that will not be retained as part of the completed plant shall be constructed of materials as indicated in Chapter 6.

A.8.4.1.2

Automatic sprinkler systems should be designed and installed in accordance with the applicable NFPA standards. Waterflow alarms should be provided and monitored at a constantly attended location as determined by the individual responsible for fire prevention and fire protection.

Commented [PH42]: Qualified individual or Registered Design professional(RDP)?

Air-supported structures ~~shall~~ should be used only for noncombustible storage.

Air-supported structures are sometimes ~~are~~ used to provide temporary warehousing space. Although the fabric envelope can be a fire-retardant material, the combustibility of contents and the values should be considered, as with any other type of warehouse. It is impractical to provide automatic sprinkler protection for air supported structures. An additional factor to consider is that relatively minor fire damage to the fabric envelope can leave the contents exposed to the elements.

Commented [BM43]: Annex material for 8.4.1 part 2

8.4.2 Temporary Structures.

8.4.2.1

Temporary enclosures, including trailers, inside permanent plant buildings shall be prohibited except where permitted by the individual responsible for fire prevention and fire protection.

Commented [BM44]: Annex for 8.4.4.3

8.4.2.2

Where the floor area of a combustible enclosure exceeds 100 ft² (9.3 m²) or where the occupancy presents a fire exposure, the enclosure shall be protected with an approved automatic fire extinguishing system.

Commented [PH45]: Separate

8.4.3 Storage.

Storage of construction materials, equipment, or supplies that are either combustible or in combustible packaging shall be prohibited in main plant buildings unless one of the following conditions applies:

- (1) An approved automatic fire extinguishing system is in service in the storage area.
- (2) ~~Where loss~~ Loss of the materials or loss to the surrounding plant area would be minimal, as determined by the individual responsible for fire prevention and fire protection.

Commented [PH46]: To what standard?

8.4.4 Mobile Buildings.

Commented [PH47]: RDP?

8.4.4.1*

Construction camps comprised of mobile buildings adjoining each other to form one large fire area shall be avoided.

Commented [PH48]: What is the requirement? Two shall statements and consideration(subjective) can be rewritten.

A.8.4.4.1

If buildings cannot be separated adequately, ~~consideration shall be given to~~ installing fire walls between units or installing automatic sprinklers throughout the buildings should be considered.

Commented [KS49]: SL: This either needs to be a requirement or annex material. I don't think we can require that something be "considered."

8.4.4.21*

Mobile buildings shall be installed and located ~~according to the requirements of~~ in accordance with NFPA 501A.

A.8.4.4.2

Insulating materials ~~utilized~~ used in mobile buildings should be noncombustible.

Commented [KS50]: SL: Annex A.

8.4.4.2

Construction camp buildings shall be designed and installed in accordance with NFPA 101.

8.4.5 Fire Alarm Systems.

8.4.5.1

Fire alarms shall be connected to a constantly attended central location.

A.8.4.5.1

All premises fire alarm systems should be installed, tested, and maintained as outlined in NFPA 72. An alternative to remote alarms would be audible and visual alarms that would alert site ~~or~~ security personnel to abnormal conditions.

Commented [KS51]: SL: No mandatory language. Annex A.

8.4.5.21

The ~~location for~~ central alarm control location shall be provided with the following:

- (1) Remote fire pump start button
- (2) Manual siren start/stop button
- (3)* Provision for Means of alerting the fire crew ~~by radio, fire alert paging, and so forth~~

A.8.4.5.2(3)

Examples of such alerting means include radio and fire alert paging.

- (4) Monitors for communication between the security guard and the responding fire crew ~~at place of fire~~
- (5) Radio link between security guard's office and the respective fire department

8.4.6 Flammable Liquids and Gases.

The handling, storage, and dispensing of flammable liquids and gases shall meet the requirements of NFPA 30, NFPA 58, and NFPA 30A.

8.4.7 Vehicle Repair.

Vehicle repair facilities shall meet the requirements of NFPA 30A.

8.4.8 Kitchens.

Construction kitchens shall be protected in accordance with NFPA 96.

8.5 Construction Site Lay-Down Areas.

8.5.1

Fire hydrant systems with an adequate water supply shall be provided in lay-down areas where ~~the need is determined~~ required by the individual responsible for fire prevention and fire protection.

Commented [PH52]: Typical - RDP?

8.5.2

Combustible materials shall be separated by a clear space to allow access for manual ~~fire-fire~~ fighting equipment (*see Section 8.8*).

8.5.3

Access ~~shall be provided and maintained~~ to all ~~fire-fire~~ fighting equipment, including fire hose, extinguishers, and hydrants, shall be provided and maintained.

Commented [PH53]: Separate.

8.6 Temporary Construction Materials.

8.6.1*

Noncombustible or fire-retardant scaffolds, form work, decking, and partitions shall be used both inside and outside of permanent buildings where a fire could cause substantial damage or delay construction schedules. ~~Consideration shall be given to providing sprinkler protection for combustible form work where a fire could cause substantial damage or construction delays.~~

Commented [PH54]: Separate.

A.8.6.1

The use of noncombustible or fire-retardant concrete form work is especially important for large structures (e.g., turbine-generator pedestal) where large quantities of forms are used.

Commented [BM55]: Annex for 8.6.1

The use of listed pressure-impregnated fire-retardant lumber or listed fire-retardant coatings ~~generally~~ would be acceptable. ~~Pressure-impregnated fire-retardant lumber should be where~~ used in accordance with its listing and manufacturer's instructions. Where exposed to the weather or moisture (e.g., concrete forms), the fire retardant used should be suitable for this exposure. Fire-retardant coatings are not acceptable on walking surfaces or surfaces subject to mechanical damage.

Commented [BM56]: Annex material for 8.6.1

Providing sprinkler protection for combustible form work where a fire could cause substantial damage or construction delays should be considered.

8.6.2

Tarpaulins and plastic films shall be of listed weather-resistant materials and meet the performance criteria of NFPA 701.

8.7 Underground Mains, Hydrants, and Water Supplies.

8.7.1 General.

8.7.1.1

Where practical, the permanent underground yard system, fire hydrants, and ~~water supply~~ (at least one water source), ~~as indicated in Chapter 7~~, shall be installed during the early stages of construction as indicated in Chapter 7.

Commented [PH57]: Subjective. Reword section?

8.7.1.1.1

Where provision of all or part of the permanent underground system and water supply is not practical, temporary systems shall be provided.

8.7.1.1.2

Temporary water supplies shall be hydrostatically tested, flushed, and arranged to maintain a high degree of reliability, including protection from freezing and loss of power.

8.7.1.1.3

~~If there is a possibility that the temporary system will be used for the life of the plant, then the~~ The temporary system shall meet the requirements indicated in Chapter 7 where potential exists that it will be used for the life of the plant.

8.7.1.2

The ~~necessary~~ reliability of construction water supplies, ~~including redundant pumps, arrangement of power supplies, and use of combination service water and construction fire protection water~~, shall be determined by the individual responsible for fire prevention and fire protection.

Commented [PH58]: RDP?

A.8.7.1.2

Examples include redundant pumps, arrangement of power supplies, and use of combination service water and construction fire protection water.

8.7.2 Hydrants.

8.7.2.2.1

Hydrants shall be installed, ~~as indicated in Chapter 7~~, in the vicinity of main plant buildings, important warehouses, office or storage trailer complexes, and important outside structures with combustible construction or combustible concrete form work as indicated in Chapter 7 (e.g., cooling towers).

A.8.7.2.2.1

An example of an outside structure with combustible construction or combustible concrete form work is a cooling tower.

8.7.2.2.2

Where practical, the underground main shall be arranged to minimize the possibility that any one break will remove ~~from service~~ any fixed water extinguishing system from service or leave any area without accessible hydrant protection.

Commented [PH59]: Separate and define.

8.7.3* Water Supplies.

8.7.3.1

~~If~~ Where required by FPDBD, a fire protection water supply shall be provided on the construction site.

8.7.3.1.1

The fire protection water supply shall be capable of ~~furnishing the largest supplying either~~ of the following, whichever is larger, for a minimum 2-hour duration:

- (1) 750 gpm (2839 L/min)
- (2) The in-service fixed water extinguishing system with the highest water demand and 500 gpm (1893 L/min) for hose streams

8.7.3.2

The highest water demand shall be determined by the hazards present at the stage of construction, ~~which might not correspond to the highest water demand of the completed plant.~~

A.8.7.3.2

This water demand might not correspond to the highest water demand of the completed plant.

8.7.3.3

Fixed systems shall be provided and placed in service 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.~~

A.8.7.3.3

~~The~~ Even if 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.

8.7.3.3.1

When the permanent hazard is introduced, the water supply shall be capable of providing the designed system demand.

8.7.3.3.2

When using construction water in permanent systems, adequate strainers shall be provided to prevent clogging of the system by foreign objects and dirt.

8.7.3.4

The water supply shall be sufficient to provide adequate pressure for hose connections at the highest elevation.

8.8 Manual Fire ~~fighting~~ ~~Fighting~~ Equipment.

8.8.1*

Commented [PH60]: Subjective? Defined in the FPDBD? Multiple items separate.

Commented [BM61]: Annex for 8.7.3.2

Commented [PH62]: Subjective, per FPDBD or designed to what standard?

First aid ~~fire-fire~~fighting equipment shall be provided, in accordance with NFPA 600 and NFPA 241.

8.8.2

Portable fire extinguishers of suitable capacity shall be provided in accordance with NFPA 10 in the following locations-as follows:

- (1) Where flammable liquids are stored or handled
- (2) Where combustible materials are stored
- (3) Where temporary oil- or gas-fired equipment is used
- (4) Where a tar or asphalt kettle is used
- (5) Where welding, grinding, or open flames are in use

8.8.3

Hoses and nozzles shall be available at strategic locations, ~~such as inside hose cabinets or hose houses or on dedicated fire response vehicles.~~

A.8.8.3

Examples of strategic locations include hose cabinets, hose houses, or dedicated fire response vehicles.

8.8.4

If fire hose connections are not compatible with local ~~fire-fire~~fighting equipment, adapters shall be made available.

Commented [PH63]: T o a standard?

Commented [KS64R63]: Needs to be more specific if it's a requirement.



Public Input No. 52-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 9]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter9_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 9 based on work by Task Group 2 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 9 Fuels, Common Equipment, and Protection

9.1* General.

The identification and selection of fire protection systems and other design features for each fire and explosion hazard described within this chapter shall should be evaluated and determined by the FPDBD based on the Fire Protection Design Basis Document. This chapter identifies fire and explosion hazards in fossil fueled electric generating stations and specifies the recommended protection criteria unless the Fire Protection Design Basis Document indicates otherwise.

A.9.1

This chapter identifies specific fire and explosion hazards in ~~fossil~~ fossil-fueled electric generating stations and specifies the recommended protection criteria unless determined by the FPDBD. ~~Fire Protection Design Basis Document indicates otherwise. The FPDBD should identify the fire and explosion hazards present and apply appropriate mitigation features.~~

Commented [BM1]: Annex material

[ALL NEW TEXT FOLLOWING 9.1]

9.2 Flammable Gases.

The storage of and associated piping systems for gases shall comply with NFPA 2, NFPA 54, NFPA 55, NFPA 56, NFPA 58, NFPA 59A, and ASME B31.1, *Power Piping*, as appropriate, ~~based on~~ for the gas being used.

9.2.1 Fuel Gas Shutoff Valves.

9.2.1.1

The ~~plant's~~ fuel gas shutoff valve for the plant shall be located in a remote area and accessible under emergency conditions.

9.2.1.2

The fuel gas shutoff valve shall be provided with both manual and automatic closing capabilities locally, and remote closing capability from the control room.

9.2.1.3

The fuel gas shutoff valve shall be arranged to fail closed ~~on the~~ upon loss of power or pneumatic control.

9.2.2 Electrical Equipment.

Electrical equipment in areas with potentially hazardous atmospheres shall be designed and installed in compliance ~~accordance~~ with Articles 500 and 501 of *NFPA 70*; ~~NFPA 497~~; and IEEE C2, *National Electrical Safety Code*.

9.2.3* Piping Underground Beneath Buildings.

A.9.2.3

The conduit ~~Conduit~~ should extend into an accessible portion of the building and, at the point where the conduit terminates in the building, the space between the conduit and the gas piping should be sealed to

Commented [SK2]: SL: Does this belong with 9.2.3.2 or one of its list items?

prevent the possible entrance of any gas leakage. Where the end sealing is of a type that retains the full pressure of the pipe, the conduit should be designed for the same pressure as the pipe. The conduit should extend at least 4 in. (100 mm) outside the building, be vented outdoors above finished ground level, and be installed ~~so as~~ to prevent the entrance of water and insects.

~~Where the~~ A conduit that originates and terminates within the same building, ~~the conduit~~ should originate and terminate in an accessible portion of the building and should not be sealed.

Commented [BM3]: Annex material for 9.2.4 part 1

Commented [BM4]: Annex material for 9.2.4 Part 1.

9.2.3.1

Gas piping greater than 125 psi (861 kPa) shall not be located underneath buildings except as permitted by 9.2.3.2.

9.2.3.2

~~Where gas~~ Gas piping greater than 125 psi (861 kPa) ~~must shall~~ be permitted to be installed underground beneath buildings if it meets, the piping shall be either of the following criteria:

- (1) ~~Encased~~ It is encased in an approved conduit designed to withstand the imposed loads and installed in accordance with 9.2.4.1 or 9.2.4.2.
- (2) ~~A~~ It is part of a piping ~~/or~~ encasement system listed for installation beneath buildings.

9.2.4* Inerting.

9.2.4.1

~~Prior~~ Inerting shall be performed prior to introducing fuel gas to, or removing fuel gas from, the fuel gas piping. ~~inerting shall be performed.~~

9.2.4.2~~1~~

Gas piping shall be inerted prior to maintenance, modifications, or repair.

9.2.5* Maintenance, Modification, and Repair.

~~The hazards associated with flammable gases, including those hazards arising from toxic constituents in the gas and asphyxiants, should be considered when performing maintenance, modifications, or repairs.~~

Commented [PH5]: Annex or shall?

~~9.2.5.1~~

When ~~performing~~ maintenance, modification, or repair of piping that contains a flammable gas that has toxic constituents is performed, or when ~~inerting~~ fuel gas piping with asphyxiants is inerted, the enclosed space shall be ventilated or considered a confined space as regulated by U.S. Department of Labor, OSHA in accordance with 29 CFR 1910.146, "Permit Required Confined Space Standard."

A.9.2.5

The hazards associated with flammable gases, including those hazards arising from toxic constituents in the gas and asphyxiants, should be considered when performing maintenance, modifications, or repairs.

Commented [PH6]: Annex or shall?

9.3 Combustible Liquids.

9.3.1

Combustible liquid storage, pumping facilities, and associated piping shall comply with NFPA 30, NFPA 31, NFPA 85, and ASME B31.1, *Power Piping*.

9.3.2

Internal tank heaters needed to maintain combustible liquid pumpability shall be equipped with temperature-sensing devices that alarm in a constantly attended area prior to the overheating of the combustible liquid.

9.3.3

External tank heaters shall be interlocked with a flow switch to shut off the heater if combustible liquid flow is interrupted.

9.3.4

Tank filling operations shall be monitored to prevent overfilling.

9.3.5

While combustible liquid unloading operations are in progress, the unloading area shall be manned by qualified personnel trained in the operation of pumping equipment, valving, and fire safety.

9.3.6

Pump installations shall not be located within tank dikes.

9.3.7

Electrical equipment in areas with potentially hazardous atmospheres shall be designed and installed in compliance with NFPA 30, NFPA 497, Articles 500 and 501 of NFPA 70, and IEEE C2, *National Electrical Safety Code*.

9.3.8* **Ventilation.**

Commented [BM7]: Annex material for 9.3.8

9.3.8.1

To prevent hazardous accumulations of flammable vapors, ventilation for indoor pumping facilities for containing combustible liquids at or above their flash point shall provide at least $1 \text{ cfm of exhaust air per ft}^2 \text{ of floor area}$ $1 \text{ ft}^3/\text{min}/\text{ft}^2$ (0.30 m³/min/m²), but not less than 150 ft³/min/ft² (4 m³/min/m²), of floor area.

Commented [SK8]: SL: Are both minimums appropriate for a requirement? (Also I fixed the beginning of the first value. Was /ft2 and /m2 missing from the second half?)

A.9.3.8

Ventilation can be accomplished by mechanical or natural exhaust ventilation arranged in such a manner to include all floor areas or pits where flammable vapors can collect.

Commented [BM9]: Annex material for 9.3.8

9.3.8.2

Exhaust ventilation discharge shall be to a safe location outside the building.

9.3.9 Fire Protection.

9.3.9.1*

Indoor combustible liquid pumping or heating facilities exceeding quantity limitations stated in the building and fire code, shall be protected with an automatic fire suppression system.

Commented [PH10]: To a standard?

A.9.3.9.1

Protection can be ~~in the form of~~ sprinklers, ~~foam-water sprinklers, a~~ water spray system, ~~a~~ water mist system, ~~a~~ hybrid fire-extinguishing systems, ~~a~~ water-based systems with water additives, ~~foam-water sprinklers, a~~ compressed air foam systems, or ~~a~~ gaseous total flooding system installed in accordance with their listing.

Commented [SK11]: SL: Specify which type?

Commented [BM12]: Annex to 9.3.9.1

Local application dry chemical systems are permitted to be used in areas that normally do not have ~~re-~~reignition sources, such as steam lines or hot boiler surfaces.

Commented [BM13]: Annex to 9.3.9.1

9.3.9.2

~~Where required by NFPA 30, combustible~~ Combustible liquid outdoor storage tanks shall be protected with a foam system where required by NFPA 30.

A.9.3.9.2

The ~~Fire Protection Design Basis Document (FPDBD)~~ should consider ~~the~~ exposure to other combustible liquid storage tanks and important structures, product value, and resupply capability, as well as the anticipated response and capabilities of the local fire brigade.

Commented [BM14]: Annex to 9.3.9.2

9.3.9.3

Outdoor combustible liquid handling and storage areas shall be provided with hydrant protection in accordance with Section 7.4.

9.4 Flammable Liquids.

9.4.1

The storage and associated piping systems for flammable liquids shall comply with NFPA 30 ~~or~~ ASME B31.1, *Power Piping* ~~or~~ and ASME B31.3, *Process Piping*.

9.4.2

Tank filling operations shall be monitored to prevent overfilling.

9.4.3

While flammable liquid unloading operations are in progress, the unloading area shall be manned by qualified personnel trained in the operation of pumping equipment, valving, and fire safety.

9.4.4

Pump installations shall not be located within tank dikes.

9.4.5

Double mechanical seals on pumps shall be provided to reduce potential sources of leaks.

9.4.6

Pressure relief shall be provided for any section of the system containing a low-vapor-pressure flammable fluid that can be isolated between two valves.

9.4.7

Relief valves shall discharge at a location that ~~will limit~~ fire exposure to critical equipment.

9.4.8

Electrical equipment in areas with potentially hazardous atmospheres shall be designed and installed in ~~compliance accordance~~ with NFPA 30_{7i}; Articles 500 and 501 of NFPA 70_{7i}; NFPA 497_{7i} and IEEE C2, *National Electrical Safety Code*.

9.4.9*

~~Emergency~~An emergency isolation valve(s) shall be provided in the piping arrangement to reduce the size of ~~possible any~~ flammable fluid releases.

A.9.4.9

The following should be considered regarding isolation valves:

(1) Actuators for remote-operated emergency isolation valves should be pneumatically or electrically powered. The preferred method would be to provide a "fail safe valve(s)" that closes up on loss of instrument air or electrical power.

(2) If pneumatic power is required to close the valve(s), the air lines and fittings should be of stainless steel construction and electrically operated valves and associated cabling should be provided with fireproofing having a 15-minute rating.

(3) Remote actuation stations are ideally located in a constantly attended control room; ~~but however~~, if locating them as such is not possible or practical, they should be located at least 50 ft (15.2 m) away from anticipated leak points.

Commented [BM15]: Annex material for 9.4.9

9.4.10* Ventilation.

9.4.10.1

To prevent hazardous accumulations of flammable vapors, ventilation for indoor facilities ~~for containing~~ flammable liquids shall provide at least ~~1 cfm of exhaust air per ft² of floor area~~ 1 ft³/min/ft² (0.30 m³/min/m²), but not less than ~~150 ft³/min/ft² (4 m³/min/m²), of floor area.~~

Commented [SK16]: SL: Are both minimums appropriate for a requirement? (Also I fixed the beginning of the first value. Was /ft2 and /m2 missing from the second half?)

A.9.4.10

Ventilation ~~should can~~ be ~~accomplished by~~ mechanical or natural exhaust ~~ventilation arranged in such a manner~~ to include all floor areas or pits where flammable vapors can collect.

Commented [BM17]: Annex for 9.4.10

9.4.10.2~~1~~

Exhaust ventilation discharge shall be to a safe location outside the building.

9.4.11* Fire Protection.

A.9.4.11.1

Commented [SK18]: SL: Nonmandatory language; placed in Annex A.

~~A~~Protection of pumps, associated piping, and fittings using automatic water-spray systems should be considered if either of the following applies:

- (1) They are located in an area exposing other equipment.
- (2) They cannot be remotely isolated.

9.4.11.12*

~~For the equipment and ground area where~~Where leaking flammable fluids could flow and expose affect critical equipment, ~~f~~fixed water spray fire protection systems or monitor nozzles shall be provided.

A.9.4.11.12

The following should be considered regarding monitor nozzles:

- (1) Adjustable monitor nozzles should be used with minimum flow rates of ~~a minimum of~~ 500 gpm (1893 L/min) that will overlap at least one other spray pattern from another monitor nozzle.
- (2) ~~Consider the prevailing winds when~~When locating monitor nozzles, ~~it~~ it should be assumed that due to seasonal changes in wind direction there will be times when could cause some monitor nozzles will to be downwind and ~~not in~~ accessible due to the vapor cloud or heat generated from a fire.
- (3) Fixed water spray systems should be designed in accordance with NFPA 15.

Commented [BM19]: Annex material for 9.4.11.2

9.4.11.23*

Supports for process structures to prevent collapse of these units in the event of a pool fire shall be protected.

A.9.4.11.23

One or more of the following should be considered regarding supports for process structures:

- (1) Steel protected with a 2-hour rated coating (listed in accordance with UL 1709, *Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel*) is acceptable for outdoor use.
- (2) Water spray on the columns is in accordance with NFPA 15.
- (3) ~~Ceiling~~The ceiling sprinkler system is designed in accordance NFPA 13.

Commented [BM20]: Annex material for 9.4.11.3

9.5 Solid Fuels.

9.5.1 Fuel Receiving and Storage Areas.

9.5.1.1

~~The indoor and outdoor~~ fuel receiving, handling, and storage areas, ~~whether indoors or outdoors~~, shall be designed in accordance with the following:

- (1) ~~Section 10.15 and Chapter 33 of NFPA 1 (see Section 10.15 and Chapter 33)~~
- (2) NFPA 80A
- (3) NFPA 652
- (4) NFPA 1144

Commented [KS21]: SL: We can't separate out the x-refs to NFPA 1 in parens; it seems like we're referencing within this document.

9.5.1.2*

A documented self-heating fire response plan shall be developed and made available to all ~~pertinent~~ personnel responsible for monitoring the applicable bulk storage or transport.

Commented [KS22]: SL: The word "pertinent" is somewhat repetitive of "responsible" here.

Commented [PH23]: Stackholders? FPDBD team?

A.9.5.1.2

Storage piles can be subject to fires caused by spontaneous heating.

9.5.1.2.1

Equipment and instrumentation required to implement the fire response plan shall be made available near the ~~site of the~~ bulk storage site.

9.5.1.2.2

The fire response plan and referenced equipment and instrumentation shall ~~also~~ be made available to responding firefighters. Storage piles can be subject to fires caused by spontaneous heating.

Commented [BM24]: Annex for 9.5.1.1

Commented [KS25R24]: Maybe 9.5.1.2? Done.

9.5.1.3*

Where fuels subject to spontaneous combustion are used, the FPDBD shall specify ~~the measures to be taken~~ to lessen the likelihood of storage pile fires.

Commented [PH26]: Subjective statement

Commented [KS27R26]: Agree. Not fitting for a requirement!

A.9.5.1.3

These ~~Such~~ measures are dependent on the type of fuel. Among the more important are the following:

(1) Short duration, active, or "live" storage piles should be worked to prevent dead pockets, which are a potential source of spontaneous heating.

(2) Storage piles should not be located above sources of heat (e.g., such as steam lines), or sources of air (e.g., such as manholes).

(3) Fuel placed in long-term storage should be piled in layers, appropriately spread, and compacted prior to the addition of subsequent layers to reduce air movement and to minimize water infiltration into the pile.

(4) Different types of fuel that are not chemically compatible should not be stored in long-term storage piles.

(5) Access to storage piles should be provided for ~~fire~~ fire fighting operations and for pulling out hot pockets. Where storage barns or domes are used to enclose storage piles, the design of the structure should include dedicated space to allow small vehicles to access all areas of the fuel pile. The design should prevent stored fuel from encroaching on the dedicated space.

Commented [BM28]: Annex for 9.5.1.3

9.5.1.4 [title]

9.5.1.4.1*

Specific hot-load unloading areas shall be designated and separated from other areas (~~preferably outdoors~~) so that to segregate loads containing smoldering or other suspect constituents ~~can be segregated~~.

A.9.5.1.4.1

It is preferred to have hot-load unloading areas designated and separated outdoors.

9.5.1.4.2

Such Hot-load unloading areas shall be properly monitored and equipped to promptly extinguish incipient fires before recombining.

Commented [PH29]: Separate

9.5.1.5

Where overhead cranes are used to load inside feed hoppers from inside the storage pits, the following specifications shall be met:

Commented [KS30]: SL: Can't have considerations in a requirement.

- (1) Locating-Locate the pulpit so that operator safety is not compromised.
- (2) The ability to have-Maintain a clear and unobstructed view of all storage and charging areas.

9.5.1.6

Where a fuel storage barns-barn or domes-are-dome is used to enclose storage piles, the FPDBD shall specify plant-specific features and requirements for fire detection, fire protection, fire alarm, dust collection, dust suppression, explosion venting, and housekeeping for the fuel storage barn or dome recommendations contained herein for fuel handling areas and structures shall be as specified in the FPDBD. The plant specific features provided for the fuel barn/dome shall be as determined during the Fire Protection Design Process. (See Chapter 4.)

Commented [KS31]: SL: Combine to be one requirement (or break into two, in which case we'd need a title for 9.5.1.6).

9.5.2 Bins, Bunkers, and Silos.

9.5.2.1 General.

Storage structures shall be of noncombustible construction and designed to minimize corners, horizontal surfaces, or pockets that cause fuel to remain trapped and present a potential for spontaneous combustion.

9.5.2.2 Access Ports.

9.5.2.2.1

Bins, bunkers, and silos shall be designed with access ports to allow manual fire-fire fighting activities such as the use of a piercing rod hand line for delivery of fire-fighting agents with water. Access ports shall be provided around the bunker or silo to allow direct attack on a fire using a piercing rod.

A.9.5.2.2

An example of such activity would be the use of a piercing rod hand line for delivery of firefighting agents with water.

9.5.2.2.2

Silos greater than 50 ft (15.2 m) in height shall be provided with access ports at multiple elevations.

Commented [PH32]: Separate multiple requirements in one section

9.5.2.3* Emptying.

9.5.2.3.1

~~During planned outages, fuel-Fuel~~ bins, bunkers, or silos shall be emptied to the extent practical during planned outages.

Commented [PH33]: Subjective

A.9.5.2.3~~2~~

The shutdown period ~~of shutdown requiring for~~ emptying ~~of~~ the bins depends on the spontaneous heating characteristics of the fuel. Spontaneous heating can be slowed by minimizing air flow through the bins by ~~such means as~~ inerting, filling the bins with high-expansion foam, or sealing the surface of the fuel with an appropriate binder ~~/or~~ sealer designed for ~~this-the~~ purpose.

Commented [BM34]: Annex for 9.5.2.2

~~During idle periods, flammable-Flammable~~ gas levels, CO levels, and temperatures should be monitored during idle periods.

Commented [BM35]: Annex for 9.5.2.2

9.5.2.3.2*

Bins, bunkers, or silos shall be provided with provisions for emptying.

A.9.5.2.3.2

Once spontaneous heating develops to the fire stage, it becomes very difficult to extinguish the fire short of emptying the bin, bunker, or silo.

Commented [BM36]: Annex for 9.5.2.2

This ~~unloading-emptying~~ process might take the form of conveyors discharging to a stacking out pile. Another method would be to use flanged openings for removing the fuel if adequate planning and necessary equipment have been provided. Removing hot or burning fuel can lead to a dust explosion if a dust cloud develops. Proper ~~preplanning-plans~~ should be developed to prevent a dust cloud, such as covering the fuel with a blanket of high-expansion foam, water mist, water spray with ~~fire-fire~~ fighting additives, dust suppression, or dust collection.

Commented [BM37]: Annex for 9.5.2.5

9.5.2.4 Bin, Bunker, or Silo Fires.

9.5.2.4.1*

Any manual actions necessary for suppression and extinguishment of bin, bunker or silo fires shall be described and evaluated in the DBD. ~~The FPDBD shall identify any equipment needed to perform these manual actions.~~

Commented [BM38]: Reworded.

Commented [BM39]: New test

A.9.5.2.4.1

The following ~~fire-fire~~ fighting strategies have been successfully employed (depending on the specific circumstances and type of fuel used):

(1) Use of ~~fire-fire~~ fighting additives, such as Class A foams, penetrants, or wetting agents and water additives

~~(2) +~~

~~(2)~~ Emptying the bin, bunker, or silo to a safe location (inside or outside the powerhouse) and removing the debris

Commented [BM40]: Annex material 9.5.2.6.1

~~The following fire-fighting strategies should be taken into consideration:~~

~~(1)~~ Water has been used successfully to control fires, ~~though-However~~, the possibility of an explosion exists under certain circumstances if the water reaches the fuel in a hot spot and the amount of water delivered in a stream can create structural support problems. Therefore, water is not a recommended ~~fire-fire~~ fighting

Commented [KS41]: SL: No need for a list intro. The second strategy is advised against, so I'm not sure what this intro is doing! We can have these 3 as paragraphs instead,

strategy for these types of fire events. ~~The amount of water delivered in a stream can create structural support problems.~~ However, use of ~~fire-fire~~fighting additives with water can be highly effective for fuel fires, especially sub-bituminous coal fires and, potentially, fires involving other type of fuels. ~~This use-Use~~ of ~~fire-fire~~fighting additives typically results in significantly less water being delivered due to the enhanced fire suppression properties of the agent and subsequent shorter delivery period.

~~(2)~~ Steam-smothering has also been used to control 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 hot spots and extinguishing them before the fuel leaves the bin, bunker, or silo is an accepted practice. The fuel hot spots are detected and extinguished. If additional hot spots are detected as the fuel drops down, fuel flow should be stopped and the hot spots extinguished. If the hot spots are exposed during the lowering of the fuel, ~~potential for dust explosions~~ potential is increased.

Commented [BM42]: Annex for 9.5.2.6.1

9.5.2.4.2

The FPDBD shall identify any equipment needed to perform these necessary manual actions.

9.5.2.5*

If required by the FPDBD, fixed or portable carbon monoxide monitoring shall be provided to detect spontaneous heating and hazardous conditions.

A.9.5.2.5

~~Care should be taken where~~ Personnel should exercise caution when working in enclosed or confined areas near fuel bins, bunkers, or silos ~~in confined areas~~ because spontaneous heating can generate gases that are both toxic and explosive.

Commented [BM43]: Annex for 9.5.2.7

9.5.2.6*

Dusttight barriers shall be provided between the boiler house and the areas of the fuel handling system above the bin, bunker, or silo.

A.9.5.2.6

It might not be practical to install explosion vents on a bin, bunker, or silo. Typical designs do not have sufficient area above the fuel level for properly designed explosion vents. Vents would present an exposure hazard to any personnel in adjacent areas (see NFPA 652).

Commented [BM44]: Annex for 9.5.2.9

9.5.2.7-1

If ~~explosion vents are~~ required by the FPDBD, they explosion vents shall be designed in accordance with NFPA 68.

9.5.3 Dust Suppression and Control.

9.5.3.1*

Dust generated due to fuel handling shall be controlled by one or more of the following methods as determined by the FPDBD:

- (1) ~~A dust~~ Dust collection system
- (2) ~~A dust~~ Dust suppression system
- (3) ~~An open~~ Open-air construction
- (4) Passive design features of the conveyor chutes and dust hoods to minimize generation of dust and spillage of fuel at the transfer points
- (5) Routine cleaning of fuel handling areas

~~Some dusts can constitute a fire and explosion hazard that should be identified and, if needed, controlled.~~

A.9.5.3.1

~~Some dusts can constitute a fire and explosion hazard that should be identified and, if needed, controlled.~~

The frequency of cleaning activities is plant specific based on factors such as refueling activities, the type of fuel, and space construction features, ~~and so on~~. Dust accumulation on overhead beams and joists contributes significantly to the secondary dust cloud. Other surfaces, such as the tops of ducts and large equipment, ~~can~~ also contribute significantly to the dust cloud potential. Due consideration should be given to dust that adheres to walls; because it is easily dislodged. Attention and consideration should also be given to other projections such as light fixtures, which can provide surfaces for dust accumulation.

Dust suppression systems usually consist of spray systems using water, surfactants, binders, or a combination ~~thereof~~ these to reduce the dust generation of fuel handling operations. The sprays are normally applied at or near those locations where the fuel is transferred from one conveyor to another and at stack-out points.

9.5.3.2*

Where dust collection or suppression systems are installed to prevent hazardous dust concentration, appropriate electrical and mechanical interlocks shall be provided to prevent the operation of fuel handling systems prior to the starting and sustained operation of ~~the~~ dust control equipment.

9.5.3.3* Dust Collectors.

A.9.5.3.3

~~For See NFPA 652 for more on dust collection systems provided for handling combustible dusts, see NFPA 652. Other recommendations for reducing the probability of explosion and fire from combustible dust are as follows:~~

- (1) Fans for dust collectors should be installed downstream of the collectors so that they handle only clean air.
- (2) 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.
- (3) Dust collectors should not discharge into inactive fuel storage bins, bunkers, or silos.
- (4) High-level detection with an annunciator alarm should be provided for the dust hoppers.
- (5) Monitoring and trending for carbon monoxide should be provided for dust collectors to detect spontaneous combustion.

Commented [BM45]: Remove or make annex material

Commented [BM46]: Remove or make annex material

Commented [BM47]: Annex material for 9.5.3.1

Commented [BM48]: Annex material for 9.5.3.1

(6) Dust collected in a dust collection system, baghouse, or cyclone should be discharged downstream of the collection system, back to the conveying system, or back to the residue or waste stream.

9.5.3.3.1

Dust collectors for combustible dusts shall be located outside except as permitted by 9.5.3.3.2.

9.5.3.3.2

Where dust collectors for combustible dusts cannot be located outside, one of the following requirements shall be met:

(1) ~~they~~ The combustible dusts shall be vented to a safe location outside *(see NFPA 68)*.

(2) ~~or explosion~~ Explosion suppression systems shall be provided *(See ~~see~~ NFPA 69)*. ~~For dust collection systems provided for handling combustible dusts, see NFPA 652. Other recommendations for reducing the probability of explosion and fire from combustible dust are as follows:~~

(1) ~~Fans for dust collectors should be installed downstream of the collectors so that they handle only clean air.~~

(2) ~~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.~~

(3) ~~Dust collectors should not discharge into inactive fuel storage bins, bunkers, or silos.~~

(4) ~~High-level detection with an annunciator alarm should be provided for the dust hoppers.~~

(5) ~~Monitoring and trending for carbon monoxide should be provided for dust collectors to detect spontaneous combustion.~~

(6) ~~Dust collected in a dust collection system, baghouse, or cyclone should be discharged downstream of the collection system, back to the conveying system, or back to the residue or waste stream.~~

9.5.3.4*

Cleaning methods such as involving vigorous sweeping of dust or blowing down with steam or compressed air shall not be used where these such methods can produce an explosive atmosphere.

A.9.5.3.4

Preferred cleaning methods would use appropriate portable or fixed pipe vacuum cleaners of a type approved for dust hazardous locations or low-velocity water spray nozzles and hose.

9.5.4* Conveyors.

A.9.5.4

Conveyor belts should be constructed of material designed to resist ignition. U.S. The US Mine Safety and Health Administration and the Canadian Bureau of Mines Standards for fire-retardant conveyor belt materials should be used as a guides. However, “fire-retardant” belt materials will burn and therefore might require additional fire protection.

9.5.4.1

Commented [BM49]: Annex for 9.5.3.1? Or break into separate shall requirements? Or combination

Commented [SK50R49]: SL: There's already annex for 9.5.3.1... I'll put this as annex for 9.5.3.3 for now? Move if necessary?

Commented [SK51]: SL: Specificity since this is requirement?

Commented [BM52]: Annex for 9.5.3.6

Commented [BM53]: Annex to 9.5.4

Each conveyor system shall be arranged to automatically shut off driving power in the event of belt slowdown of greater than 20 percent or misalignment of belts.

9.5.4.2

A complete belt interlock shutdown system shall be provided ~~so such that, if stopping of~~ any conveyor ~~stops, causes~~ the power to all conveyor systems feeding that belt ~~would to~~ be shut down automatically.

Commented [PH54]: Separate.

9.5.4.32*

Where unlisted ~~non fire non-fire~~ retardant hydraulic fluids ~~must be are~~ used, the FPDDB shall ~~consider~~ ~~require~~ protection by a fire suppression system.

Commented [PH55]: To a standard?

Commented [KS56]: SL: This needs to be a requirement, not a consideration, especially if we're permitting unlisted fluids.

Commented [BM57]: Annex for 9.5.4.3

A.9.5.4.32

Hydraulic systems should use only listed fire-retardant hydraulic fluids.

9.5.4.43*

A means for removing foreign material shall be provided as early in the fuel handling process as ~~is~~ ~~practical possible~~.

A.9.5.4.43

Foreign materials pose a threat to shredders, crushers, pulverizers, and feeders by interrupting the flow of fuel or by causing sparks capable of igniting dust/air mixtures. Methods of removing tramp metals and other foreign materials include magnetic separators, pneumatic separators, and screens.

Commented [BM58]: Annex for 9.5.4.4

9.5.4.54

~~Prior to extended idle periods, the~~ The conveyor system shall be cleared of fuel ~~prior to extended idle periods if the fuel is~~ subject to spontaneous combustion.

Commented [PH59]: Subjective

Commented [KS60R59]: I agree. We should specify time.

9.5.4.65*

Conveyors handling noncombustible materials shall ~~meet the recommendations of~~ comply with 9.5.4.1 through 9.5.4.3, 9.5.5.1, 9.5.6.1 through 9.5.6.4, and 9.5.6.6.

A.9.5.4.65

These conveyors are typically components of FGD systems and fluidized bed boiler systems, and the materials transported typically include limestone and gypsum.

Commented [BM61]: Annex for 9.5.4.6

9.5.5 Fuel Conveying and Handling Structures.

9.5.5.1

Fuel conveying and handling structures and supports shall be constructed of noncombustible materials ~~construction~~.

9.5.5.2*

~~The potential for accumulation of combustible dust in enclosed~~ Enclosed buildings shall be designed to reduce accumulation of combustible dust and to provide access for reduced by design. ~~Access shall be provided to facilitate~~ cleaning of all areas.

Commented [BM62]: Split and reworded

A.9.5.5.2

Structural members can be shaped or installed on the exterior of the enclosure to minimize the surface area where dust can settle.

Commented [BM63]: Annex to 9.5.5.2

9.5.5.3

Explosion venting for enclosed structures shall comply with NFPA 68.

9.5.5.4

~~lighting~~ Lighting and electrical power circuits shall be de-energized without requiring personnel to enter dust-producing sections of the plant during emergencies.

9.5.5.5

~~Split into subsections~~ Areas of the fuel handling system requiring heat shall use approved heaters suitable for hazardous areas.

9.5.5.5.1

The heating equipment shall be kept free of dusts.

9.5.5.5.2

The heating equipment shall be designed to limit surface temperature below the autoignition temperature of the material and dust.

9.5.5.6 Electrical Equipment.

9.5.5.6.1

Electrical equipment within fuel handling areas ~~with potential at risk~~ for combustible dust generation shall be approved for use in ~~hazardous locations~~ Class II, Division 1 or Division 2 hazardous locations. (See Article 502 of NFPA 70 and NFPA 499.)

9.5.5.6.2

Electrical equipment subject to accumulations of methane gas or carbon monoxide shall be listed and installed, as appropriate, for use in ~~hazardous locations~~ Class I, Division 2, Group D hazardous locations. (See Articles 500 and 501 of NFPA 70, NFPA 497, and Section 127 of IEEE C2, National Electrical Safety Code.)

9.5.5.7*

Static electricity hazards shall be minimized by the permanent bonding and grounding of all conductive equipment, ~~including duct work, pulleys, take-up reels, motor drives, dust collection equipment, and vacuum cleaning equipment.~~ (See NFPA 77.)

A.9.5.5.7

Conductive equipment to be bonded and grounded includes duct work, pulleys, take-up reels, motor drives, dust collection equipment, and vacuum cleaning equipment.

9.5.6 Fire Protection.

9.5.6.1*

Automatic sprinkler or water spray fixed systems shall be provided for fuel handling structures that are critical to power generation and subject to accumulations of fuel or fuel dust.

Commented [PH64]: To a standard

A.9.5.6.1

Stacker-reclaimer and barge/ship unloader conveyors present unique fire protection concerns. Protection of the equipment and safety of the personnel is made more difficult ~~due to~~ by the movement-in-place capabilities of the equipment and its mobility and movement along a fixed rail system. Provision of hydrants in the area might not be sufficient protection primarily due to the extreme delay in response in the event of fire emergency and the difficulty in reaching all areas involved in a fire with hand-held hose equipment.

9.5.6.1.1

Where provided, automatic sprinkler systems shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) density over a 2500 ft² (232 m²) area. ~~Note reference NFPA 15 use of option linear feet~~

9.5.6.1.2

Where water spray fixed systems are used to protect structures, a density of 0.25 gpm/ft² (10.2 mm/min) shall be used.

9.5.6.2*

Automatic sprinkler or water spray fixed systems shall be provided for conveyors that are critical to continuous power generation.

A.9.5.6.2

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

Commented [BM65]: Annex for first part of 9.5.6.2

If a sprinkler system is used to protect the conveyor, particular care should be exercised in locating closed sprinkler heads so that they will be in the path of the heat produced by the fire and still be in a position to provide good coverage of all belt surfaces along the conveyor. (See NFPA 15.) The conveyor width and other sprinkler obstructions should be considered in protection of the return belt and other floor level equipment. (See NFPA 13 for positioning of sprinklers to avoid obstructions.) Where sprinklers cannot provide adequate coverage due to obstructions, a water spray system using above- and below-belt nozzles should be considered instead of a sprinkler system.

Commented [BM66]: Annex for 9.6.5.2

~~Conveyors that are below grade or enclosed shall be provided with automatic water spray or sprinkler systems.~~

Conveyors that are below grade or enclosed are extremely hazardous to maintenance or fire-fighting personnel in the event of a fire. Even though they might not be critical to plant operations, they should be provided with automatic water spray or sprinkler systems ~~protection should be considered for these conveyors.~~

Commented [BM67]: Annex for 9.6.5.2

Commented [BM68]: Annex for 9.5.6.2.2

9.5.6.2.1*

Where provided, system coverage shall include transfer points ~~(tail dust hoods and head chutes).~~

A.9.5.6.2.1

Examples of transfer points include tail dust hoods and dead chutes.

9.5.6.2.2

Sprinklers shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) density over 2000 ft² (186 m²) of enclosed area or the most remote 100 linear ft (30 m) of conveyor structure up to 2000 ft² (186 m²).

9.5.6.2.3

Where water spray systems are provided, the design criteria in NFPA 15 shall be applied.

9.5.6.2.4

Where water spray or sprinkler systems are provided on conveyors, actuation of water spray or sprinkler systems shall shut down the conveyor belt involved and all conveyor belts feeding the involved belt.

9.5.6.2.5

Where provided, the sprinkler or water system control valve shall be located in an area or enclosure separate from the hazard.

9.5.6.2.6

Where required by the FPDBD, dust collectors and fans shall automatically shut down along with other related equipment upon detection of fire.

9.5.6.2.7*

Where required by the FPDBD due to the length of the conveyor, draft barriers shall be installed at the end and midpoints of enclosed conveyors and between separate sprinkler and water spray systems.

A.9.5.6.2.7

Draft barriers will improve the response time of installed automatic sprinkler or detection systems and minimize the chimney effects in the event of fire.

9.5.6.2.7.1

Where required by the FPDBD due to the length of the conveyor and water supply limitations, multiple water spray systems shall be provided.

A.9.5.6.2.7

Draft barriers will improve the response time of installed automatic sprinkler or detection systems and minimize the chimney effects in the event of fire.

9.5.6.3*

Where required by the FPDBD, an automatic water spray or sprinkler system shall be provided over the conveyor belt and striker plate areas within the stacker-reclaimer.

A.9.5.6.3

Commented [BM69]: Annex for 9.5.6.2.6

The water supply could be from a 3000 gal to 5000 gal (11,355 L to 18,925 L) capacity pressure tank located on-board. A fire department pumper connection should be provided so connection can be made to the fire hydrants in the area during down or repair periods to provide a more adequate water supply.

9.5.6.3.1

Where required by the FPDDB, enclosed electrical control cabinets on a stacker-reclaimer shall be protected by a pre-engineered fixed automatic gaseous-type suppression system activated by a fixed temperature detection system.

Commented [BM70]: Annex to 9.5.6.1

~~A.9.5.6.3~~

~~The water supply could be from a 3000 gal to 5000 gal (11,355 L to 18,925 L) capacity pressure tank located on-board. A fire department pumper connection should be provided so connection can be made to the fire hydrants in the area during down or repair periods to provide a more adequate water supply.~~

Commented [BM71]: Annex for 9.5.6.4

9.5.6.4*

Where required by the FPDDB, bag-type dust collectors, baghouses, and cyclone-type separators that are located inside buildings or structures shall be protected with automatic sprinkler or water spray systems inside of the collectors.

9.5.6.4.1*

Where provided, sprinklers for bag-type dust collectors, baghouses, and cyclone-type separators shall be designed for ordinary-hazard systems. ~~Sprinkler and water spray systems should be designed for a density of 0.20 gpm/ft² (8.1 mm/min) over the projected plan area of the dust collector. Use of fire fighting additives should be considered for dust collectors used for materials that are subject to spontaneous combustion (e.g., sub-bituminous coal dust collectors).~~

Commented [HT72]: Split into separate sections or consider moving some to annex material

A.9.5.6.4.1

Sprinkler and water spray systems should be designed for a density of 0.20 gpm/ft² (8.1 mm/min) over the projected plan area of the dust collector. Use of fire-fighting additives should be considered for dust collectors used for materials that are subject to spontaneous combustion (e.g., sub-bituminous coal dust collectors).

Commented [HT73]: Split into separate sections or consider moving some to annex material

~~Consideration should be given to providing automatic~~ Automatic sprinkler systems should be considered for bag-type dust collectors, baghouses, and cyclone-type separators located outdoors with the following characteristics:

- (1) ~~Are They are~~ in continuous operation.
- (2) ~~Process They process~~ large amounts of combustible dust.
- (3) ~~*Have They have~~ limited access for manual fire-fighting.
- (4) ~~Are They are~~ critical to plant operation.

Commented [BM74]: Annex for 9.5.6.5.1

9.5.6.4.2*

Where provided, protection inside dust collectors shall include the clean air plenum and the bag section.

A.9.5.6.4.2

~~Consideration should be given to providing~~ Providing detection-only systems on noncritical conveyors to facilitate a manual response should be considered.

Commented [BM75]: Annex for 9.5.6.2

9.5.6.4.2.1

If the hopper is shielded from water discharge, sprinklers also ~~shall~~ be provided in the hopper section.

~~A.9.5.6.4.2~~

~~Consideration should be given to providing detection-only systems on noncritical conveyors to facilitate a manual response.~~

Commented [BM76]: Annex for 9.5.6.2

9.6* Hydraulic Control System.

~~9.6.1*~~

Hydraulic control systems shall use a listed fire-resistant fluid.

~~A.9.6.1~~

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-uses 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.

Commented [BM77]: Annex for 9.6.1

9.6.1.1*

Combined systems using lube oil as the hydraulic fluid shall be provided with ~~an~~ automatic fire suppression.

Commented [SK78]: SL: This annex discussing how to know if fire-resistant fluid is needed or not doesn't make much sense because the requirement doesn't allow any alternatives...

~~A.9.6.1.1~~

~~Where water sprinkler and spray systems are provided, protection shall-should be over oil-containing equipment and for 20 ft (6.1 m) beyond in all directions.~~

Commented [AB79]: RE-examine at a later date

For water sprinkler and spray systems, a density of 0.25 gpm/ft² (10.2 mm/min) ~~shall-should~~ be provided.

Commented [AB80]: RE-visit if it should be 0.30 gpm

Where compressed air foam systems are provided, they ~~shall-should~~ be designed and installed in accordance with NFPA 11 and its listing for the specific hazards and protection objectives specified in the listing.

Commented [BM81]: Split ... needs renumbered

9.6.2.1.2*

~~If a listed fire-resistant fluid is not used and where required~~ Where permitted by the FPDDB, hydraulic equipment, reservoirs, coolers, stop valves, intercept valves, reheat valves, and associated oil-filled equipment shall be provided with automatic fire suppression in lieu of using listed fire-resistant fluid.

Commented [SK82]: SL: Not sure if this is supposed to be mandatory or annex...

~~A.6.2.1.2~~

Fire protection can consist of automatic sprinkler, water spray protection, water additive, gaseous extinguishing, hybrid extinguishing ~~systems~~, or compressed air foam systems.

Commented [BM83]: Annex for 9.6.1.2

9.6.3.1.3

Commented [AB84]: Annex material for 9.6.1.1

Oil piping shall be welded and flanged to minimize the possibility of an oil leak due to severe vibration.

9.7 Electrical Equipment.

9.7.1* General.

Electrical equipment in areas with potentially hazardous atmospheres shall be designed and installed in compliance with Article 500 of *NFPA 70* and IEEE C2, *National Electrical Safety Code*.

A.9.7.1

Where ~~Switchgear~~ ~~switchgear~~ buildings, motor control centers, and control rooms could be exposed to a flammable vapor cloud, they should be pressurized using air from a safe location to prevent vapor entry. ~~Combine into one paragraph~~ Pressure should be monitored, with an alarm sounding to a constantly attended location upon loss of pressure ~~to a constantly attended location~~.

9.7.2 Control, Distributed Control System (DCS), and Telecommunications Rooms.

9.7.2.1

Control, distributed control system (DCS), or telecommunications buildings, rooms, and enclosures shall meet the applicable requirements of NFPA 75.

9.7.3*

A smoke detection system shall be installed throughout buildings, rooms, or enclosures, including walk-in-type consoles, above suspended ceilings where combustibles are installed, and below raised floors.

A.9.7.3

Where the only combustibles above the false ceiling are cables in conduit and the space is not used as a return air plenum, smoke detectors are permitted to be omitted from this area.

In addition, total flooding gaseous fire-extinguishing systems should be considered for areas 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.

9.7.4*

~~In addition, total flooding gaseous fire-extinguishing systems should be considered for areas 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.~~

A.9.7.4

Fire protection can consist of automatic sprinkler protection, hybrid fire-extinguishing, or automatic water mist fire protection systems.

Individual equipment and cabinet protection could be considered in lieu of total flooding systems.

9.7.45*

Cable raceways not terminating in the control room shall not be routed through the control room.

A.9.7.5

~~Fire protection can consist of with automatic sprinkler, water spray, water mist, hybrid fire-extinguishing, or automatic gaseous-extinguishing systems.~~

Commented [AB85]: Other countries that have their own standards those should be used instead. Re-word for annex material.

Commented [AB86]: Move to annex material

Commented [PH87]: To standard?

Commented [BM88]: Annex for 9.7.3

Commented [AB89R88]: Agree

Commented [AB90]: Keep in and reword to comply with NFPA 75, chapter 9.1, 2020 edition

Commented [SK91]: SL: This had nonmandatory language in it...

Commented [BM92]: Annex for 9.7.4

Commented [AB93R92]: Agree

Commented [BM94]: Annex for 9.7.4 second part

Commented [AB95R94]: We agree

Commented [BM96]: Annex for 9.7.5

9.7.56 Cable Spreading Room and Cable Tunnels.

9.7.56.1*

Cable spreading rooms, occupiable cable tunnels, and other rooms with significant concentrations of combustible cable jacketing or oil-filled cable shall be protected.

A.9.7.56.1

[This coverage is for area protection. Individual cable tray tier coverage could be required based on the fire risk evaluation. If water-type systems cannot be used, foam or gaseous systems should be provided.]

Commented [BM97]: Annex to 9.7.6.1

Commented [AB98R97]: We agree

9.7.56.1.1

Automatic sprinkler systems shall be designed for a density of 0.30 gpm/ft² (12.2 mm/min) over 2500 ft² (232 m²) or the most remote 100 linear ft (30 m) of cable tunnels up to 2500 ft² (232 m²).

9.7.56.2

Cable spreading rooms and cable tunnels shall be provided with a fire detection system.

9.7.67 Grouped Electrical Cables or Areas with High Cable Concentrations.

9.7.67.1*

Grouped electrical cables shall be routed away from exposure hazards except as permitted by 9.7.6.1.1.

9.7.6.1.1*

Where routing cable trays near sources of ignition or flammable and combustible liquids is unavoidable, cable trays shall be provided with fire protection.

A.9.7.67.1.1

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

Commented [BM99]: Annex for 9.7.7.1

Commented [AB100R99]: We agree

9.7.67.2

Electrical power, control, and instrument cabling required for safe shutdown of critical equipment during emergency plant shutdown shall be routed outside the fire area, ~~in areas where there is~~ the potential for flammable or combustible liquid pool fires exists, except as permitted by 9.7.6.2.1. PER the FPDBD?

9.7.67.2.1

If ~~routed routing~~ through the fire area ~~is unavoidable and if required by the FPDBD~~, critical cabling shall be permitted by the FPDBD to be protected with fireproofing material in accordance with ASTM E1725, *Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components*, or API 2218, *Fireproofing Practices in Petroleum and Petrochemical Processing Plants*.

Commented [AB101]: Design Basis Document first time in () and be consistent

9.7.67.3*

Cable trays subject to accumulation of combustible dust or the spread of an oil spill shall be covered by sheet metal. ~~Where the potential for oil leakage is possible, solid bottom trays shall be avoided.~~

A.9.7.67.3

Changes in elevation can prevent oil travel along cables in a tray.

Commented [BM102]: Annex material for 9.7.7.3

Commented [AB103R102]: We agree

9.7.6.3.1

~~Where the potential for oil leakage exists is possible, solid-bottom trays shall be avoided.~~

9.7.67.4*

~~The FPDBD shall consider the provision of fire suppression systems or fire-retardant cable coatings, or both, for protection of cable concentrations from exposure fires. Where fire-retardant coatings are applied to power cables, the design shall ensure that derating of the cable is considered.~~

Commented [PH104]: Subjective

A.9.7.67.4

~~The FPDBD shall consider the provision of providing fire suppression systems or fire-retardant cable coatings, or both, for protection of cable concentrations from exposure fires.~~

Commented [PH105]: Subjective

~~Consideration also should be given to the ability to add Adding or remove-removing cables and to make making repairs to cables protected with fire-retardant coatings should be considered.~~

Commented [BM106]: Annex for 9.7.7.4

Commented [AB107R106]: We agree

9.7.67.5*

In plants where ~~the potential for hazardous atmospheres exists are present~~, arc-resistant switchgear ~~(see IEEE C37.20.7, Guide for Testing Metal Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults)~~ shall be used.

A.9.7.6.5

~~See IEEE C37.20.7, Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults, for more information.~~

9.7.78* Battery Rooms.

Battery rooms shall be provided with ventilation to limit the concentration of hydrogen to 1 percent by volume.

A.9.7.7

For further information refer to IEEE 484, *Recommended Practice for Installation Design and Installation of Vented Lead-Acid Batteries for Stationary Applications*.

Commented [BM108]: Annex material for 9.7.8

Commented [AB109R108]: We need to review and all get on same page.

Commented [AB110R108]: Lets bring this up to the group , need further discussion.

Commented [AB111R108]: Maybe go with IFC?

Commented [AB112]: Shall because DBD... for further discussion

Commented [BM113]: Annex for 9.7.9

Commented [AB114R113]: We agree

9.7.89* Transformers.

~~Where required by the FPDBD, oil~~Oil-filled main, station service, and startup transformers not meeting the separation or fire barrier recommendations in 6.1.4 shall be protected ~~as required by the FPDBD.~~

A.9.7.89

Protection can consist of automatic water spray systems, systems with water additives, or foam-water spray systems.

9.7.910 Substations and Switchyards.

Substations and switchyards located at the generating facility and ~~utilizing using~~ combustible oil-filled equipment should be protected by the yard fire hydrant system where practical.

Spatial separation of transformers and other equipment containing over 500 gal (1893 L) of oil should ~~be in accordance comply~~ with 6.1.4. ~~Consideration should be given to water~~ Water spray protection of transformers critical to the transmission of the generated power ~~should be considered~~.

Commented [PH115]: Shall requirement or Annex

Commented [SK116R115]: There is no "shall" language so this needs to be annex but there's no text in 9.7.9 for this to be annex...

Commented [PH117]: To a standard

9.8 Storage Rooms, Offices, and Shops.

Where required by the FPDDB, automatic sprinklers shall be provided for storage rooms, offices, and shops containing combustible materials that present an exposure to surrounding areas that are critical to plant operations. *(For oil storage rooms, see Section 9.9.)*

9.9* Oil Storage Areas.

Where required by the FPDDB, clean or dirty oil storage areas shall be protected.

A.9.9

This area generally represents the largest concentrated oil storage in the plant. The designer should consider, as a minimum, the installation of fixed automatic fire protection systems and the separation, ventilation, and drainage requirements in Chapter 6.

Commented [BM118]: Annex for 9.9

Commented [AB119R118]: We agree

9.10 Warehouses.

Where required by the FPDDB, automatic sprinklers ~~should shall~~ be provided for warehouses that contain high-value equipment and combustible materials that are critical to power generation or that constitute a fire exposure to other important buildings.

Commented [AB120]: Topic for another time for discrepancies with the building and fire codes

Commented [PH121]: To a standard.

9.11 Fire Pumps.

Rooms housing diesel-driven fire pumps shall be protected in accordance with NFPA 20.

9.12 Cooling Towers.

Where required by the ~~FP~~ FPDDB, cooling towers of combustible construction that are essential to continued plant operations shall be protected by automatic sprinkler or water spray systems in accordance with NFPA 214.

9.13 Auxiliary Boilers.

9.13.1

Auxiliary boiler-furnaces, their fuel burning systems, combustion products removal systems, and related control equipment shall be designed, installed, and operated in accordance with 12.3.1.

9.13.2*

Where required by the FPDDB, oil-fueled auxiliary boilers installed within main plant structures shall be protected.

A.9.13.2

Protection can consist of automatic sprinkler, water spray, ~~or foam-water sprinkler systems~~, or compressed air foam systems. A sprinkler system is preferred throughout the auxiliary boiler room on a 0.25 gpm/ft² (10.2 mm/min) density.

Commented [AB122]: Should this be 0.30?

Commented [BM123]: Annex for 9.13.2

Commented [AB124R123]: We agree

9.13.2.1

Where required by the FPDDB, sprinklers, water spray protection, or systems with water additives shall be provided as outlined in 12.3.1.1.

9.13.2.2

Where provided, compressed air foam systems shall be designed and installed in accordance with NFPA 11 and their listing for the specific hazards and protection objectives specified in the listing.

9.14 Vehicle Repair Facilities.

Vehicle repair facilities shall meet the requirements of NFPA 30A.

9.15 Air Compressors.

Where required by the FPDDB, air compressors containing a large quantity of oil shall be protected.

Commented [AB125]: What is the definition of large quantity

9.15.1

Where required by the FPDDB, automatic sprinkler protection shall be designed for a density of 0.25 gpm/ft² (10.2 mm/min) over the postulated oil spill area.

Commented [AB126]: 0.30?

9.15.2

Where required by the FPDDB, compressed air foam systems shall be designed and installed in accordance with NFPA 11 and their listing for the specific hazards and protection objectives specified in the listing.

A.9.15.2

Where the hazard is not great enough to warrant a fixed-fire suppression system, automatic fire detection should be considered (*see 7.7.2*).



Public Input No. 53-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 10]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter10_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 10 based on work by Task Group 3 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 10 Turbines, Generators, and Internal Combustion Engines

10.1 General.

Combustion turbine (CT), steam turbine (ST), and internal combustion engine (ICE) electric generating units shall comply with Chapters 4 through 9, as applicable.

Commented [SK1]: SL: Modified to remove repetition of "applicable chapters" and "shall apply".

10.1.1

~~Chapter 10 identifies fire and explosion hazards of combustion turbine (CT), steam turbine (ST), and internal combustion engine (ICE) electric generating units and specifies recommended protection criteria.~~

10.1.2

~~It should be recognized that some CT generating facilities consist of manufactured modules wherein construction consists of siting these modules, providing fuel supply, essential services, and interconnections to the electric system, while other facilities consist of buildings specifically designed and built or modified for the CT generator and its auxiliaries. Therefore, some recommendations might be more suitable for one type of plant than another.~~

10.1.3

~~ST generating facilities consist of turbine assemblies and auxiliary equipment wherein construction consists of incorporating these items into a boiler or HRSG steam system. Although the typical installation is in an open area within a dedicated turbine building, outdoor installations with weather enclosures for the turbine are known and acoustic enclosures might be incorporated for indoor units. As for the CT installations, some recommendations might be more suitable for one type of plant than another.~~

10.1.4*

~~Modern ICE generating equipment is typically provided as a complete package requiring only a fuel source and electrical connections to the system to be powered. The installations should be either fixed/permanent or installed as a portable/temporary power source. The recommendations of this chapter should be applied to fixed nonresidential installations only.~~

A.10.1.4

~~Although it is intended that these recommendations are to be applied to fixed, nonresidential ICEs only, larger portable units (often trailer mounted) can include fire detection and suppression systems to limit damage from fire. The recommendations of this chapter can be used as guidance for these units as well.~~

10.1.5

~~Compressors and regulating stations installed on-site should be protected in accordance with the recommendations of Chapter 10.~~

[ALL NEW TEXT FOLLOWING 10.1]

10.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which requirements apply to specific CT, ST, and ICE electric generating units.

A.10.2

~~Following are descriptions of CT, ST and ICE facilities~~

~~(1) CT Facilities. It should be recognized that some~~ Some CT electric generating facilities consist of manufactured modules wherein construction consists of siting these modules, ~~and~~ providing fuel supply, essential services, and interconnections to the electric system; ~~while~~ other CT facilities consist of buildings specifically designed and built or modified for the CT generator and its auxiliaries. Therefore, some protection measures might be more suitable for one type of plant ~~than over~~ another.

~~(2) ST Facilities. ST electric~~ generating facilities consist of turbine assemblies and auxiliary equipment wherein construction consists of incorporating these items into a boiler or HRSG steam system. Although ~~the a~~ typical installation is in an open area within a dedicated turbine building, outdoor installations with weather enclosures for the turbine ~~are known exist~~ and acoustic enclosures might be incorporated for indoor units. As for the CT installations, some protection measures might be more suitable for one type of plant ~~than over~~ another.

~~(3) ICE Facilities. Modern ICE electric~~ generating equipment is typically provided as a complete package requiring only a fuel source and electrical connections to the system to be powered. The installations should be either fixed/permanent or ~~installed as a~~ portable/temporary power source. The protection measures in ~~this chapter~~ Chapter 10 should be applied to fixed nonresidential installations only.

~~(4) Although it is intended that these the~~ requirements of Chapter 10 ~~are to~~ be applied to fixed, nonresidential ICEs only, larger portable units (often trailer mounted) can include fire detection and suppression systems to limit damage from fire. The requirements of ~~this chapter~~ Chapter 10 can be used as guidance for these units as well.

The major fire and explosion hazards associated with ~~combustion turbine (CT), steam turbine (ST), and internal combustion engine (ICE)~~ electric generating units are as follows:

- (1) Flammable and combustible fuels
- (2) Hydraulic and lubricating oils
- (3) Electrical and control equipment
- (4) Filter media
- (5) Combustible enclosure insulation
- (6) Internal explosions in CTs
- (7) Crankcase explosions in ICEs

In the event of a pipe failure, large amounts of oil or fuel could be released and ignite on contact with hot metal parts. In addition to external fire hazards, CTs are subject to explosions if flameout occurs and the fuel is not shut off immediately, or if fuel is admitted to a hot engine and ignition does not occur. Crankcase explosions in ICEs have caused large external fires.

10.1.2

Where required by the FPD BD, compressors and regulating stations installed on-site shall be protected in accordance with ~~this chapter the recommendations of Chapter 10.~~

A.10.1.2

~~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 or ST units, or combined cycle plants, it is expected

Commented [DL(V2)]: Is it permissible to use the term "requirements" when referring to the main body of the Standard?

Commented [PH3R2]: I think your are ok. Thomas?

Commented [DL(V4)]: Existing Annex material

Commented [DL(V5)]: Existing Annex material

Commented [PH6]: Does this belong in general section or move down? Recommend move down.

that most of the ~~recommendations-requirements~~ will apply, but for individually packaged CT and ICE units, many of the ~~recommendations-requirements~~ will not apply since the hazards described might not exist (e.g., small units might not have a cable spreading room or a warehouse).

10.3 Design and Equipment Arrangement.

10.3.1 Turbine and Internal Combustion Engine Generators.

10.3.1.1* General.

The installation and operation of CT and ICE generators shall ~~be in accordance-comply~~ with this chapter and NFPA 37.

A.10.3.1.1

Site-specific design considerations or ~~the~~ manufacturer's typical design will govern what equipment has enclosures or how many separate enclosures will be provided for the CTs, STs, or ICEs. ~~The A~~ CT generator is frequently supplied as a complete power plant package with equipment mounted on skids or pads and provided with metal enclosures forming an all-weather housing. In addition to being weathertight, the enclosures are designed to provide thermal and acoustical insulation. ST generators are typically supplied as components that are incorporated into the power plant design and installed in an open room or separate building. Metal acoustic enclosures are available as options for some ST generators. Smaller ICE plants might involve enclosures for equipment, ~~but more commonly though it is more common for~~ engine generators ~~are to be~~ installed in a row in an open room or hall.

10.3.1.2* Prevention of External Fires.

A.10.3.1.2

~~For recommendations regarding-~~See Section 6.5 for requirements on containment and drainage of liquids,~~-see Section 6.5.~~

10.3.1.2.1*

Piping systems supplying flammable and combustible liquids and gases shall be designed to minimize oil and fuel piping failures.

A.10.3.1.2.1

~~The following piping features should be considered:~~

(1) If rigid metal piping is used, it should be designed with freedom to deflect with the unit, in any direction. This recommendation ~~also~~ should also apply to hydraulic lines that are connected to accessory gearboxes or actuators mounted directly on the unit. Properly designed metallic hose is an alternative for fuel, hydraulic, and lube oil lines in high vibration areas, between rigid pipe supply lines, and manifolds in and at the points of entry at the engine interface.

(2) Rigid piping connected directly to the unit should be supported such that failures will not occur due to the natural frequency of the piping coinciding with the rotational speed of the machine. ~~Care should be taken in the-~~The design of pipe supports ~~to-should~~ avoid vibrations induced by other equipment that can excite its natural frequency.

(3) Welded pipe joints should be used where practical. Threaded couplings and flange bolts in fuel and oil piping should be assembled using a torque wrench and torqued to the manufacturer's requirements. Couplings should have a positive locking device to prevent unscrewing.

Commented [SK7]: SL: This is a large list with multiple sentences per item. I feel like this would be better suited as paragraphs. Maybe some combining and/or reorganizing of content? I have combined 7 and 8.

~~(4)~~ Instrumentation tubing, piping, and gauges should be protected from accidental mechanical damage. Liquid level indicators should be listed and protected from impact.

~~(5)~~ Where practical, lubricating oil lines should use guarded pipe construction with the pressure feed line located inside the return line or in a separate shield pipe drained to the oil reservoir and sized to handle the flow from all oil pumps operating at the same time. If this is not practical, noncombustible coverings (e.g., piping sleeves, ~~and/or~~ tubing and flange guards) should be used to reduce the possibility of oil atomization and contact with hot surfaces with subsequent spray fires.

~~(6)~~ On some turbine-generators employing the guard pipe principle, the guard piping arrangement terminates under the machine housing where feed and return piping run to pairs of bearings. Such locations are vulnerable to breakage with attendant release of oil in the event of excessive machine vibration and should be protected.

~~(7)~~ If practical, fluid piping should be clear of, shielded from, or routed below steam piping, hot metal parts, electrical equipment, or other sources of ignition to preclude leaked fluid dripping on the equipment. Insulation with impervious lagging should be provided for steam piping or hot metal parts under or near oil piping or turbine bearing points.

~~(8)~~ Insulation with impervious lagging should be provided for steam piping or hot metal parts under or near oil piping or turbine bearing points.

~~(9)~~ Lubricating oil system designs should reflect a design objective to minimize the amount of oil needed and the amount of piping and associated components necessary.

Commented [DL(V8)]: Existing Annex material

Commented [DL(V9)]: Existing Annex material

10.3.1.2.2*

Where required by the FPDBD, all areas beneath the turbine-generator operating floor that are subject to oil flow, oil spray, or oil accumulation shall be protected by an automatic sprinkler or foam-water sprinkler system.

A.10.3.1.2.2

~~This coverage~~ Protection coverage normally includes all areas beneath the operating floor in the turbine building.

Where provided, the sprinkler system beneath the turbine-generator ~~shall take into consideration should consider~~ obstructions from structural members and piping to the extent practical.

~~Where provided, the sprinkler system beneath the turbine-generator shall be designed to a density of 0.30 gpm/ft² (12.2 mm/min) over a minimum application of 5000 ft² (464 m²).~~

To avoid water application to hot parts or other water sensitive areas and to provide adequate coverage, designs that incorporate items such as fusible element operated directional spray nozzles ~~may/might~~ be necessary.

Commented [DL(V10)]: Manual of Style?

Commented [DL(V11)]: Existing Annex material

10.3.1.2.2.1

Where provided, the sprinkler system beneath the turbine-generator shall be designed to a density of 0.30 gpm/ft² (12.2 mm/min) over a minimum application of 5000 ft² (464 m²).

10.3.1.2.3

Where required by the FPDBD, lubricating oil lines above the turbine operating floor that are subject to oil accumulation, including the area within the turbine lagging (skirt), shall be protected with an automatic sprinkler system ~~covering those areas subject to oil accumulation, including the area within the turbine lagging (skirt).~~

10.3.1.2.3.1

Where provided, the automatic sprinkler system shall be designed to a density of 0.30 gpm/ft² (12.2 mm/min).

10.3.1.2.4*

Where required by the FPDBD, and where a pedestal-mounted turbine generator with no operating floor exists beneath the turbine generator is used that is subject to oil flow, oil spray, or oil accumulation, the space shall be protected by an automatic sprinkler per in accordance with NFPA 13 or a foam-water sprinkler system per in accordance with NFPA 11.

A.10.3.1.2.4

~~Protection for pedestal-mounted turbine generators with no operating floor can be provided to meet these requirements and by containing and drainage of oil spills and providing local automatic protection systems for the containment areas. In this type of a layout using pedestal-mounted turbine generators with no operating floor,~~ spray fires from lube oil and hydrogen seal oil conditioning equipment and from control oil systems using mineral oil, if released, could expose building steel or critical generating equipment. Additional protection such as enclosing the hazard, installing a noncombustible barrier between the hazard and critical equipment, or use of a water spray system over the hazard should be considered.

Above the operating floor, ceiling level sprinkler systems might not be effective to protect floor level equipment and components from oil fires because of the high ceilings [typically ~~in excess of greater than~~ 40 ft (12 m)].

A spray fire can blow past conventional automatic sprinkler protection without operating the system and can expose structural steel or critical components of the turbine generator. The concern is that fire exposure to the roof for the rundown time of the turbine could bring down building steel and result in damage to long lead time equipment critical to operation of the turbine or that ~~the~~ fire could directly expose critical equipment such as the generator. Where possible, one of the following protection measures should be used:

- (1) *Enclosure of the hazard.* ~~An For~~ example, ~~the hazard could would be location located~~ within a room of noncombustible construction protected with automatic sprinkler protection.
- (2) *Use of a barrier.* A metal barrier could be installed between the hazard and critical equipment or the roof of the building, with automatic sprinklers installed under the barrier.
- (3) *Water spray protection.* Tests have shown that deluge sprinklers over the hazard can reduce the size of an oil spray fire. The tests were conducted with pendant sprinklers spaced 5 ft × 5 ft (1.5 m × 1.5 m) apart, with an orifice coefficient of K-8.0 (115) and an end head pressure of 50 psi (3.9 bar) located 6 ft (1.8 m) over the hazard. The system should be automatically activated by a listed ~~line-line-~~ type heat detection or flame detection system.

10.3.1.2.5*

Where required by the FPDBD, foam-water sprinkler systems installed in place of automatic sprinklers shall be designed based on the design densities specified in Chapter 9 and in accordance with NFPA 11.

A.10.3.1.2.5

Protein and aqueous film-forming foams (AFFF) are effective in control of flammable liquid pool fires in high bay buildings. FM Global conducted tests for the US Air Force at the Test Campus in 1975. Flammable liquid pool fires 900 ft² (83.6 m²) in area were used. Foam was applied from nozzles at ceiling level 60 ft (18.3 m) above the floor. Foam reduced the fire area by 90 percent less than 5 minutes after application started. It is effective on high flashpoint liquid fires such as mineral oil fires. Tests have also been conducted using foam for

Commented [DL(V12)]: Created charging statement to link the text that changed to annex material

Commented [SK13]: SL: I was confused at how this requirement was rewritten to accommodate mandatory language. I think it was missing a key part (the pedestal-mounted bit)... I referred to the annex material and the original RP to try and fix this but it might need more work from someone other than a lay person!

Commented [DL(V14)]: This appears to be the charging statement from the original Recommended Practice text as a lead-in to the Annex material. Delete? Make separate? Incorporate it into the first paragraph of the existing Annex material?

Commented [DL(V15)]: Existing Annex material

the protection of chemical process structures. The tests involved a three-dimensional spill of flammable liquid from a process vessel 20 ft (6.1 m) above the floor onto grade level. The process structure was 40 ft (12.2 m) high. Foam protection was provided at each floor elevation. Foam limited the size of the pool fire but had no effect on the three-dimensional spill fire.

Micelle-encapsulating agents can enhance open head water spray systems for pool fires. Research has been conducted for use of this agent on some hydrocarbon pool fires, although turbine lubricating oil has not been tested. In addition, testing has not been performed for three-dimensional fire scenarios that can occur during a turbine lubricating oil spray fire. See A.9.5.2.6 for additional information on micelle-encapsulating agents.

10.3.1.2.6

Electrical equipment in the area covered by a water or foam-water system shall be ~~of the enclosed~~ enclosed-type or otherwise protected to minimize water damage in the event of system operation.

10.3.1.2.7

Where required by the FPDDB, control packages shall include the parameter monitoring and shutdown capabilities described in Chapter 9 of NFPA 37 to prevent conditions that could cause a fire ~~while the~~ during unit operation-is operating.

10.3.1.3 Lubricating Oil Systems.

10.3.1.3.1*

Where required by the FPDDB, combined oil systems that use lubricating oil for both lubrication and hydraulic control shall use a listed fire-resistant fluid.

A.10.3.1.3.1

Use of a listed fire-resistant (i.e., less hazardous or less flammable) lubricating oil should be considered. The use of a listed fire-resistant fluid as a turbine-generator lubricating oil could eliminate the need for fire protection beneath the operating floor, at lubricating oil lines, at lubricating oil reservoirs, and at 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 10.3.1.2.4 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 10.3.5.9. Stakeholders should be involved in the decision-making process before eliminating fire protection for the turbine lubrication oil hazard.

There is limited information available detailing industry experience with fire-resistant fluids as turbine lubrication oils or in seal oil systems. The use of fire-resistant fluids in hydraulic systems is common in the utility industry. Literature is available documenting use of these fluids in Europe. Information detailing operational experience using fire-resistant fluids on lubrication oil systems on turbine-generators in North America is limited.

~~Utilizing~~ Using a listed fire-resistant turbine lubricating oil potentially reduces the hazard associated with the lubricating oil system, but the remaining hazards still need to be addressed in determining the appropriate suppression systems and design densities needed in these areas (i.e., grouped cables and other mineral oil-based lubricating systems).

Given the fact that fire-resistant fluid can still ~~has the ability to~~ burn, care should be exercised in selecting the fluid. ~~When selecting the fluid, consideration should be given to the~~ The fluid's heat release rate, fire point, and ability to sustain a spray or cascading fire once the ignition source is removed should be considered. The autoignition temperature of the fluid used should be sufficient to minimize the potential for a fire based on common ignition and heat sources located in the turbine generator area.

Commented [DL(V16): Verify this is the correct reference

Commented [SK17R16]: It isn't. (Or at least not the Chapter 9 I worked on!)

Commented [DL(V18): Existing Annex material

Commented [DL(V19): Revised reference

Commented [DL(V20): Revised reference

Internal combustion engines do not normally have any hydraulic systems.

Commented [DL(V21)]: Existing Annex material

10.3.1.3.2

~~If the oil systems are separate and where~~ Where required by the FPDBD ~~and where oil systems are separate,~~ the hydraulic control system shall use a listed fire-resistive hydraulic fluid ~~and a listed fire-resistant fluid shall be considered for the lubricating system.~~

A.10.3.1.3.2

~~A listed fire-resistant fluid should be considered for the lubricating system.~~

10.3.1.3.3

Lubricating oil storage, pumping facilities, and associated piping shall comply with NFPA 30.

10.3.1.3.4

Lubricating oil reservoirs shall be provided with a vapor extractor vented to a safe outside location.

10.3.1.3.5

Where required by the FPDBD, ~~Curbing or curbing,~~ drainage, or both shall be provided for the lubricating oil reservoir in accordance with Section 6.5.

10.3.1.3.6

Where required by the FPDBD, ~~All~~ oil piping serving the CT, ST, ICE, or generator shall be designed and installed to minimize the possibility of an oil fire in the event of severe turbine vibration. (See NFPA 30.)

10.3.1.3.7*

Where required by the FPDBD, remote operation from the control room of the condenser vacuum break valve and shutdown of the lubricating oil pumps shall be provided.

A.10.3.1.3.7

Breaking the condenser vacuum markedly reduces the rundown time for the machine and thus limits oil discharge in the event of a leak. See ~~the discussion in~~ 5.4.6.1 on fire emergency planning involving turbine lubricating oil fires.

Commented [DL(V22)]: Reference clause to be verified

10.3.1.3.8*

Where required by the FPDBD, cable for operation of lube oil pumps shall be protected from fire exposure.

A.10.3.1.3.8

Protection can consist of ~~the~~ separation of cable for ac and dc oil pumps or 1-hour ~~fire-fire~~-resistive coating (derating of cable should be considered).

10.3.1.3.9* Fire Protection.

~~10.3.1.3.9.1*~~

Where required by the FPDBD, lubricating oil reservoirs and handling equipment shall be protected in accordance with 10.3.1.4.2.

A.10.3.1.3.9.1

If the lubricating oil equipment is in a separate room enclosure, protection can be provided by a total flooding gaseous extinguishing system ~~per in accordance with~~ NFPA 2001 ~~or by~~ a hybrid fire extinguishing system ~~per in accordance with~~ NFPA 770.

Commented [PH23]: Do we id a standard?

10.3.1.4 Inlet Air System.

10.3.1.4.1*

Where required by the FPDBD, air filters and evaporative cooling media shall be constructed from less flammable materials whenever practical.

Commented [SK24]: SL: This is kind of flimsy in terms of a requirement!

A.10.3.1.4.1

See UL 900, *Standard for Safety Test Performance of Air Filters*, ~~can be used as for~~ guidance.

The use of less flammable filter or media in the CT air inlet is recommended where not constrained by other engineering needs (~~such as e.g.~~ pressure loss across the elements) and cost considerations associated with ~~UL 900~~-Class I (i.e., do not contribute fuel) versus Class II fire-resistant elements.

Commented [DL(V25): Existing Annex material
It appears these two entries can be consolidated

10.3.1.4.2

Where required by the FPDBD, manual ~~fire-fire~~fighting equipment shall be available to personnel performing maintenance on air filters.

10.3.1.4.3

Where required by the FPDBD, access doors or hatches shall be provided for manual ~~fire-fire~~fighting on large air filter structures.

10.3.1.5 Starting Equipment for CTs.

Where ICEs or torque converters are used and where required by the FPDBD, fire protection shall be provided ~~based on consideration of the factors in 10.3.2.2.1~~.

Commented [SK26]: SL: Not sure "based on considerations" is enforceable...

10.3.2 Combustion Turbines.

10.3.2.1

Where required by the FPDBD, combustible gas detector(s) shall be provided for ~~the~~ CT enclosures.

10.3.2.2 Fire Protection.

10.3.2.2.1*

Where required by the FPDBD, protection shall be provided for the CT ~~and~~ auxiliary enclosures.

A.10.3.2.2.1

~~Determination of the need for fire~~ Fire suppression for combustion turbines should be based on consideration of the value of the unit, consequences of loss of the unit, and vulnerability of adjacent structures and equipment to damage. (See Chapter 7 for general fire protection methods ~~guidance~~.)

10.3.2.2.21.1

Where required by the FPDBD, fire system operation ~~should shall~~ be arranged to close the fuel valves.

10.3.2.3 Prevention of Internal Explosions in Combustion Turbines.

10.3.2.3.1*

Combustion turbines shall have a proof-of-flame detection system in the combustion section to detect flameout during operation or ignition failure during startup, as follows ~~and includes the following functions:~~

- (1) In case of flameout, the fuel shall be shut off.
- (2) If ignition is not achieved within a normal startup time, ~~then~~ the control system shall abort the startup and close the fuel valves.

A.10.3.2.3.1

When a flameout occurs, fuel valves should close as rapidly as possible to preclude the accumulation of unburned fuel in the combustion chamber. Loss experience documents that fires or explosions have occurred in systems where the fuel isolation was not achieved within 3 seconds.

10.3.2.3.2

Fuel isolation and venting shall be accomplished in accordance with Chapter 5 of NFPA 37 ~~Chapter 5~~ for gaseous fuels or Chapter 6 of NFPA 37 ~~Chapter 6~~ for liquid fuels.

10.3.3 Steam Turbines.

Where required by the FPDBD, steam turbines and their associated hazards shall be designed and protected in accordance with an appropriate method selected from Section 9.6 and ~~considering the guidance provided in accordance with~~ 10.3.1.2.2 through 10.3.1.2.6, 10.3.1.3.1, and 10.3.1.3.2.

10.3.3.1* Bearings.

A.10.3.3.1

Additional information concerning turbine-generator fire protection can be found in EPRI Research Project Report 1843-2 ~~report~~, *Turbine Generator Fire Protection by Sprinkler System*.

In February 1997, the National Institute of Standards and Technology (NIST) published NIST Report Technical Note 1423, "Analysis of High Bay Hangar Facilities for Fire Detector Sensitivity and Placement." This report provides design recommendations for sprinkler and detection systems (protecting fuel pool fires) at those facilities, which can provide some design guidance if sprinkler systems are installed at the ceiling level of the turbine building.

However, turbine building hazards include pool fires and three-dimensional and spray fires. Without further testing, such systems should not be considered to provide equivalent protection to the turbine building systems ~~required by this standard recommended in the body of NFPA 850~~. If used in addition to those ~~recommended-required~~ systems, a properly designed ceiling level sprinkler system can provide additional protection for the turbine building roof if exposure to a large fire on the operating floor is a concern.

10.3.3.1.1*

Where required by the FPDBD, turbine bearings shall be protected with an automatic closed-head sprinkler system ~~utilizing using~~ directional nozzles or a water spray or water mist systems.

10.3.3.1.1.1

~~Where provided water spray and sprinkler systems for turbine generator bearings shall be designed for a minimum density of 0.25 gpm/ft² (10.2 mm/min) over the protected area of all bearings.~~

A.10.3.3.1.1

Commented [DL(V27)]: The original entry had three separate sentences with "should" changed to "shall", broke up for Manual of Style compliance

Commented [DL(V28)]: Existing Annex material

Commented [DL(V29)]: Verify the reference is still valid

Commented [DL(V30)]: Existing Annex material

Accidental water discharge on bearing points and hot turbine parts should be considered. If necessary, these areas can ~~be permitted to~~ be protected by shields and encasing insulation with metal covers.

Automatically actuated systems have proven to actuate properly under fire conditions and are not prone to spurious actuation. If a manually operated water system is installed, ~~consideration should be given to a~~ supplemental automatic gaseous fire extinguishing system should be considered.

The 2000 edition of ~~NFPA 850 this standard~~ allowed manual operation of bearing protection systems. In most incidents involving bearing oil releases, this would be adequate; ~~for~~ ~~in~~ some types of release, however, such as seal oil failures, ~~that this~~ might not allow the operator time to activate the system. There are some turbine buildings where the control room is not located in the turbine building, which would also delay response.

If turbine-generator bearings are protected with a manually operated sprinkler system, the following should be provided:

- (1) Manual activation should be from the control room or a readily accessible location not exposing the operator to the fire condition. Staffing of the plant should be sufficient to promptly handle this function as well as other responsibilities during an emergency of this nature.
- (2) Automatic fire detection should be provided over the area of each bearing and within the skirting of the turbine where a potential for oil to pool can alert operators to a fire condition.
- (3) Documented procedures should be in place with authorized approval given to operators to activate the system, if necessary, in a fire condition.
- (4) Periodic training should be given to operators regarding the need for prompt operation of the system.

Commented [DL(V31)]: Existing Annex material

10.3.3.1.1.1

Where provided, water spray and sprinkler systems for turbine-generator bearings shall be designed for a minimum density of 0.25 gpm/ft² (10.2 mm/min) over the protected area of all bearings.

10.3.3.1.2

Where required by the FPDDB, and where enclosures are provided, one of the following methods shall be provided:

- (1) Water ~~Sprinkler-sprinkler~~ system
- (2) Carbon ~~Dioxide-dioxide~~ system
- (3) Water ~~Mist-mist~~ system
- (4) Compressed air foam system
- (5) Hybrid fire-extinguishing systems

10.3.4 Internal Combustion Engines.

10.3.4.1

Where required by the FPDDB, combustible gas detector(s) shall be provided for the ICE enclosures.

10.3.4.2 Fire Protection.

~~10.3.4.2.1~~

Where required by the FPDBD, fire protection shall be provided for the ~~internal combustion engine-ICE~~ using a method defined in Chapter 7.

10.3.4.3*

Activation of the fire protection system shall initiate fuel isolation and venting in accordance with Chapter 5 of NFPA 37 ~~Chapter 5~~ for gaseous fuels or Chapter 6 of NFPA 37 ~~Chapter 6~~ for liquid fuels.

A.10.3.4.3

In the event of a problem with older ICEs, shutdown might be difficult. Several different methods, operating independently, should be provided. These methods can include centrifugally tripped (overspeed condition) spring-operated fuel rack closure, governor fuel rack closure, electropneumatic fuel rack closure, or ~~air inlet guillotine-type air inlet guillotine-type~~ air shutoff.

10.3.4.4~~3.1~~

Where the ICE is provided as an emergency power supply, closure of the fuel valves shall ~~be as allowed by-comply with~~ NFPA 110.

10.3.5 Generators.

10.3.5.1* Hydrogen Cooled Generators.

A.10.3.5.1

~~For-See NFPA 2 for~~ hydrogen storage systems, ~~see NFPA 2.~~

10.3.5.1.1*

Where required by the FPDBD, bulk hydrogen systems supplying one or more generators shall have automatic shutoff valves located at the source of supply. ~~Where provided, automatic shutoff valves shall be operated either by "dead man" type controls at the generator fill point(s) or from the control room.~~

A.10.3.5.1.1

~~This Automatic shutoff valves~~ would minimize the potential for a major discharge of hydrogen in the event of a leak from piping inside the plant. Alternatively, vented guard piping can be used in the building to protect runs of hydrogen piping.

10.3.5.1.1.1

Where provided, automatic shutoff valves shall be operated either by "dead man" type controls at the generator fill point(s) or from the control room.

10.3.5.1.2

Where required by the FPDBD, the following design features shall be provided:

- (1) Routing of hydrogen piping shall avoid areas containing critical equipment and potential ignition sources.
- (2) Hydrogen cylinders and generator hydrogen fill and purge manifolds shall be located remote from the turbine generator.
- (3) Electrical equipment in the vicinity of the hydrogen handling equipment shall ~~meet-comply with~~ Article 500 of *NFPA 70* and Section 127 of IEEE C2, *National Electrical Safety Code*.

Commented [DL(V32)]: Use this language uniformly for all technologies

Commented [DL(V33)]: NFPA 37 provides explicit emergency fuel isolation and venting requirements for ICEs, this is NOT subject to a DBD determination ...

Commented [DL(V34)]: Reworded to act as a "modifier" to the NFPA 37 requirement as outlined in NFPA 110

Commented [DL(V35)]: Existing Annex material

Commented [DL(V36)]: Review other sections for a similar rewrite

Commented [DL(V37)]: NFPA 70 recognizes the IEC area classification and equipment designs, is IEEE C2 doing the same in the latest edition? If so, add the appropriate references here (NFPA 70 Article 505 and C2 ref).

10.3.5.2 Hydrogen Seal Oil System.

10.3.5.2.1

Where required by the FPDBD, the following design features shall be provided:

- (1) Redundant hydrogen seal oil pumps with separate power supplies shall be provided for adequate reliability of seal oil supply.
- (2) Electrical circuits to redundant pumps shall be run in buried conduit or provided with fire-retardant coating if exposed in the area of the turbine generator to minimize possible loss of both pumps as a result of a turbine generator fire.
- (3) Hydrogen seal oil units shall be protected in accordance with a method selected from Section 7.6 and ~~considering the requirements provided in~~ accordance with 10.3.1.2.2 through 10.3.1.2.6.

Commented [DL(V38)]: Verify the reference is still valid

10.3.5.2.2

Where required by the FPDBD, curbing ~~of~~ drainage, or both shall be provided for the hydrogen seal oil unit in accordance with Section 6.5.

Commented [DL(V39)]: Verify the reference is still valid

10.3.5.34 [title]

Where required by the FPDBD, a flanged spool piece or equivalent arrangement shall be provided to facilitate the separation of the hydrogen supply when the generator is opened for maintenance.

10.3.5.45 [title]

Where required by the FPDBD, electrical equipment in the vicinity of the hydrogen handling equipment, ~~including detrainning equipment, seal oil pumps, valves, and so forth~~ shall ~~meet-comply with~~ Article 500 of NFPA 70 and Section 127 of IEEE C2, *National Electrical Safety Code*.

Commented [DL(V40)]: Article 505? Does C2 recognize the IEC Classifications? NO (2017 edition), cannot include 505 unless C2 changes

A.10.3.5.4

Such equipment includes, but is not limited to, detrainning equipment, seal oil pumps, and valves.

10.3.5.56 Control Room.

10.3.5.5.1

Where required by the FPDBD, control room alarms shall be provided to indicate abnormal gas pressure, temperature, and percentage of hydrogen in the generator.

10.3.5.5.210.3.5.7

Hydrogen lines shall not be piped into the control room.

10.3.5.68 Hydrogen Dump Valve.

Where required by the FPDBD, ~~The-the~~ following design features shall be provided for the hydrogen dump valve:

- (1) The ~~generator~~ hydrogen dump valve and hydrogen detrainning equipment shall be arranged to vent directly to a safe outside location.

(2) The dump valve shall be remotely operable from the control room or from an area accessible during a machine fire.

10.3.5.79

Where required by the FPDBD, Fire fire protection shall be provided in accordance with an appropriate method selected from Section 7.6 and ~~considering the guidance provided in~~ accordance with 10.3.3.1 for turbine bearings and 10.3.1.2.2 through 10.3.1.2.5 for oil piping or any area where oil can flow, accumulate, or spray.

Commented [DL(V41)]: Verify the reference is still valid

10.3.5.89.1 Exciter.

10.3.5.8.1

Where required by the FPDBD, the area inside an exciter housing shall be protected by one of the following methods:

- (1) ~~a~~ A total flooding automatic carbon dioxide system ~~per in accordance with~~ NFPA 12.
- (2) ~~a~~ A total flooding automatic inert gas system ~~per in accordance with~~ NFPA 2001
- (3) ~~a~~ A total flooding automatic water mist system ~~per in accordance with~~ NFPA 750

Commented [PH42]: To a standard?

10.3.5.89.2

If a water mist system is applied to an exciter housing, an appropriate discharge delay after the generator is tripped shall be included to mitigate a potential arc flash event

Commented [DL(V43)]: Added this requirement as discussed by the TG during the meeting but not captured at the time

10.3.5.910*

Air-cooled generators shall be tightly sealed against the ingress of moisture in the event of- a water spray system discharge ~~(accidental or otherwise)~~.

A.10.3.5.910

Sealing should be positive, such as by a gasket or grouting, all around the generator housing.

ICE-powered generators are normally provided with an open drip-proof enclosure. Shielding might be needed when a water-based fire protection system is used.

Commented [DL(V44)]: Existing Annex material

10.3.6 Emergency Generators.

10.3.6.1 General.

The installation and operation of emergency generators shall ~~be in accordance-comply~~ with NFPA 110.

10.3.6.2 Fire Protection.

10.3.6.2.1

Emergency generators located within main plant structures shall be protected in accordance with ~~a method selected from~~ Section 7.6.

Commented [DL(V45)]: Verify the reference is still valid perhaps just "Chapter 7"?

10.3.6.2.2

Commented [SK46R45]: FYI, MOS dictates the most specific reference be used whenever possible. If Section 7.6 is appropriate, we should leave it as such.

Where gaseous suppression systems are used on combustion engines that can be required to operate during the system discharges, the ~~FDDBD-FPDBD~~ shall evaluate the supply of engine combustion air and outside air for equipment cooling.

10.4 Combined Cycle Units.

~~10.4.1* Heat Recovery Steam Generators.~~

Heat recovery steam generators using supplemental firing shall be designed and protected in accordance with 12.3.1. ~~(See NFPA 85 for additional requirements.)~~

~~A.10.4.1~~

~~(See NFPA 85 for additional requirements.)~~

Commented [SK47]: SL: The only requirement here is that something be evaluated. Not sure we can keep in body of text...

Commented [DL(V48): Verify the reference is still valid



Public Input No. 54-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 11]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter11_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 11 based on work by Task Group 3 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 11 Alternative Fuels

11.1* General.

Chapter 11 identifies fire and explosion hazards of alternative fuel-fired electric generating plants and specifies protection criteria common to all such plants regardless of the fuel. CT, ST and ICE electric generating units operating on alternative fuels shall comply with Chapters 4 through 9, as applicable.

~~A.11.1-~~

~~Examples of alternative fuels include, but are not limited to, refuse derived fuel (RDF), municipal solid waste (MSW), and biomass.~~

~~11.1.1~~

~~The major fire and explosion hazards associated with mass burn units' power boilers are as follows:~~

- ~~(1) Sourcing, receipt, handling, and storage of large quantities of alternative fuels~~
- ~~(2) Unsuitable waste entering the facility, such as certain hydrocarbons, flammable liquids, metal dusts, acetylene, explosives, and so on~~
- ~~(3) Hydraulic and lubricating oils associated with the processing equipment~~
- ~~(4) Improperly maintained electrical equipment~~
- ~~(5) Large amounts of fuel accumulating in unsuitable areas as a result of spillage or handling~~
- ~~(6) Inadequate dust control~~

~~11.1.2*~~

~~Hose stations designed in accordance with NFPA 14 should be located throughout fuel materials storage areas (e.g., tipping building), charging floors, firing floors, hydraulic areas, and residue buildings. Due to the high frequency of use, the following points should be considered:~~

- ~~(1) Location and physical protection so as to avoid potential damage due to traffic patterns~~
- ~~(2) Size and number to be determined for unique plant geometry (e.g., push walls)~~
- ~~(3) Ease of use, maintenance, and storage, such as through the use of continuous flow, noncollapsible hose reels~~
- ~~(4) Protection from freezing in unheated areas~~

~~A.11.1.2~~

~~Based on plant geometry, combustible loading, and staff size, a 250 gpm (946 L/min) monitor nozzle could be needed in lieu of or in conjunction with hose.~~

[ALL NEW TEXT FOLLOWING 11.1]

11.2 Applicability.

The ~~Fire Protection Design Basis Document-FPDDB~~ shall determine which requirements apply to any specific CT, ST, and ICE electric generating units operating on alternative fuels.

Commented [PH1]: Defined terms?

Commented [PH2R1]: No acronyms in first use of term.

A.11.2

~~The Fire Protection Design Basis Document should determine which requirements apply to any specific alternative fuel facility.~~ This determination is ~~done-made~~ by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For most alternative-fuel facilities, it is expected that most of the ~~recommendations-requirements~~ will apply, ~~although-though~~ there could be particular ~~recommendations-requirements that~~ will not apply because the hazards described ~~might-not-do not~~ exist.

Examples of alternative fuels include, but are not limited to, refuse derived fuel (RDF), municipal solid waste (MSW), and biomass.

Commented [DL(V3)]: Existing Annex Entry

The major fire and explosion hazards associated with mass burn units' power boilers are as follows:

- (1) Sourcing, receipt, handling, and storage of large quantities of alternative fuels
- (2) Unsuitable waste entering the facility, such as certain hydrocarbons, flammable liquids, metal dusts, acetylene, and explosives, ~~and so on~~
- (3) Hydraulic and lubricating oils associated with ~~the~~ processing equipment
- (4) Improperly maintained electrical equipment
- (5) Large amounts of fuel accumulating in unsuitable areas ~~as a result of from~~ spillage or handling
- (6) Inadequate dust control

Commented [BD4]: This text should be added a second paragraph to A.11.1.

11.2.1*

~~Where required by the FPDDB, hose stations shall be designed by a Qualified person in accordance with NFPA 14. Where required by the FPDDB, hose stations shall be located throughout fuel materials storage areas such as tipping building, charging floors, firing floors, hydraulic areas, and residue buildings. Due to the high frequency of use, the following points should be considered:~~

Commented [PH5]: Add qualified person - Typical of all Designed by - see new definition in chapter 3

Commented [PH6R5]: This should be moved down into the body after 11.3.

- ~~(1) Location and physical protection to avoid potential damage due to traffic patterns~~
- ~~(2) Size and number to be determined for unique plant geometry such as push walls.~~
- ~~(3) Ease of use, maintenance, and storage, such as through the use of continuous flow, non-collapsible hose reels~~
- ~~(4) Protection from freezing in unheated areas~~

A.11.2.1

~~Based on plant geometry, combustible loading, and staff size, a 250 gpm (946 L/min) monitor nozzle could be needed in lieu of or in conjunction with hose.~~

Commented [DL(V7)]: Existing Annex Entry

11.3 Design and Equipment Arrangement.

11.3.1

Where required by the FPDDB, hose stations shall be designed by a ~~Qualified~~ qualified person in accordance with NFPA 14.

11.3.2*

Where required by the FPDDB, hose stations shall be located throughout fuel materials storage areas.

A.11.3.2

Examples of fuel materials storage areas include tipping buildings, charging floors, firing floors, hydraulic areas, and residue buildings.

Due to the high frequency of use, the following points should be considered:

- (1) Location and physical protection to avoid potential damage due to traffic patterns
- (2) Size and number to be determined for unique plant geometry ~~such as~~ (e.g., push walls);
- (3) Ease of use, maintenance, and storage (e.g., ~~such as~~ through the use of continuous-flow, ~~non~~ noncollapsible hose reels)
- (4) Protection from freezing in unheated areas

Based on plant geometry, combustible loading, and staff size, a 250 gpm (946 L/min) monitor nozzle ~~could~~ might be needed in lieu of or in conjunction with hose.

11.3.3*

Where required by the FPDDB, fire areas shall be separated from each other by an approved means.

A.11.3.1

In addition to the ~~applicable recommendations requirements~~ in 6.1.1.2 and 6.1.1.3, ~~it is recommended that, as a minimum,~~ fire area boundaries should be provided to separate initial fuel receiving, processing, and storage areas.

The refuse pit is normally enclosed on three sides, up to the charging level, by reinforced concrete walls. The thickness of the walls ~~vary-varies~~ with facility design, but should provide a minimum of 2-hour fire separation.

Exposed steel columns located at the front of the refuse pit should be protected against structural damage caused by heat. This protection could include concrete encasement, water spray, or other suitable alternatives and should extend from the base of the column to the roof of the refuse pit enclosure. ~~Care should be taken to protect fireproofing. Fireproofing should be protected~~ from mechanical damage.

11.3.4*

Transfer to and mixing of material in the pit ~~is typically shall be accomplished~~ using overhead cranes.

A.11.3.2

Overhead cranes are often used to mix and stock the refuse within the pit. Undesirable waste (e.g., large items such as refrigerators) is often separated from the waste stock by the crane operator for offsite disposal or for shredding/processing (*see 11.5.5*) prior to replacement into the waste stock. All other items are loaded directly into boiler feed hoppers without processing. In addition, the acceptable method for extinguishment of small fires is also direct loading of the smoldering refuse into the hoppers by the crane operator. The following ~~considerations~~ should be given-considered with respect to the crane operator's pulpit:

Commented [PH8]: Add qualified person - Typical of all Designed by - see new definition in chapter 3

Commented [PH9R8]: This should be moved down into the body after 11.3.

Commented [SK10]: SL: Use of what?

Commented [DL(V11): Existing Annex Entry

Commented [DL(V12): 11.3.2 and 11.3.3 incorporated into the A11.3.1 Annex text

Commented [PH13]: Subjective statement

Commented [PH14R13]: Needs a requirement or move to the annex.

Commented [SK15R13]: Added requirement; OK?

- (1) Locating the pulpit such that operator safety is not compromised
- (2) ~~Ability-Being able~~ to have a clear and unobstructed view of all storage and charging areas
- (3) Providing self-contained breathing apparatus (SCBA) for operator egress
- (4) Providing direct communication with the boiler control room and floor manager
- (5) ~~Ability-Being able~~ to activate fire protection equipment

11.3.53

Where used by mass burn facilities ~~utilize hammer and flail mills, such equipment hammer and flail mills~~ shall comply with the criteria in 11.5.2.

11.4* Risk Considerations for Municipal Solid Waste (MSW).

11.4.1* General.

~~This section identifies fire and explosion hazards that are unique to the use of MSW as a boiler fuel by means of a process that includes the hauling of MSW directly to a tipping floor or storage pit and burning without any special processing.~~

A.11.4.1

This section identifies fire and explosion hazards that are unique to the use of MSW as a boiler fuel by means of a process that includes the hauling of MSW directly to a tipping floor or storage pit and burning without any special processing. ~~MSW is municipal solid waste consisting of commonly occurring residential and light commercial waste.~~

11.4.12 Fire Protection.

11.4.12.1* General.

11.4.1.1.1

Where required by the FPDBD, the tipping ~~or~~ receiving building shall be provided with automatic sprinkler protection throughout.

~~A.11.4.2.1~~

~~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 (.25/3000) for 20 ft. The decision was made to increase the density to .25/3000. If the mix is different from above or storage heights are greater than 20 ft (6.1 m), consult NFPA 12.~~

11.4.1.1.2*2.1.1

Where provided, automatic sprinkler systems shall ~~comply with~~ meet the following criteria:

- (1) ~~Designed Systems shall be designed~~ for a minimum of 0.25 gpm/ft² (10.2 mm/min) over the most remote 3000 ft² (279 m²).

Commented [PH16]: First us in the body - Defined term?

Commented [BD17]: This should be moved to the annex. It does not contain a requirement.

Commented [DL(V18): Existing Annex Entry

Commented [BD19R18]: This appears to belong to 11.4.2.1.1.

(2) ~~When using~~ Where a dry pipe system is used, the most remote area shall be increased by 30 percent.

(3) The protection area per sprinkler shall not exceed 130 ft² (12 m²).

(4) High-temperature sprinklers [250°F to 300°F (121°C to 149°C)] shall be used.

(5) ~~If~~ Where the tipping ~~or~~ receiving floor is used as the charging storage area, additional protection shall be provided in accordance with 11.4.2.2.2.

A.11.4.2.1.2

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, and 14 percent leaves and grass. Solid pile storage up to 20 ft (6.1 m) was used. This resulted in selecting a Class III commodity (density of 0.22/3000) for 20 ft (6.1 m). The decision was made to increase the density to 0.25/3000. If the mix is different from above or storage heights are greater than 20 ft (6.1 m), consult NFPA 13.

11.4.12.2* ~~The~~ MSW Storage Pit, Charging Floor, and Grapple Laydown Areas.

A.11.4.12.2

See the National Institute of Standards and Technology's (NIST's) Report Technical Note 1423, "Analysis of High Bay Hangar Facilities for Fire Detector Sensitivity and Placement."

11.4.12.2.1 Refuse Enclosure.

11.4.1.2.1.1

Where required by the FPDDB, automatic sprinkler protection shall be provided throughout the refuse enclosure to protect the entire roof area against structural damage.

11.4.12.2.1.2

Where provided, automatic sprinkler systems shall ~~comply with~~ meet the following criteria:

(1) Systems shall be designed for a minimum of 0.20 gpm/ft² (8.1 mm/min) over the most remote 3000 ft² (279 m²).

(2) ~~When using~~ Where a dry pipe system is used, the most remote area shall be increased ~~by~~ 30 percent.

(3) The protection area per sprinkler shall not ~~to~~ exceed 100 ft² (9.3 m²).

(4) High-temperature sprinklers [250°F to 300°F (121°C to 149°C)] shall be used.

(5) Exposed steel column protection shall be designed in accordance with NFPA 15 and ~~can be~~ connected to the overhead sprinkler system.

11.4.12.2.1.34*

Where required by the FPDDB, manual fire hose stations ~~and/or~~ monitor nozzles shall be provided.

A.11.4.12.2.1.34

Commented [DL(V20): Existing Annex Entry

Commented [BD21R20]: This appears to belong to 11.4.2.1.1.

Commented [PH22]: Acronym

Commented [DL(V23): Existing Annex Entry

Commented [BD24]: This needs a number.

Due to the distance between the bottom of the refuse pit and the sprinkler system, manual hoses ~~and/or~~ monitor nozzles should be considered as the primary means of fighting a MSW storage pit fire. Manual fire ~~host hose~~ stations should be installed in accordance with NFPA 14. Monitor nozzles should be installed in accordance with NFPA 24.

11.4.12.2.2* Storage Pit.

Where required by the FPD~~BD~~, ~~and~~ in addition to sprinkler protection in accordance with ~~Section~~ 11.4.2.1-~~above~~, the storage pit shall be provided with monitor nozzle protection designed to furnish a minimum of 250 gpm (946 L/min) at 100 psi (689 kPa) at the tip.

A.11.4.2.2.2

Monitors should be located ~~so as to~~ allow for coverage of all pit areas with at least two streams operating simultaneously. Due to frequency of use and potential for operator fire exposure, oscillating monitor nozzles with manual override should be provided.

11.4.2.3 Harsh Environments.

~~Particular care shall be taken in the selection~~ Selection of fire detection devices ~~in consideration of~~ should consider harsh and dusty environments and high air flows.

Commented [PH25]: Subjective - Needs a requirement or move to annex

Commented [SK26]: SL: This isn't a requirement. Belongs in annex but I'm not sure where.

11.4.132.4 Explosion Suppression.

MSW facilities ~~utilizing-using~~ hammer and flail mills for ~~the~~ processing of oversize bulky waste shall ~~comply with follow the recommendations of~~ 11.5.3.

11.5* Risk Considerations for Refuse Derived Fuel (RDF).

Commented [PH27]: First us in the body

11.5.1*

~~This section identifies fire and explosion hazards that are unique to the processing of MSW into RDF.~~

A.11.5.1

~~This section identifies fire and explosion hazards that are unique to the processing of MSW into RDF.~~

RDF is a boiler fuel manufactured by means of a process that includes storing, shredding, classifying, and conveying the waste to a fuel storage area. It is then conveyed to the boiler through a metering device.

~~There is a potential fire and explosion hazard with the use of hammermills and flail mills and associated dust collection equipment. During the size-reduction process, flammable or explosive materials in the waste stream can be ignited.~~

11.5.2

~~There is a potential fire and explosion hazard with the use of hammermills and flail mills and associated dust collection equipment. During the size reduction process, flammable or explosive materials in the waste stream can be ignited.~~

Commented [SK28]: SL: Neither of these are requirements. Condense to Annex A?

11.5.12.4 Shredder Location.

11.5.112.1.1*

Where required by the FPDBD, the primary shredder shall be located within an enclosure of damage-limiting construction.

A.11.5.1.12.1.1

~~In view of~~ Due to the difficulties in preventing and controlling all types of shredder explosions, it is important to isolate the shredder and surrounding enclosure from vulnerable equipment and occupied areas in the plant. ~~Consideration should be given to the protection of~~ Protecting operating personnel or visitors from the potential blast zone ~~should be considered~~.

It is preferable that the enclosure be detached from the main building. Other alternatives include locating the enclosure as follows following:

- (1) Outside of, but sharing a common wall with, the main building
- (2) Inside of the main building, along an outside wall

~~(3) A substantial increase in explosive pressure as a result of venting of shredders into a combustible vapor-air mixture within the enclosure is possible and should be considered. Shredders, shredder enclosures, and openings into the enclosure should be designed so that, by a combination of venting and wall strength, they will resist a postulated worst-credible case explosion, such as an acetylene tank explosion, by a combination of venting and wall strength. It is recommended that designers have specialized experience in the analysis of such hazards, including specifying and constructing of explosion venting and shredder enclosures.~~

~~(4) Consideration should be given to a substantial increase in explosive pressure as a result of venting of shredders into a combustible vapor-air mixture within the enclosure.~~

~~(5) It is recommended that designers have specialized experience in the analysis of such hazards, including specifying and constructing of explosion venting and shredder enclosures.~~

~~An example of the postulated worst-credible case explosion might be an acetylene tank. Explosions involving detonable material are beyond the scope of this document.~~

11.5.12.2*

Where specific designs do not eliminate the potential for explosions in the secondary shredder and where required by the FPDBD, the ~~recommendations-requirements~~ in 11.5.3 shall ~~apply-be-applied~~.

A.11.5.2.2

Secondary shredders do not exhibit as significant a fire and explosion potential as primary shredders.

11.5.12.3

Where required by the FPDBD, platforms at intermediate elevations shall be constructed of open grating to reduce obstructions to the effective vent area.

11.5.12.4

Electrical equipment located inside the shredder enclosure shall be rated for use in both hazardous vapor and dust atmospheres in accordance with Articles 500 and 501 of *NFPA 70*.

11.5.12.5

Commented [DL(V29): This pulled in from the original 11.5.2.3 text

Commented [PH30R29]: Designed by competent person or registered design professional

Commented [DL(V31): Existing Annex Entry from 11.5.2.3 that Mark recommended we move to the annex here

Commented [SK32]: SL: These were standalone sentences and didn't belong in the list. Additionally I think they can be condensed into one paragraph as shown.

Commented [PH33]: Seems 11.5.2.2 and 3 can be combined into one statement

Commented [PH34]: Two requirements separate or bullet points? Cannot include two shall statements in one section?

Service panels or controls for the shredder shall be located ~~so as not to expose such that~~ operating personnel are not exposed to the blast zone.

11.5.12.6*

Where required by the FPDBD, explosion venting shall be sized using properties based on hydrogen as described in NFPA 68.

Commented [SK35]: SL: This needs to be more specific.

A.11.5.12.6

Where ducts are used to vent explosions to the outside, increased pressure caused by the length of the vent duct is possible and should be considered. See Section 11.5 provides guidance for requirements on explosion suppression systems.

11.5.2.6.1

~~Where ducts are used to vent explosions to the outside, consideration shall be given to increased pressure caused by the length of the vent duct.~~

11.5.1.6.12.6.2

~~If~~ Where the vent area available is inadequate for sufficient explosion venting ~~because of due to~~ the height of the vent stack or other factors and where required by the FPDBD, an explosion suppression system in the shredder shall be used to augment the venting arrangement.

11.5.12.7

Where ~~access door assemblies are~~ provided for the primary shredder enclosure and required by the FPDBD, ~~they access door assemblies~~ shall be kept secured to prevent unauthorized access when the equipment is operating and. ~~Where access door assemblies are provided, they shall~~ have the same pressure rating as the enclosure.

Commented [PH36]: Multiple requirements - Format Denise to confirm proper NFPA form.

11.5.23 Prevention of Fires and Explosions in RDF Units.

11.5.23.1*

~~The process shall be designed to minimize the production of dust.~~ Dust collected in a dust collection system, baghouse, or cyclone shall be discharged downstream of the collection system, back to the conveying system, or back to the residue or waste stream.

Commented [BD37]: This is not code text and serves no purpose.

A.11.5.23.1

~~Section~~ See 9.5.3 ~~provides guidance for~~ requirements on dust collection systems.

11.5.2.23.2¹ Radiation Imaging Equipment.

11.5.2.2.1*

Where required by the FPDBD, Radiation-radiation imaging equipment ~~(e.g., x ray)~~ shall be provided ~~as a means~~ to detect tanks or containers ~~that could containing~~ flammable materials.

A.11.5.2.2.13.2

~~An example of radiation imaging equipment is an x-ray machine.~~ An image of what is seen in the waste is transmitted to an operator. If a tank-shaped object is observed, the conveyor should be stopped and the tank ~~should be~~ removed.

~~The radiation~~ Radiation imaging equipment is ~~the~~ superior ~~method for to methods relying on operators standing beside the conveyor using rakes to~~ identifying tanks or other containers of flammable materials. The following factors make ~~other methods, such as relying on operators standing beside the conveyor and using rakes, this method~~ less than effective:

- (1) Speed of conveyor — the faster the conveyor is moving, the less chance operators have to detect tank-shaped objects
- (2) Depth of trash on the conveyor
- (3) Concealment of tanks in other waste (e.g., a propane tank inside a mattress)

11.5.2.2.2.2.1

Where provided, ~~the radiation~~ detection equipment shall be arranged to monitor waste on the conveyor before it enters the shredder.

11.5.2.3* Supplemental Protection.

Where required by the FPDBD ~~as a supplemental explosion protection measure~~, a combustible gas detection system shall be provided ~~as a supplemental explosion protection measure~~.

~~(1) the location of sensors or sampling lines shall be based on site-specific conditions, including air flow rates through the shredder and associated components located upstream and downstream of the shredder~~

~~(2) the system shall be arranged with alarm annunciation at 25 percent of the calibrated lower explosive limit (LEL) and interlocks at 50 percent of the LEL.~~

A.11.5.2.3

~~Anticipated flammable vapors can include a wide variety of flammable materials and the~~ The selected gas detection device should ~~consider a wide variety of flammable materials~~ take this into consideration.

Interlocks ~~that should be considered to consider~~ include area evacuation; shutdown of shredder, associated conveyors, and dust collection systems; and operation of fire or explosion suppression systems.

11.5.2.3.1

The location of sensors or sampling lines shall be based on site-specific conditions.

A.11.5.3.3

~~Site-specific conditions that influence sensor or sampling line locations include air flow rates through the shredder and associated components located upstream and downstream of the shredder.~~

11.5.2.3.2

The system shall be arranged such that the alarm annunciates at 25 percent of the calibrated lower explosive limit (LEL) and interlocks at 50 percent of the LEL.

Commented [BD38]: This needs a number.

Commented [BD39]: To keep this formatting, end the sentence above with "in accordance with the following:" or something similar. Or give each a subordinate number and start with "Where, provided..."

Commented [SK40]: SL: Can't have a list if the main para doesn't lead it in. I think these work fine as standalone requirements sub to 11.5.2.3, which is what I've done.

Commented [SK41]: SL: Annex A for examples.

11.5.34 Fire Protection.

11.5.34.1*

Where required by the FPDBD, the actuation of a fire suppression system shall cause the equipment it protects to shut down.

11.5.3.1.1

~~With the~~ Upon shutdown of the equipment, the upstream feed conveyors shall ~~also~~ shut down to stop feeding combustible material to the fire.

11.5.3.1.2

~~Additionally, downstream~~ Downstream conveyors shall be stopped to prevent the spread of the fire.

11.5.3.1.3

A manual means of initiating conveyor shutdown shall be provided in the control room.

A.11.5.34.1

Where a facility has a rigidly enforced operating sequence and satisfies itself and the authority having jurisdiction that the operating practices and the judgment of the plant operators provide acceptable protection, this interlock with the fire protection system could ~~be permitted to~~ be provided through operator action in accordance with operating procedures.

Commented [PH42]: Multiple requirements

Commented [PH43R42]: See 11.5.3.3 as example for formatting typical comment thru 11.5 section

Commented [DL(V44)]: Existing Annex Entry

11.5.34.2*

Where required by the FPDBD, classifiers ~~/or~~ trommels, ~~such as rotating screens~~, shall be provided with water spray protection to prevent fire from propagating downstream through the screen. ~~Where provided, water spray systems shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) of the entire screen area with nozzles no more than 10 ft (3.0 m) on center.~~

A.11.5.34.2

~~An example of a trommel would be a rotating screen. Consideration should be given to avoiding physical~~ Physical damage from mobile equipment operation in the area and from the material being processed ~~should be avoided.~~

11.5.3.2.1

Where provided, water spray systems shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) of the entire screen area with nozzles no more than 10 ft (3.0 m) on center.

11.5.34.3*

Where required by the FPDBD, the tipping ~~/or~~ receiving building shall be provided with automatic sprinkler protection throughout.

11.5.3.3.1

Where provided, automatic sprinkler systems shall meet the following criteria:

Commented [SK45]: SL: Revised to match other similar instances of text in this chapter.

(1) ~~Systems~~ shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) over the most remote 3000 ft² (279 m²)

(2) ~~Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems) of floor area,~~

(3) ~~with the~~The protection area per sprinkler shall not ~~to~~ exceed 130 ft² (12.0 m²).

11.5.3.3.2

Where required by the FPDBD, high-temperature sprinklers [250°F to 300°F (121°C to 149°C)] shall be used.

A.11.5.34.3

The requirements specified in 11.5.34.3 are based on storage heights not exceeding 20 ft (6.1 m). For storage heights greater than 20 ft (6.1 m), ~~the density should be increased in accordance with~~ see NFPA 13.

11.5.34.4*

Where required by the FPDBD, the processing building shall be provided with automatic sprinkler protection throughout.

11.5.3.4.1

Where provided, automatic sprinkler systems shall meet the following criteria:

(1) ~~Systems shall~~ be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) over the most remote 3000 ft² (279 m²).

(2) ~~Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems) of floor area, with~~

(3) ~~the~~The protection area per sprinkler shall not ~~to~~ exceed 130 ft² (12.0 m²).

A.11.5.34.4

~~Due to the large quantity of platforms, equipment, and walkways, care should be taken to include coverage~~
Coverage under all obstructions greater than 4 ft (1.2 m) wide should be included due to the large quantity of platforms, equipment, and walkways.

11.5.34.5

Where required by the FPDBD, an RDF plant that has a tipping floor and pit, ~~it~~ shall be protected with monitor nozzle coverage that aligns/complies with ~~the recommendations of~~ 11.4.2.2.2.

11.5.34.6*

Where required by the ~~FDDBD~~FPDBD, the RDF storage building shall be provided with automatic sprinkler protection throughout.

A.11.5.34.6

The requirements specified in 11.5.34.6 are based on storage heights not exceeding 20 ft (6.1 m). For storage heights greater than 20 ft (6.1 m), ~~the density should be increased in accordance with~~ see NFPA 13.

Commented [DL(V46): Existing Annex Entry

11.5.34.6.1

Where provided, automatic sprinkler systems shall meet the following criteria:

(1) Systems shall be designed for a minimum of 0.35 gpm/ft² (14.3 mm/min) over the most remote 3000 ft^{2±} (279 m²).

(2) Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems of floor area, with

(3) the ~~The~~ protection area per sprinkler shall not ~~to~~ exceed 100 ft² (9.3 m²).

Commented [BD47]: This needs a number.

Commented [BD48R47]: 11.5.4.6.1

11.5.34.6.2

Where required by the FPD BD, High ~~high~~ temperature sprinklers [250°F to 300°F (121°C to 149°C)] shall be used.

Commented [BD49]: This needs a number.

Commented [BD50R49]: 11.5.4.6.2

11.5.34.7*

Where required by the FPD BD, the RDF boiler feed system area, including bins, hoppers, chutes, conveyors, and so forth, shall be provided with automatic sprinkler protection.

A.11.5.3.7

The RDF boiler feed system area includes, but is not limited to, bins, hoppers, chutes, and conveyors.

11.5.34.7.1

Where provided, ~~the automatic sprinkler~~ systems shall meet the following criteria:

(1) Systems shall be designed for a minimum of 0.20 gpm/ft² (8.1 mm/min) over the most remote 2000 ft² (186 m²).

(2) Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems of floor area, with

(3) the ~~The~~ protection area per sprinkler shall not ~~to~~ exceed 130 ft² (12.0 m²).

Commented [BD51]: This needs a number.

Commented [BD52R51]: 11.5.4.7.1

11.5.34.7.2

Where required by the FPD BD, internal, as well as and external, protection also shall be provided as necessary based upon specific equipment design, ceiling heights, and accessibility for manual fire- ~~fire~~ fighting.

Commented [BD53]: Another number.

Commented [BD54R53]: 11.5.4.7.2

11.5.34.8

Where required by the FPD BD, shredder enclosures shall be provided with automatic sprinkler or water spray protection.

11.5.34.8.1

Where provided, automatic sprinkler systems shall meet the following criteria:

(1) ~~Systems shall~~ be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) over the most remote 3000 ft² (279 m²).₂

(2) ~~Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems) of floor area, with~~

(3) ~~the~~ The protection area per sprinkler shall not ~~to~~ exceed 100 ft² (9.3 m²). |

Commented [BD55]: This needs a number.

11.5.34.8.2

Where required by the FPDBD, water spray protection ~~should also shall~~ be provided within the shredder housings at intake and discharge chutes and within vent shafts. |

Commented [BD56]: Also needs a number.

11.5.34.9*

Where required by the FPDBD, detection devices compatible with the environment shall be used.

A.11.5.34.9

When selecting detection devices, the following should be considered:

(1a) Heat detection is most reliable under conditions encountered in process areas.

(2b) Smoke detection should not be used in process areas.

(3e) If flame detectors are used, an air sweep of the lens should be provided.

11.5.45 Explosion Suppression.

11.5.45.1*

Where required by the FPDBD, explosion suppression systems shall be provided for protection of shredders.

A.11.5.45.1

NFPA 69, ~~Standard on Explosion Prevention Systems~~ and ASTM E1248, *Standard Practice for Shredder Explosion Protection*, provide design ~~guidance information~~ for mitigation of explosions.

11.5.45.1.1

Where provided, the explosion protection system shall be designed and installed by qualified individuals using listed components. |

Commented [PH57]: Qualified or registered?

11.5.45.2*

Where required by the FPDBD, explosion suppression system detectors and agent distribution shall cover the entire shredder volume and all contiguous areas, ~~including inlet and discharge conveyors, reject chutes, and dust collection systems.~~

Commented [BD58]: Needs a number.

A.11.5.4.2

Contiguous areas include inlet and discharge conveyors, reject chutes, and dust collection systems.

11.5.45.3*

Where provided, the explosion suppression system equipment and associated mountings shall be inspected periodically.

A.11.5.45.3

Automatic cleaning systems have not been practical. Manual cleaning of at least once per work shift has been found necessary in several facilities to be effective. Manual cleaning ~~could also might~~ not be practical ~~because if~~ the shredder ~~could be is~~ in continuous operation for several days. Manufacturers have attempted to locate pressure sensors in areas where they will not be plugged. If there is a delay in operation of the suppression system, there could be an increase in pressure above what would be expected in an unsuppressed explosion.

Commented [SK59]: SL: We need to provide a specific timeline.

Commented [DL(V60)]: Existing Annex Entry

11.5.45.3.1

Where provided, the extinguisher and detector ports shall be cleaned frequently to ensure successful operation.

Commented [PH61]: Subjective statement

Commented [SK62R61]: Agree!

Commented [BD63]: Needs a number.

11.5.45.4*

Where provided, explosion suppression system pressure sensors shall be located in areas of the shredder where they will not be plugged.

Commented [PH64]: Clarify

Commented [SK65R64]: Agree.

A.11.5.45.4

If there is a delay in operation of the suppression system, there could be an increase in pressure above what would be expected in an unsuppressed explosion.

11.6* Risk Considerations for Biomass Fuels.

~~This section identifies fire and explosion hazards that are unique to the processing of forest and agricultural by-products (e.g., wood chips, rice hulls, sugar cane) into boiler fuel manufactured by means of a process that can include, but is not limited to, storing, shredding, classifying, and conveying the biomass to a fuel storage area and conveying it from the storage area to feed the boiler through a metering device.~~

Commented [BD66]: This is annex text.

A.11.6

~~This section identifies fire and explosion hazards that are unique to the processing of forest and agricultural by-products (e.g., wood chips, rice hulls, sugar cane) into boiler fuel manufactured by means of a process that can include, but is not limited to, storing, shredding, classifying, and conveying the biomass to a fuel storage area and conveying it from the storage area to feed the boiler through a metering device.~~

In general, biomass fuels are such that fires of low to moderate intensity would be expected. There can be cases, however, where fuel type and processing will present a greater fire hazard and so require a higher level of protection.

11.6.1*

~~The FPDBD shall consider the~~The specific properties of the fuel ~~shall be included in determining the determination of~~ explosion potential ~~by the FPDBD~~.

A.11.6.1

~~Where process~~ Process or handling equipment ~~that~~ involves biomass fuel materials with ~~a~~ particle size less than 80 mesh and with moisture content less than 30 percent by volume, ~~a may might~~ create an explosive environment.

Biomass units ~~utilizing using~~ equipment capable of producing explosive concentrations of gases should be provided with explosion venting or explosion suppression systems.

~~See NFPA 68, Standard on Explosion Protection by Deflagration Venting, NFPA 69, Standard on Explosion Prevention Systems, and NFPA 664, Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities provide guidance for more on the assessment of the explosion hazards.~~

11.6.2* Sprinkler Protection.

11.6.2.1*

Where required by the FPDDB, biomass storage buildings shall be provided with automatic sprinklers throughout.

A.11.6.2.1

Biomass fuels exhibit a wide range of burning characteristics and upon evaluation can require increased levels of protection.

11.6.2.2~~1~~

Where provided, automatic sprinklers systems shall meet the following criteria:

(1) Systems shall be designed for a minimum of 0.25 gpm/ft² (10.2 mm/min) over the most remote 3000 ft² (279 m²).

(2) ~~Where a dry pipe system is used, the most remote area shall be increased by 30 percent for dry pipe systems) of floor area,~~

(3) ~~with the~~ The protection area per sprinkler shall not ~~to~~ exceed 130 ft² (12.0 m²).

11.7* Risk Considerations for ~~Tire-Tire~~ Derived Fuels.

~~11.7.1 General.~~

~~This section identifies fire and explosion hazards that are unique to the processing of rubber tires as a primary or secondary boiler fuel.~~

~~11.7.1.1*~~

~~Fuel creation from rubber tires may include, but is not limited to, storing, shredding, and conveying the rubber tires to a fuel storage area (and conveying it from the storage area to fuel the boiler).~~

~~A.11.7.1.1~~

~~This section identifies fire and explosion hazards that are unique to the processing of rubber tires as a primary or secondary boiler fuel. Fuel creation from rubber tires can include, but is not limited to, storing, shredding, and conveying the rubber tires to a fuel storage area (and conveying it from the storage area to fuel the boiler).~~

In general, rubber tires have a Btu content of 15,000 Btu/lb (7180 J/kg), roughly two to three times that of wood or RDF.

Commented [DL(V67)]: Existing Annex Entry

Commented [SK68]: SL: Revised to match other similar instances of text in this chapter.

Commented [BD69]: This needs a number.

Commented [BD70]: This is annex text.

Commented [PH71]: Combine with first statement?

Commented [PH72R71]: Create a requirement?

Commented [SK73]: SL: None of this contained requirements. Moved to annex for now.

Commented [DL(V74)]: Existing Annex Entry

There are several inherent fire hazards associated with scrap tires, whether outside or inside a building. Once tires are ignited, the fire develops rapidly, and it is difficult to extinguish. The tires will generate a large amount of black smoke. ~~In addition, as~~ As the tires burn, they also generate oil that can spread and increase the size of the fire.

~~See NFPA 68, Standard on Explosion Protection by Deflagration Venting, NFPA 69, Standard on Explosion Prevention Systems, and NFPA 652, Standard on the Fundamentals of Combustible Dust provide guidance for more on the assessment of the explosion hazards.~~

11.7.2 Fire Protection.

11.7.2.1

~~For the water~~ Water supply and fire protection ~~requirements~~ of outdoor storage of scrap rubber tires, see shall comply with Chapter 33 of NFPA 1.

11.7.2.2*

Where required by the FPDDB, the scrap rubber tire pit shall be provided with water additive or foam-water spray protection throughout.

A.11.7.2.2

Where provided, the system(s) should be designed for a minimum of 0.24 gpm/ft² (9.8 mm/min) over the entire pit area, with the protection area per nozzle not to exceed 100 ft² (9.3 m²). Due to the extreme hazard, clearance between the top of storage and foam water spray systems should be minimized.

Automatic versus manual actuation should be considered ~~within~~ by the FPDDB.

11.7.2.3*

Where required by the ~~FPDDB~~, and in addition to the water additive or ~~foam-foam~~ water spray protection, the storage pit should be provided with monitor nozzle protection designed to furnish a minimum of 250 gpm (946 L/min) at 100 psi (689 kPa) at the tip.

A.11.7.2.3

Where monitors are provided, they should be located ~~so as~~ to allow for coverage of all pit areas with at least two streams operating simultaneously. Due to the potential for operator fire exposure, oscillating monitor nozzles with manual override should be provided.

11.7.2.4*

~~Where~~ required by the FPDDB, the protection and storage of scrap rubber tires indoors shall be in accordance with NFPA 13.

A.11.7.2.4

The boiler's tire feed system, including bins, hoppers, and chutes, should be considered for automatic water additive or foam-water protection. ~~Where provided, the system should be designed for a minimum of 0.30 gpm/ft² (12.2 mm/min) over the most remote 2500 ft² (232 m²).~~

11.7.2.5*

Commented [SK75]: SL: Turned this into a requirement, but the changes can be reversed and the para moved to the annex if preferred.

Commented [BD76]: Why is this annex text when all those above are attached as mandatory?

Commented [BD77]: It really seems arbitrary that some sprinkler spec's are annex and some are mandatory. What is methodology?

Where provided, manual water spray systems shall include remote actuation from the control room or other constantly attended areas.

A.11.7.2.5

Additionally, local actuation stations should be placed adjacent to the fire areas along lines of egress and ~~in consideration of~~ should consider operator safety and protection from damage due to equipment.

11.7.2.6*

Where required by the FPDDB, explosion venting or explosion suppression systems shall be provided for scrap rubber tire units utilizing-using equipment capable of producing explosive concentrations of gases or dusts.

A.11.7.2.6

For ~~assessments of~~ tire plant processes that might generate dust explosion ~~hazards-potential~~, refer to see NFPA 68, ~~Standard on Explosion Protection by Deflagration Venting, and~~ NFPA 69, ~~Standard on Explosion Prevention Systems for the assessment of the explosion hazard.~~

11.8* Other Alternative Fuels and Processes.

The ~~Fire Protection-FP~~DBD shall evaluate the unique characteristics of any particular fuel or technology to properly apply the appropriate portions of this and other applicable NFPA standards.

A.11.8

Other alternative fuels (e.g., culm, peat, gob) exist that are used as boiler fuels. ~~Also, other-Other~~ technologies also exist for the ~~utilization-use~~ and processing of alternative fuels as boiler fuels. Designers should understand the unique characteristics of any particular fuel or technology being considered to properly apply the appropriate portions of this and other applicable NFPA standards-documents.

Commented [PH78]: Capable doesn't mean required

Commented [SK79]: SL: What does "dust explosion potential" mean? Should we rewrite as "that might generate a dust explosion"?

Commented [SK80]: SL: I have no idea what this is requiring. An evaluation of something, but nothing is specified? It is also very similar to the second sentence of the annex, which leads me to believe its more informational than a requirement.



Public Input No. 55-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 12]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter12_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 12 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 12 Power Boilers

12.1* General.

This chapter identifies fire and explosion hazards associated with electric generating plants utilizing power boilers and specifies recommended protection criteria regardless of the fuel used. Electric generating stations using power boilers shall comply with Chapters 4 through 11, as applicable.

A.12.1

Examples of alternative fuel include, but are not limited to, refuse derived fuel (RDF), municipal solid waste (MSW), and biomass.

12.1.1

The major fire and explosion hazards associated with power boilers are as follows:

- (1) Sourcing, receipt, handling, and storage of large quantities of fuels
- (2) Unsuitable waste entering the facility, such as certain hydrocarbons, flammable liquids, metal dusts, acetylene, explosives, and so on
- (3) Hydraulic and lubricating oils associated with the processing equipment
- (4) Improperly maintained electrical equipment
- (5) Large amounts of fuel accumulating in unsuitable areas as a result of spillage or handling
- (6) Inadequate dust control

12.1.2*

Automatic sprinkler protection should be provided in plastic ducts over 12 in. (300 mm) in diameter whether ducts are located inside or outside the tipping building. Sprinklers should be spaced not more than 12 ft (3.7 m) apart in horizontal ducts and no more than 24 ft (7.32 m) apart in vertical ducts. Water supply should be adequate for a flow rate of 20 gpm (1.26 L/sec) per head.

A.12.1.2

Duct systems could be used for odor control by exhausting air from processing to the boiler. A fire in an unprotected plastic duct system could result in a number of fires in different areas of the processing buildings overtaxing the sprinkler system.

12.1.3

Automatic sprinklers should be corrosion resistant to withstand corrosion from products of combustion from combustion engine-driven front end loaders and from trash trucks.

12.1.4*

Fuel handling structures and conveyors should be protected in accordance with 9.5.6.

A.12.1.4

Conveyors can be considered protected by overhead building protection if not enclosed or hooded.

[ALL NEW TEXT FOLLOWING 12.1]

12.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to specific ~~power boilers~~ Power Boilers.

A.12.2

~~The Fire Protection Design Basis Document (FPDBD) should determine which requirements apply to any specific Boiler Technology.~~ 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 protection methods 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-FPDBD~~ indicates that a single source of water (e.g., a single tank) is considered adequate and reliable

The major fire and explosion hazards associated with power boilers are as follows:

- (1) Sourcing, receipt, handling, and storage of large quantities of fuels
- (2) Unsuitable waste entering the facility (e.g., such as certain hydrocarbons, flammable liquids, metal dusts, acetylene, explosives) ~~and so on~~
- (3) Hydraulic and lubricating oils associated with the processing equipment
- (4) Improperly maintained electrical equipment
- (5) Large amounts of fuel accumulating in unsuitable areas ~~as a result of due to~~ spillage or handling
- (6) Inadequate dust control

12.2.1

Where required by the FPDBD, automatic sprinkler protection shall be provided in plastic ducts over 12 in. (300 mm) in diameter regardless of whether ~~ducts they~~ are located inside or outside the tipping building.

12.2.1.1

Where provided, sprinklers shall be spaced ~~not no~~ more than 12 ft (3.7 m) apart in horizontal plastic ducts and no more than 24 ft (7.32 m) apart in vertical plastic ducts.

12.2.1.2

Where provided, the water supply for plastic duct sprinklers shall be adequate for a flow rate of 20 gpm (1.26 L/sec) per head.

12.2.2

Commented [SK1]: SL: This was just repeating the above, but in nonmandatory form.

Commented [BM2]: Annex for 12.2

Commented [LS3R2]: Incorporated A.12.1 into 12.1
General to be consistent with format style

Commented [BM4]: Annex for 12.2, part 2

Commented [PH5R4]: Don't like "most of"?

Commented [LS6R4]: Deleted "most of"

Commented [PH7]: Body or Annex?

Commented [LS8R7]: Moved this section as A12.1 to Annex

Where provided, sprinkler heads in enclosed fuel receiving areas shall be ~~corrosion-resistant~~ able to withstand corrosion from products of combustion from ~~combustion-combustion-engine-driven-driven~~ front end loaders and from trash trucks.

12.3 Design and Equipment Arrangement.

12.3.1 Steam Generators.

12.3.1.1

Steam ~~Generators~~ generators shall meet the applicable ~~sections~~ requirements of NFPA 85.

12.3.1.1 Fire Protection.

12.3.1.2

Where required by the FPDDB, power boiler-furnaces with multiple oil-fired burners or that use oil for ignition shall be protected with automatic sprinkler, water spray, water additive, foam, or foam-water sprinkler systems; or compressed air foam systems covering the burner front oil hazard.

12.3.1.3

Where provided, burner front fire protection systems for power boilers shall provide coverage for the fuel oil burners and igniters and adjacent fuel oil piping and cable a ~~distance of~~ 20 ft (6.1 m) ~~distance~~ from the burner and igniter, ~~including structural members and walkways at these levels.~~

A.12.3.1.3

~~The coverage area includes structural members and walkways within the required distance.~~

12.3.1.3.1

Where required by the FPDDB, sprinklers coverage shall include areas where oil can collect.

12.3.1.3.2

Where provided, sprinkler, water spray, and water additive systems shall be designed for a density of 0.25 gpm/ft² (10.2 mm/min) over the protected area.

12.3.1.3.3

Where provided, compressed air foam systems shall be designed and installed in accordance with NFPA 11 and their listing for the specific hazards and protection objectives specified in the listing.

12.3.2 Boiler Fuel Feed Equipment.

12.3.2.1*

The boiler fuel feed equipment, ~~such as a metering bin,~~ shall be ~~constructed~~ of noncombustible material and designed to minimize pockets or corners that would cause combustible material to build up.

A.12.3.2.1

~~An example of such equipment would be a metering bin.~~ Video monitoring should be considered for locations not readily visible to plant staff. (See NFPA 85.)

Commented [BM9]: Is enclosed areas the intent?

Commented [LS10R9]: Yes

Commented [PH11R9]: See comment above.

Commented [LS12R9]: Enclosed area is the intent of this requirement

Commented [BM13]: Should this be moved to Chapter 9.5.1?

Commented [PH14R13]: 3 shall statements need to be separated.

Commented [PH15R13]: These sections look they should be moved down below section 12.3? And sepearted into 3 separate sections.

Commented [LS16R13]: Relocate to 9.5.1, not sure how this gets done with other Task Group

Commented [SK17R13]: I don't see this in Chapter 9...

Commented [BM18]: Should this move to 9.5.1?

Commented [PH19R18]: Still open.

Commented [LS20R18]: Relocate to 9.5.1, not sure how this gets done with other Task Group

Commented [SK21R18]: Again not sure what's going on with this...

Commented [BM22]: reworded

Commented [LS23R22]: Reworded text

Commented [SK24]: SL: Can we move examples to Annex A? I don't know if I got the context right, though.

Commented [BM25]: Annex for 12.3.2.1

Commented [LS26R25]: Agreed

12.3.2.2*

Where required by the FPDDB, ~~Access-access~~ hatches ~~should~~ shall be provided to allow operating personnel to break up accumulations of combustible material ~~or pluggages~~.

A.12.3.2.2

The hatches should be placed so that the stream from a fire hose can be directed onto a fire ~~that can occur~~ inside the equipment.

12.3.2.3 Pulverizers.

12.3.2.3.1

Pulverized fuel systems shall ~~meet the applicable sections of~~ comply with NFPA 85.

12.3.2.3.2

Where required by the FPDDB, carbon monoxide gas detection systems shall be provided for pulverizers as an early warning for conditions ~~leading that can lead~~ to fires and explosions.

12.3.2.3.3

Where required by the FPDDB, inerting and temperature control shall be provided ~~as explosion prevention~~ for pulverizers ~~explosion mitigation~~.

12.3.2.3.4

Where required by the FPDDB, personnel warning systems shall be provided during pulverizer startup, shutdown, and trip.

12.3.3 Boiler Feed Pumps.

12.3.3.1*

Coverage of steam-driven boiler feed pumps ~~should~~ shall include oil lubrication lines, bearings, and oil reservoirs.

A.12.3.3.1

Accidental water discharge on bearing points and hot turbine parts should be considered. If necessary, these areas are permitted to be protected by shields and casing insulation with metal covers. Boiler feed pumps that are ~~electric-electric~~ motor-driven, with lubricating or hydraulic oil hazards, can require protection depending on the quantity of oil, oil pressure, or exposure to other equipment.

- ~~(1) Accidental water discharge on bearing points and hot turbine parts should be considered.~~
- ~~(2) If necessary, these areas are permitted to be protected by shields and casing insulation with metal covers.~~
- ~~(3) Boiler feed pumps that are electric motor driven, with lubricating or hydraulic oil hazards, can require protection depending on the quantity of oil, oil pressure, or exposure to other equipment.~~

12.3.3.2*

Commented [KS27]: SL: "Pluggages" isn't a word. Blockage? But nothing is specified... a blockage of what? Other material? If we're still talking about combustible material, I think "accumulations" covers what you're trying to say.

Commented [BM28]: Annex for 12.3.2.1

Commented [LS29R28]: Agreed, made 12.3.2.2 a shall statement and moved hatch information to annex

Commented [BM30]: Annex for 12.3.2.2

Commented [LS31R30]: Moved to annex

Commented [KS32]: SL: We should either generalize (comply with NFPA 85) or specify (comply with Section X.X and X.X of NFPA 85).

Commented [BM33]: reworded

Commented [LS34R33]: Agreed with change

Commented [BM35]: Annex for 12.3.3.2

Commented [LS36R35]: Agreed, made 12.3.2.1 a shall statement and moved supplemental information to annex

Commented [BM37]: Annex for 12.3.3.2

Commented [LS38R37]: Agreed, made 12.3.2.1 a shall statement and moved supplemental information to annex

Commented [SK39]: SL: Combined to para above.

Where required by the FPDBD, hydraulic and lubricating oil hazards associated with boiler feed pumps ~~that are~~ driven with steam turbines shall be protected in accordance with 10.3.1.4.2.

A.12.3.3.2

The use of a listed fire-resistant lubricant and hydraulic fluid can eliminate the need for fire protection systems.

Commented [BM40]: Annex for 12.3.3.2

Commented [LS41R40]: Agreed will move to Annex

12.3.3.3

Where required by the FPDBD, curbing ~~of drainage~~ or both shall be provided for the steam-driven boiler feed pump oil reservoirs in accordance with Section 6.5.

12.3.4 Flue Gas.

12.3.4.1 ~~Forced Draft, Induced Draft, and Flue Gas Recirculation Fans.~~

~~12.3.4.1.1*~~

Where required by the FPDBD, combustible oil hazards associated with forced and induced draft fans driven with steam turbines ~~should shall~~ be protected with automatic sprinkler systems, water spray systems, systems with water additives, foam-water sprinkler systems, or compressed air foam systems.

A.12.3.4.1.1

Coverage of steam-driven fans should include oil lubrication lines, bearings, and oil reservoirs. Accidental water discharge on bearings points and hot turbine parts should be considered. If necessary, these areas can be ~~permitted to be~~ protected by shields and casing insulation with metal covers.

Commented [BM42]: Annex for above section

Commented [LS43R42]: Agreed, will move to Annex

~~(1) Accidental water discharge on bearings points and hot turbine parts should be considered.~~

~~(2) If necessary, these areas can be permitted to be protected by shields and casing insulation with metal covers.~~

Commented [SK44]: SL: Added to para above.

Commented [BM45]: Annex for above section 12.3.4.1.1

Commented [LS46R45]: Moved to annex

12.3.4.1.1

Where provided, water spray systems for ~~steam-steam-turbine-driven-driven~~ forced draft and induced draft fans shall be designed for a density of 0.25 gpm/ft² (10.2 mm/min) over the oil containment equipment surface.

Commented [BM47]: Annex for above section 12.3.4.1.1

Commented [LS48R47]: Moved to annex

12.3.4.1.2

Where provided, water spray systems shall be designed for 0.25 gpm/ft² (10.2 mm/min) for a minimum 20 ft (6.1 m) from the hazard.

Commented [BM49]: Annex for above section 12.3.4.1.1

Commented [LS50R49]: Moved to annex

12.3.4.1.3

Where provided, compressed air foam systems ~~should shall~~ be designed and installed in accordance with NFPA 11 and their listing for the specific hazards and protection objectives ~~specified in the listing~~.

12.3.4. ~~2-1-2~~

Where required by the ~~FP~~-FPDBD, forced draft fans, induced draft fans, and flue gas recirculation fans shall use a listed fire-resistant fluid for hydraulic drives.

12.3.4.3

Where ~~nonapproved hydraulic fluids are used and if their use is~~ required by the FP-FPDBD, ~~protection nonapproved hydraulic fluids shall be provided as described~~ protected in accordance with 12.3.4.1.1.

12.3.5 Regenerative Air Heaters.

12.3.5.1*

Where required by the FP-FPDBD, ~~Regenerative Air Heaters~~ regenerative air heaters shall be provided in the inlet and outlet ducts for both flue gas and air.

A.12.3.5.1

Fires have occurred in air heaters ~~after from~~ the accumulation of ~~appreciable quantities of~~ unburned combustibles on plate surfaces resulting from incomplete combustion of fuel in the boiler. Incomplete combustion is most likely to occur during startup ~~but, incomplete combustion also~~ can also occur during load changes, periods of low firing rate, or normal operation due to unstable or over-rich firing.

12.3.5.2*

Where required by the FP-FPDBD, temperature sensors shall be provided in the inlet and outlet ducts for both flue gas and air. ~~Where provided, an alarm shall be provided in the control room to alarm when air or flue gas temperatures exceed 50°F (28°C) above normal operating temperature.~~

A.12.3.5.2

Fire-loss experience does not presently indicate the need for special protection for other than regenerative-type air heaters. Regenerative-type air heater fires have occurred when firing on all types of fuel. Fires have occurred most frequently when firing oil or shortly after changing to pulverized coal from oil.

Temperature sensors alone might not be adequate to provide early warning of a fire in an air heater. In large air heaters, air flow rates are high enough so that a fire will be well developed before the temperature increases enough to alarm and warn the operator. The length of time the operator has to take action is greatly reduced, and severe damage can occur. The installation of a special detection system can allow operators time to quickly detect a fire, isolate the air heater, open drains, and activate the water spray system.

12.3.5.2.1

Where temperature sensors are provided, an alarm shall be provided placed in the control room to alarm annunciate when air or flue gas temperatures exceed 50°F (28°C) above normal operating temperature.

12.3.5.3*

Where required by the FP-FPDBD, a minimum of one observation port ~~should shall~~ be provided in the inlet and/or outlet ducts for both flue gas and air.

A.12.3.5.3

Large air heaters can require more than one observation port. ~~Where provided, observation ports shall~~ should be placed such that they are accessible for viewing the rotor or stator surface.

~~Where provided, observation ports shall be placed such that they are accessible for viewing the rotor or stator surface.~~

Commented [BM51]: Annex for 12.3.5.3

Commented [LS52R51]: Moved to annex

Commented [BM53]: Annex for 12.3.5.3

Commented [LS54R53]: Moved to annex

Commented [BM55]: Annex for 12.3.5.4

Commented [LS56R55]: Moved to annex, rewrote A12.3.5.5 (1)

12.3.5.4

Where required by the ~~FP~~-FPDBD, a manual water spray system shall be provided to protect the rotor or stator.

A.12.3.5.4

~~(1)~~ Where provided, the water spray system ~~shall~~should be capable of being activated from either the control room, or from the air heater area (control valve should be easily accessible) or both.

~~(2)~~ Where provided for a horizontal rotor and stator, the water spray system ~~shall~~should be designed for a minimum density of 0.60 gpm/ft² (24.4 mm/min) applied to the upper surface.

~~(3)~~ Water can be expected to flow by gravity down over plate surfaces.

~~(4)~~ Where provided for a vertical rotor or stator, the water spray system ~~shall~~should be designed for a minimum density of 0.30 gpm/ft² (12.2 mm/min) on both sides to obtain adequate penetration.

~~(5)~~ Water wash systems might not be adequate to give full coverage because of rotor drive failure.

Commented [BM57]: Annex for above

Commented [LS58R57]: Moved to annex

Commented [BM59]: Annex material for 12.3.5.5 part 1

Commented [LS60R59]: Agreed, moved to annex

Commented [KS61]: SL: I don't know if this is supposed to be mandatory or annex... it was placed in the annex so I've updated the language. No need for list item structure since there's no lead-in...

12.3.5.5*

Where required by the ~~FP~~-FPDBD, access hatches for the use of hose streams shall be provided and~~Where provided, hatches shall~~ be designed for quick access.

A.12.3.5.5

A minimum of one hatch should be provided ~~per for every~~ 10 ft (3.0 m) of rotor or stator diameter. For horizontal shaft air heaters, access should be provided on both sides of the rotor or stator. For vertical shaft units, access hatches should be provided above the rotor or stator, with one hatch below for units under 20 ft (6.1 m) in diameter and two hatches below for units 20 ft (6.1 m) or more in diameter.

Commented [BM62]: Annex for 12.3.5.6

Commented [LS63R62]: Moved to annex

12.3.5.6

Where required by the ~~FP~~-FPDBD, drainage shall be provided to remove suppression water to a safe area.

12.3.5.6.1

Where provided, drains from air heaters, ducts, or both ~~should~~shall either be accessible or be controlled by remotely operated valves.

12.3.5.7*

Where required by the ~~FP~~-FPDBD, a ~~zero-zero~~zero-speed switch with alarm in the control room shall be provided on the rotor shaft or on the output shaft from the fluid coupling or gear reducer.

A.12.3.5.7

~~Zero-A~~ zero-speed alarm warns of stoppage of the rotor or air hoods. This stoppage could be due to failure of the drive motor or coupling, ~~which that~~ will lead to overheating of a section of the rotor or stator, which can result in a fire. Stoppage also can be caused by high temperatures generated by a fire that has caused the rotor to bind against the housing or caused the air hoods to bind against the stator.

Commented [BM64]: Annex for above

Commented [LS65R64]: Made 12.3.5.8 a shall statement and moved supplemental information to annex

12.3.6 ~~Flue-Flue-Gas-Bag-Type-Bag-Type~~ Dust Collectors.

12.3.6.1*

Flue ~~gas-bag-type gas bag-type~~ dust collectors ~~(also known as fabric filters)~~ can be damaged by overheating or fire. ~~Filter media can be damaged by flue gases entering at a temperature above the operating temperature of the filter media. Fires have been caused by incomplete combustion in the boiler resulting in carryover of burning particulate igniting the filter media and by maintenance operations such as cutting and welding.~~

A.12.3.6.1

Flue-gas-bag-type dust collectors are also known as fabric filters. Filter media can be damaged by flue gases entering at a temperature above the operating temperature of the filter media. Fires have been caused by from incomplete combustion in the boiler resulting in carryover of burning particulates that ignite igniting the filter media and by maintenance operations such as cutting and welding.

12.3.6.2*

Where required by the ~~FP~~-FPDBD, collectors equipped with bags that have an operating temperature limit exceeding 400°F (204°C) shall be subdivided into compartments by noncombustible partitions.

12.3.6.2.1

Where provided, ~~the noncombustible~~ partitions shall extend through the flue gas bag area.

A.12.3.6.2

The filter bag area provided in each compartment should be such that the fabric filter systems will not limit boiler load with one compartment fully isolated to repair damaged filter bags. The pressure drop across the fabric filter system should not increase significantly when one compartment is isolated.

12.3.6.3

Where required by the ~~FP~~-FPDBD, collectors equipped with other types of bags shall be subdivided into compartments constructed of either of the following:

- (1) ~~compartments by partitions of~~ Where automatic sprinkler protection is not provided, 30-minute fire-~~resistant partitions~~ ~~resistance if no automatic sprinkler protection is provided.~~ ~~or~~
- (2) Where automatic sprinkler protection is provided, noncombustible partitions ~~if sprinklers are provided.~~

12.3.6.3.1

Where provided, partitions shall extend from the hopper, through the bag area, to the clean air plenum.

12.3.6.3.2

Where provided, the water spray or sprinkler system shall be designed for a density of 0.20 gpm/ft² (8.1 mm/min) over the plan area of the dust collector.

12.3.6.3.3

Where provided, protection inside dust collectors shall include the bag area.

Commented [BM66]: Annex for 12.3.6.2

Commented [LS67R66]: Moved to annex

12.3.6.4

~~Where automatic sprinkler protection is provided, structural design of the collector shall take into consideration maximum water loading.~~ Where automatic sprinkler protection is provided, a method ~~should~~ shall be provided for drainage of water from the hoppers.

A.12.3.6.4

~~Where automatic sprinkler protection is provided, The structural design of the drainage collector shall take into consideration~~ should consider maximum water loading.

Commented [KS68]: SL: Not sure if this works for the context...

12.3.6.5

Where required by the ~~FP~~ FPDBD, a heat detection system; shall be provided in each compartment arranged to with an alarm to annunciate in a constantly attended area at ~~a temperature~~ 50°F (28°C) above normal operating temperature ~~shall be provided in each compartment.~~

12.3.6.6

Where required by the ~~FP~~ FPDBD, one of the following shall be provided to prevent high temperature inlet flue gas from damaging the bags:

- (1) ~~an~~ An automatic isolation valve and bypass duct to divert inlet gas streams around the flue gas bag collector (where permitted for emergency conditions); ~~or~~
- (2) A flue gas tempering water spray system in the duct between the boiler and the flue gas bag collector

12.3.6.7

Where required by the ~~FP~~ FPDBD, manual ~~fire~~ fire fighting equipment shall be available to personnel performing maintenance on a collector. ~~Where required by the FP FPDBD, a standpipe system should be provided such that each compartment is accessible by at least one hose system.~~

A.12.3.6.4

~~Where required by the FP FPDBD, a~~ A standpipe system should be provided such that each compartment is accessible by at least one hose system.

12.3.6.8

Where required by the ~~FP~~ FPDBD, access doors or hatches for manual ~~fire~~ fire fighting and viewing ports shall be provided for all compartments.

12.3.7* Electrostatic Precipitators.

A.12.3.7.1

Electrostatic precipitators can be damaged by heat from a fire. High temperatures can warp collecting plates, decreasing collection efficiency. Combustibles can be generated by over-rich boiler-furnace firing. Solid and liquid products of incomplete combustion can be collected on plate surfaces. Ignition can occur by arcing in the electrostatic precipitator.

Commented [BM69]: Annex for 12.3.7.2

Commented [LS70R69]: Moved to annex

Commented [KS71]: SL: None of these are requirements; Annex A?

12.3.7.12*

Where required by the ~~FP~~-FPDBD, temperature sensors shall be provided in the inlet and outlet ducts.

A.12.3.7.12

Where temperature sensors are provided, alarms ~~shall~~should be provided in the control room to indicate abnormal operating temperatures.

12.3.7.23*

Where required by the ~~FP~~-FPDBD, transformer-rectifier sets shall use high fire point insulating fluids or be of the dry type.

A.12.3.7.23

Alternatively, a fire barrier(s) or spatial separation in accordance with Chapter 6 can be used. (See 6.1.4 and 6.1.5.)

12.3.7.23.1

~~If~~Where mineral oil insulating fluids are used and where required by the ~~FP~~-FPDBD, hydrants or standpipes shall be located so that each transformer-rectifier set can be reached by at least one hose stream.

12.3.7.23.2

~~If~~Where mineral oil insulating fluids are used and where required by the ~~FP~~-FPDBD, automatic water spray protection shall be designed for a density of 0.25 gpm/ft² (10.2 mm/min) over the exposed surface of the transformer-rectifier set.

12.3.7.23.3

~~If~~Where mineral oil insulating fluids are used and where required by the ~~FP~~-FPDBD, automatic sprinkler systems shall be designed for a density of 0.25 gpm/ft² (10.2 mm/min) over 3500 ft² (325 m²).

12.3.7.23.4

Where required by the ~~FP~~-FPDBD, the drain system shall be capable of handling oil spillage plus the largest design water flow from the fire protection system.

12.3.8 Scrubbers, Scrubber Buildings, and Exhaust Ducts.

~~12.3.8.1 General.~~

12.3.8.12* Scrubber Buildings.

A.12.3.8.12

Scrubbers are the main component for flue gas desulfurization (FGD) processes, which are frequently used to maintain low sulfur emissions. Auxiliary equipment associated with the FGD process is often enclosed in scrubber buildings constructed around the lower elevations of the scrubber. Some scrubbers are entirely enclosed in the scrubber building as well. Exhaust ducts provide a flow path from the scrubber outlet to the stack. Fires have occurred in scrubbers with combustible lining, combustible packing, or both. The fires

Commented [PH72]: Need to separate into individual sections

Commented [BM73]: Annex for 12.3.7.3 part 2

Commented [LS74R73]: Moved alternate barrier walls to annex

occurred during outages and were caused by cutting and welding. Attempts to manually fight the fires were not successful since smoke and heat prevented access to the scrubber. Where scrubbers were located in buildings, there was extensive smoke and heat damage to the building. Fires can also occur in ductwork.

12.3.8.12.1

Where required by the ~~FP~~-FPDBD, buildings ~~should~~shall be constructed of materials meeting the criteria outlined in Section 6.3.

12.3.8.12.2

Where scrubbers have combustible linings and where required by the FPDBD, one of the following methods of protection for the building shall be provided:

(1) Automatic sprinkler protection at ceiling level, sized to provide 0.20 gpm/ft² (8.1 mm/min) over the area of the building or 10,000 ft² (930 m²).

(2) Fire proofing and venting as ~~follows described below~~:

(a) ~~1-hour~~ fireproof coating on the roof deck and supporting steel.

(b) ~~2-hour~~ fireproof coating on building columns from the roof to 20 ft (6.1 m) below the roof

(c) ~~2-hour~~ fireproof coating on columns adjacent to scrubber openings ~~from the roof to below the scrubber opening~~.

(d) Automatic or remotely actuated heat venting, based on a vent area of 1 ft² (0.09 m²) ~~per for every~~ 50 ft² (4.6 m²) of floor area.

A.12.3.8.12.2

Where draft curtains are provided, the area of operation can be reduced to the largest area subdivided by draft curtains.

12.3.8.12.3

~~If~~ ~~Where~~ a listed less flammable fluid is not used and where required by the ~~FP~~-FPDBD, hydraulic and lubricating oil equipment shall be protected ~~as described in~~ accordance with 9.6.1.

12.3.8.23 Scrubbers.

12.3.8.23.1 ~~Materials of Construction.~~

Where required by the ~~FP~~-FPDBD, scrubbers, internal piping, and ducts shall comply with one of the following:

(1) They shall be constructed of noncombustible materials. ~~or~~

(2) ~~the recommendations~~ The requirements of 10.3.5.2.1 and 10.3.5.2.2 ~~should~~shall be incorporated.

12.3.8.23.2

Commented [BM75]: Annex for 12.3.8.2

Commented [LS76R75]: Comment unclear, MB
Comment is for 12.3.8.2 but highlighted text is 12.3.8.1?

Commented [PH77R75]: Looks like 12.3.8.1 should be annex move down under .2 maybe some numbering clean up.

Commented [BM78]: Reworded for consistency

Commented [LS79R78]: Based on comment, looks like paragraph already changed

Commented [BM80]: Annex to above

Commented [LS81R80]: Moved to annex

All ~~equipment~~ associated ~~equipment with the scrubber equipment~~ lined with combustible material shall be identified with warning signs or placards.

12.3.9* Activated Carbon Injection Systems.

~~12.3.9.1* 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.~~

A.12.3.9.1

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 (spent) PAC is collected with fly ash in the baghouse ash hoppers.

Types of ~~PAC-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 FPDBD-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 FPDBD-Fire Protection Design Basis Document should consider a worst-case scenario.

Storage of ~~PAC-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, and 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.

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 12.3.9.2), 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 FPDBD-Fire Protection Design Basis Document.

12.3.9.15* Fire Detection-Protection.

Where required by the ~~FP~~-FPDBD, fire detection shall be provided for the PAC ~~Silo~~silos.

A.12.3.9.15

Commented [BM82]: Should a statement such as this be added to

Commented [LS83R82]: Not sure of meaning of comment, revised text

Commented [PH84R82]: Also sperate to 2 sections

Commented [BM85]: Annex for 12.3.9.5

Commented [LS86R85]: Moved to Annex

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.

~~Upon receipt of an alarm, thermographic cameras should be used to confirm the presence of a fire in the silo.~~

12.3.9.26* Fire Protection.

12.3.9.2.1

Where required by the ~~FP~~FPDBD, fire protection shall be provided for the PAC ~~Silo~~silo.

12.3.9.2.2

One of the following methods of fire protection shall be provided:

(1)* A fixed water-based (i.e., water, foam-water, or water with wetting agents and/or water additives) system that is designed to protect a full silo—

(2)* A fixed water-based (i.e., water, foam-water, or water with wetting agents and/or water additives) system that is designed to wash down a nearly empty silo—

(3)* Low-pressure carbon dioxide (CO₂) can be used to inert the silo—

(4) Other approved means—

A.12.3.9.2.2(1)6

~~One of the following methods of protection shall 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—~~

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~~use 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—~~

A.12.3.9.2.2(2)

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.

~~(2) Low-pressure carbon dioxide (CO₂) can be used to inert the silo—~~

A.12.3.9.2.2(2)

This can be a fixed system with a low-pressure CO₂ storage tank, vaporizer, and distribution piping. The silo manufacturer should be consulted during system design ~~of the system~~ to confirm that the silo design pressure is high enough for a CO₂ discharge, and to confirm how many nozzle locations are required to ensure that the CO₂ can permeate the dense PAC in the silo. As an ~~alternate~~alternative to the fixed low-pressure CO₂

Commented [BM87]: Annex for above

Commented [LS88R87]: Added 12.3.9.6, moved supplemental information to annex

Commented [KS89]: SL: I think this was supposed to be requirements, not annex.... I've moved the list items up as required text, and added asterisks to indicate the annex materials in paragraph form below.

Commented [KS90]: SL: By whom?

Commented [BM91]: Annex for (1)

Commented [LS92R91]: Rewrote sentence in 12.3.9.5, moved (1), (2) and (3) to annex

Commented [BM93]: Annex for (2)

Commented [LS94R93]: Moved to annex

storage tank, the system could ~~utilize-use~~ a dry-header and fixed vaporizer with connections for a CO₂ tank truck. The silo should be equipped with access platforms for maintenance of nozzles.

~~(4) Other approved means.~~

Commented [BM95]: Annex for (3)

Commented [LS96R95]: Moved to annex

12.3.10 Stacks.

12.3.10.1

Noncombustible liners shall be used where practical. *(See Annex C for fire tests.)*

12.3.10.2*

Combustible materials shall not be stored in the stack unless the liner is adequately protected by a fire barrier.

A.12.3.10.2

The barrier ~~could-should~~ be ~~either~~ a 2-hour fire barrier, ~~or a~~ A 1-hour fire barrier is suitable if automatic sprinkler protection is provided over the combustible material.

Commented [BM97]: Annex for 12.3.10.2

Commented [LS98R97]: Moved to annex

12.3.10.3*

A fire protection system shall be provided for maintenance operations inside combustible stack liners.

A.12.3.10.3

A fixed protection system installed on scaffolding is recommended. It should be capable of both manual and automatic operation and designed to protect the work platform and twice the area that can be reached by workers on the platform.

Commented [BM99]: Annex for 12.3.10.3

Commented [LS100R99]: Moved to annex

12.3.10.4

Ignition sources shall be eliminated when work is being performed on combustible liners.

12.3.10.5

Noncombustible scaffolding shall be used for work on combustible plastic liners.



Public Input No. 56-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 13]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter13_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 13 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Chapter 13 Wind Turbines

13.1 General.

~~13.1.1~~ [move text to 13.1]

~~Chapter 13 identifies fire and explosion hazards of wind-Wind turbine electric generating units and associated wind generating facilities (i.e., wind farms) shall comply with Chapters 4 through 9, as applicable and specifies recommended protection criteria.~~

~~13.1.2~~

~~Most wind farms consist of a varied number of tower-mounted wind turbine generators with electrical outputs tied together with the electrical power voltage stepped up to match grid voltage. The particular design of the wind turbine generators can vary, as will that of the configuration of the power output circuitry and components. Therefore, some recommendations might be more suitable for one type of wind turbine or wind farm facility than another. Many of the specific guidelines herein might require modification after due consideration of all local factors involved. Given the geographical remoteness of the typical wind farm, the emphasis of this guideline is on prevention of fire by design with the addition of fire suppression equipment to be guided by the Fire Protection Design Basis Document as well as a cost-benefit analysis to determine the extent to which fire protection is justified.~~

[ALL NEW TEXT FOLLOWING 13.1]

13.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which requirements apply to specific wind turbine electric generating units and associated wind generating facilities (i.e., wind farms).

A.13.2

~~The Fire Protection Design Basis Document (FPDBD) shall determine which requirements apply to any specific wind generating facility.~~

~~Most wind farms consist of a varied number of tower-mounted wind turbine generators with electrical outputs tied together with and the electrical power voltage stepped up to match grid voltage. The particular design of the wind turbine generators can vary, as will that of the configuration of the power output circuitry and components. Therefore, some recommendations requirements might be more suitable for one type of wind turbine or wind farm facility than another. Many of the specific guidelines requirements herein might require modification after due consideration of all local factors involved. Given the geographical remoteness of the typical wind farm, the emphasis of this chapter guideline is on prevention of fire by design with the addition of fire suppression equipment to be guided by the FPDBD-Fire Protection Design Basis Document as well as a cost-benefit analysis to determine the extent to which fire protection is justified.~~

~~The major fire and explosion hazards associated with Wind-wind Turbines-turbines and Wind-wind Turbine turbine farms are as follows:~~

- ~~(1) Nacelle Transformertransformers~~
- ~~(2) Lube Oil-oil Systems-systems in Nacellenacelle~~
- ~~(3) Lightning Strikesstrikes~~

Commented [HT1]: Consider as annex material

Commented [LS2R1]: Already moved to Annex

Commented [PH3]: Add hazards. Can pull similar hazards and statement from other chapters

Commented [LS4R3]: Added hazards (1) through (5) in red

(4) Wildfires

(5) Surrounding vegetation fires

~~This determination is done~~ Applicable requirements are determined 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 chapter~~ will apply, although there could be particular wind turbines and output circuit designs for which some of the ~~recommendations requirements~~ will not apply since the hazards described might not exist (e.g., no transformer in the wind turbine nacelle).

Site-specific considerations or a manufacturer's typical layout will govern wind turbine generating facility design. This will include the wind turbine design, tower design and heights, tower foundations, power output, and load control circuitry. This will dictate how many separate structures or enclosures will be provided in addition to the wind turbine towers. The wind turbines and associated towers are commonly installed in multiple rows or long strings, depending on the land and wind topography.

Adequate separation should be provided between the following, as determined by the FPDBD:

- (1) Adjacent wind turbine units consistent with land and wind topography constraints
- (2) Adjacent structures or exposures, including transformers
- (3) Adjacent properties (e.g., aboveground pipelines, tank farms, or natural gas facilities that could present a severe exposure)

~~Consideration should be given to equipment layout that is~~ Placing equipment adjacent to wind turbines and in line with the planes of the rotating blades and hub in typical wind conditions that have a higher potential for damage from flying debris (such as blade sections on overspeed or ice) should be considered.

13.3 Design and Equipment Arrangement.

13.3.1*

Special-purpose electrical heaters in wind turbine nacelles shall be listed.

A.13.3.1

Special-purpose electrical heaters can be used in wind turbine nacelles to provide for oil sump and space heating.

13.3.2*

~~The use of shield(s) for high~~ High-speed braking systems, ~~where used, (if used)~~ shall ~~use a shield be considered~~ to isolate sparks from combustible equipment components and locations where leaked combustible fluids can accumulate.

A.13.3.2

~~High~~ High-speed brakes ~~(if used)~~ can create a large quantity of sparks.

13.3.3*

Vegetation clearance, separation distance, and emergency planning shall ~~follow the requirements found in~~ comply with NFPA 1143 and NFPA 1144.

A.13.3.3

Commented [HT5]: Split into separate sections or consider moving some to annex material

Commented [LS6R5]: Already moved to Annex

Commented [HT7]: Split into separate sections or consider moving some to annex material

~~Particular care should be practiced with respect to spatial~~ Spatial separation and protection from wildland fires should be considered as well as the control of vegetation where wind turbines and associated equipment might be located.

13.4 Hazard Consideration.

13.4.1

~~if Where~~ required by the FPDBD, ~~a failure event involving a wind turbine generator~~, automatic shutdowns in case of a failure event involving a wind turbine generator shall be provided that result in stopping of shaft rotation, braking, and isolation of electrical power to the tower and nacelle.

13.4.2*

~~Different methods of equipment shutdown and isolation~~, operating independently, shall be provided as required by the FPDBD.

A.13.4.2

~~These~~ Such methods can include blade pitch control ~~and/or~~ hydraulic braking, as well as power isolation in concert with electronic control termination.

13.4.3* Fire Detection or Suppression.

The FPDBD shall determine ~~the need for~~ fire detection ~~/or~~ suppression needs and associated wind turbine safe shutdown sequences s for wind generating facilities.

A.13.4.3

~~Determination of the need for~~ Determining fire detection ~~/or~~ suppression needs and associated wind turbine safe shutdown sequences s for wind generating facilities should be based on the facility design and layout, including specific equipment and components used in producing power within the facility. This should be addressed in the FPDBD ~~with regard to~~ regarding the wind turbine and tower as well as power delivery and control circuits. In addition, ~~consideration should be given to~~ the consequences of loss of a wind turbine unit or multiple units as well as the vulnerability of adjacent structures and equipment to damage should be considered.

~~Fire suppression within sealed electrical enclosures and cabinets is~~ discussed ~~contained~~ in Chapter 9.

A local application system is more appropriate for unsealed electrical enclosures and cabinets within the nacelle and tower. Likewise, a local application extinguishing system might be appropriate for the gearbox lubrication system or hydraulic control system. If used, fire suppression capability should be provided for oil piping or any area where oil can flow, accumulate, or spray.

The positioning of local application nozzles should be such that maintenance access to the wind turbine components within the nacelle is maintained.

Fire extinguishing systems, where provided for hydraulic control equipment, should include protection of reservoirs, pumps, accumulators, piping, and actuating systems. Listed systems should be used.

~~Discharge rates and duration should be such that cooling and shutdown occur to prevent~~ re-reignition of the fire. System operation should be arranged to coincide with automatic shutdown of the wind turbine.

13.4.3.12*

Commented [PH8]: Subjective

Commented [LS9R8]: It may be subjective but statement allows flexibility on separation from wildland/vegetation exposures.

Commented [PH10R8]: Recommend tied back to the requirements of the FPDBD.

Commented [PH11]: Subjective

Commented [LS12R11]: It may be subjective but statement allows flexibility on shutdown and annex provides examples of shutdown systems that can be used.

Commented [PH13R11]: Recommend tied back to the requirements of the FPDBD.

Commented [HT14]: Split into separate sections or consider moving some to annex material

Commented [LS15R14]: Already in Annex Section A 13.4.3.1

Commented [HT16]: Split into separate sections or consider moving some to annex material

Commented [LS17R16]: Already in Annex Section A 13.4.3.1

Commented [HT18]: Split into separate sections

The FPDBD shall determine where fire detection systems are required.

A.13.4.3.2

This requirement applies to all fire detection systems provided for the wind turbine sites including nacelles, towers, electrical equipment enclosures, and buildings.

13.4.3.2.1

~~The FPDBD shall determine where fire detection systems are required.~~

13.4.3.2*~~2~~

Fire detection, when provided, shall be arranged to ~~activate~~ annunciate alarms at a constantly attended location or via ~~the provision of~~ remote operator circuits.

A.13.4.3.2

This requirement applies to all fire detection systems provided for the wind turbine sites including nacelles, towers, electrical equipment enclosures, and buildings.

13.4.3.~~32.3~~

A smoke ~~or~~ fire detection system with occupant notification ~~should~~ shall be installed throughout the tower and nacelle to provide early warning and alarm functions.

13.4.3.~~43~~*

Where required by the FPDBD, the use of water suppression systems shall ~~follow the general requirements in~~ comply with Chapter 9.

A.13.4.3.~~43~~

Due to the remote location of ~~the majority of~~ most on-shore wind generating facilities and the lack of abundant water supplies, the use of water-based fire protection systems is unlikely. For ~~off~~ offshore facilities, the same is true because the construction of pumping and fire water distribution systems ~~would be~~ is cost prohibitive.

13.4.3.~~54~~

Where required by the FPDBD, ~~fire~~ firefighting capability using water shall ~~follow the requirements in~~ comply with NFPA 1142.

13.5 Hazard Protection.

13.5.1*

Piping systems supplying flammable and combustible liquids shall be designed to prevent hydraulic and lubricating oil piping failures in accordance with ~~the requirements in~~ NFPA 30.

A.13.5.1

In general, the principles outlined in NFPA 30 should be applied to gearboxes and lubricating oil sumps, pumps, coolers, filters, and associated piping. ~~As~~ At a minimum, piping systems supplying flammable and combustible liquids should be designed to prevent hydraulic and lubricating oil piping failures ~~as follows:~~

Commented [HT19]: Split into separate sections or consider moving some to annex material

Commented [LS20R19]: Rewrote A 13.4.3.2, added red text for clarification of A 13.4.3.2

Commented [HT21]: Split into separate sections or consider moving some to annex material

Commented [LS22R21]: Rewrote A 13.4.3.2, added red text for clarification of A 13.4.3.2

Commented [PH23]: To a standard?

Commented [LS24R23]: The content of Paragraph 13.5.3.2.4 needs to be reviewed by Committee for nacelle only or removal. Doubtful most wind turbines have smoke detection throughout tower.

Commented [PH25R23]: TG to submit separate PI

Commented [HT26]: Split into separate sections or consider moving some to annex material

(1) If rigid metal piping is used, it should be designed with freedom to deflect with the gearbox, in any direction, at the interface with the gearbox. This recommendation also should apply to hydraulic lines that are connected to accessory gearboxes or actuators mounted directly in the nacelle. Properly designed metallic hose is an alternative for hydraulic and lube oil lines in high vibration areas to allow relative motion between rigid pipe supply lines and manifolds, and at the points of entry at the gearbox and generator interfaces.

(2) Rigid piping connected directly to the gearbox should be supported such that failures ~~will do~~ not occur due to the natural frequency of the piping coinciding with the rotational speed of the gearbox, drive shaft and hub, and generator. ~~Care should be taken in the design of pipe~~ Pipe supports should be designed to avoid vibrations induced by other equipment that can excite ~~its~~ their natural frequency.

(3) Welded pipe joints are preferred. Threaded couplings and flange bolts in oil piping should be assembled using a torque wrench and torqued to the manufacturer's instructions ~~requirements~~. Threaded fittings should have a positive locking device to prevent unscrewing.

(4) Instrumentation tubing, piping, and gauges should be protected from accidental mechanical damage. Sight glasses should be listed.

(5) Lubricating oil lines should use "guarded" pipe construction with the pressure feed line located inside the return line. Where guarded pipe construction is not used, piping sleeves should be used to reduce the possibility of oil atomization. All mechanical connections should be guarded.

(6) Containment and drainage should be provided ~~so as~~ to minimize the spread of oil within the nacelle or externally, which poses a risk to equipment or personnel below.

(7) Fluid piping should be routed below all electrical equipment to preclude leaked fluid dripping on the equipment.

13.5.2

For wind turbine generators, the following monitors ~~and/or~~ trip functions shall be provided to monitor the operation of wind turbine generators safely, and initiate a safe shutdown of abnormal operating conditions or parameters as follows:

- (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 (i.e., 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

Commented [HT27]: Split into separate sections or consider moving some to annex material

Commented [LS28R27]: Already moved to Annex

13.5.2.1* Batteries.

A.13.5.2.1

Batteries are frequently employed to provide back-up power for the nacelle and hub of a wind turbine proper, and other support structures (e.g., control rooms).

13.5.2.1.1

Batteries shall be provided with a ventilation rate ~~as prescribed in~~ accordance with 9.6.5.1.5 of NFPA 855, Chapter 9, Paragraph 9.6.5.1.5.

13.5.2.1.2

Batteries shall be kept clean from dirt, grease, and corrosion and ~~free from storage of~~ stored separate from combustibles or tools.

13.5.2.2

Lightning protection for blades, nacelles, towers, power lines, transformers, and support structures shall be provided in accordance with NFPA 780 or IEC 62305, *Protection Against Lightning*.



Public Input No. 57-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 14]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter14_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 14 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 14 Solar Generation

14.1* General.

Solar power electric generating units and associated facilities shall comply with Chapters 4 through 11, as applicable. Chapter 14 covers fire hazards associated with solar power generating stations. The process used in current commercial applications typically involves 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.

A.14.1

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.

[ALL NEW TEXT FOLLOWING 14.1]

14.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to specific solar power electric generating units and associated facilities.

A.14.2

Solar plants use the energy of the sun to produce electrical power. The process used in current commercial utility-scale applications typically involve one of two basic technologies: concentrated solar power (CSP) (see A.14.3.1) and photovoltaic (PV) solar power (see A.14.3.2).

14.3 Design and Equipment Arrangement.

14.3.1* Concentrated Solar Power (CSP).

A.14.3.1

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

In concentrating solar plants, ~~the heat energy of from the sun's heat~~ is used to generate steam that will, in turn, be used in a steam turbine generator as part of a Rankine cycle similar to that employed in fossil-~~fuel-fuel-fuel~~ fired steam plants.

Power Tower. In concentrating solar power plants that use a "power tower," a vast array of computer-controlled mirrors or reflectors surrounds the tower. The reflectors are referred to as heliostats and use a

Commented [SK1]: SL: This annex seemed to be all over the place. I've tried to condense similar subjects and make use of ital headings, but it'll need more work from a technical perspective.

dual-axis tracking system to focus and concentrate sunlight the sun's energy on a specially designed thermal receiver at the top of a tower. The working fluid in the receiver can be water, and the water is sufficiently heated in the tower to make steam, thus eliminating the need for a separate steam generator.

Linear concentrating systems collect the sun's energy using long, rectangular, curved (U-shaped) mirrors or reflectors referred to as solar collection assemblies that focus sunlight on tubes (or receivers) that run the length of the mirrors. The reflected sunlight heats a fluid flowing through the tubes. The hot fluid ~~then is~~ then used to produce steam in a conventional steam generator, which is then used to turn a steam turbine generator to produce electricity.

There are two major types of linear concentrator systems: ~~1-~~ parabolic trough systems, where receiver tubes are positioned along the focal line of each parabolic mirror, ~~2-~~ and linear Fresnel reflector systems, where one receiver tube is positioned above several strip-like mirrors to allow the mirrors greater mobility in tracking the sun. Such systems permit the use of more reflective surfaces in the same amount of space as a parabolic trough system.

~~A power tower system uses a large field of flat mirrors known as heliostats to focus and concentrate sunlight onto a receiver on the top of a tower. The heliostats are positioned by a dual axis, sun-tracking system. A heat transfer fluid heated in the receiver is used to generate steam, which, in turn, is used in a conventional turbine generator to produce electricity. Some power towers use water/steam as the HTF.~~

~~Each such system will differ from the other in thermodynamic efficiencies and the associated peak temperatures involved.~~

Parabolic Trough System. A parabolic trough system uses solar collection assemblies in which a tube-type receiver is positioned along the focus line in the middle of a trough-like parabolic mirror reflector that rotates around the receiver on a single axis as the sun moves from east to west. The tube-like receiver is filled with a working fluid that picks up heat as it flows through the receiver. The heated fluid is then used as a heat source in a steam generator that provides steam to a steam turbine generator.

Fresnel Reflector System. Fresnel reflectors work in a similar manner as parabolic trough systems in terms of focusing the sun's energy on a receiver through which a working fluid moves. Fresnel reflector technology employs many thin, flat mirror strips to concentrate sunlight onto the receiver tubes.

~~In concentrating solar power plants that use a "power tower," a vast array of computer-controlled mirrors/reflectors surrounds the tower. The reflectors are referred to as heliostats and use a dual axis tracking system to focus the sun's energy on a specially designed thermal receiver at the top of a tower. The working fluid in the receiver can be water, and the water is sufficiently heated in the tower to make steam, thus eliminating the need for a separate steam generator.~~

Each such system will differ from the other in thermodynamic efficiencies and the associated peak temperatures involved.

With respect to the working fluid discussed above, the working fluid is frequently a specially formulated heat transfer fluid (HTF) that is heated in the solar fields to temperatures above 700°F (371°C). That heat is subsequently transferred from the HTF to water in a steam generator to produce steam. In a given solar field, there can be several hundred solar collection assemblies (SCAs) typically arranged in quadrants, with aisles between them. The HTF 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 ~~or~~ steam on the secondary side), the hot fluid HTF then flashes water to steam. The steam is ~~then~~ used to drive one or more steam turbine generators. Other than the ~~mentioned~~ heat exchangers, the steam side is similar to most traditional steam turbine generator installations.

Commented [SK2]: SL: More power tower information? Condense above?

Commented [PH3]: Does this fit better under the section that is HTF?

Commented [LS4R3]: Will move Concentrated Solar information to Annex Section

Commented [PH5R3]: Not moved yet?

To augment the heating of the HTF, each solar generating unit is typically provided with auxiliary natural ~~gas-fired-gas-fired~~ HTF heaters. As the amount of available sunlight 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.

In some systems, the working fluid is molten salt. Such a fluid retains heat for some time and is therefore amenable to a plant design that incorporates energy storage with the ability to produce steam when the sun is over the horizon.

The major hazards associated with concentrated solar generating plants ~~include the following are as follows:~~

- (1) Release of large quantities of combustible ~~Heat Transfer Fluid (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

14.3.1.1* Heat Transfer Fluid (HTF) Pumps and Piping.

A.14.3.1.1

~~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 limit damage in the event of a fire exposure in both the solar field and power generation areas.

Pressurized leaks can ignite and spray burning HTF with thermal and nonthermal damage to other equipment. In one incident, a valve stem failure resulted in HTF mist being carried over a large area, causing contaminate damage to a number of mirrors. A pressurized leak, even if distant from mirrors, could carry a long way due to high ambient temperature in solar plant locations.

~~Careful consideration should be given to the~~ The design, application, construction, and installation of connections (e.g., rotating ball joint, flexible hose, ~~etc.~~) employed in areas such as the HTF loop connections of adjacent solar collector assemblies ~~to should~~ prevent possible ~~sources of~~ HTF leaks.

14.3.1.1.1

~~The design of HTF piping systems shall comply with ASME B31.1, Power Piping, shall be used in the design of HTF piping systems.~~

14.3.1.1.2

Piping and fittings shall be designed to resist an exposure fire until protection can be achieved by water spray.

14.3.1.1.3

Gaskets and seals shall be compatible with HTF.

14.3.1.1.4

Commented [HT6]: Split into separate sections or consider moving some to annex material

Commented [LS7R6]: Already in Annex Section

Flanges and piping connections on HTF systems shall have guards.

14.32.1.1.5

Piping and components containing and using HTF shall be located outside.

14.32.1.1.6 Pressure Monitoring.

14.32.1.1.6.1

~~Loss of pressure~~ Pressure shall be monitored upstream of the HTF heat exchanger and on each HTF loop.

14.32.1.1.6.2

A loss of pressure condition shall initiate the following:

- (1) ~~alarm~~ Alarm to a constantly attended area,
- (2) ~~interlock~~ Interlock to shut down pumps
- (3)* ~~isolate~~ Isolate a loop using a remotely operated emergency isolation valve(s).

A.14.32.1.1.6.2(3)

~~Consideration should be given to the use of remotely~~ Remotely operated emergency isolation valve(s) in the piping arrangement should be considered to reduce the volume of flammable fluid released. Actuators for remotely operated emergency isolation valves should be controlled pneumatically, electrically, or both.

Pneumatic operation is preferred. This method provides a "fail safe valve(s)" that closes up on loss of instrument air or electrical power. If pneumatic power is used to close the valve(s), the air lines and fittings should use stainless steel construction.

Electrically operated valves and associated cabling should be provided with fireproofing, allowing cable to remain in service when exposed to a 30-minute ~~UL-1709~~ time-temperature exposure in accordance with UL 1709, title. Cable for valves that fail in the closed position up on loss of power need not be fireproofed.

Remote actuation controls or devices should be located in a constantly attended control room. If not, they should be at least 50 ft (15.2 m) from anticipated leak points.

14.32.1.1.7*

A means to direct leaking HTF away from important equipment and structures shall be provided.

A.14.32.1.1.7

Sloping the ground can be done to channel leaking HTF to safe areas and curbs to prevent flow toward equipment ~~can be used~~.

Stone or crushed rock surfaces could also be an effective fire control measure near high value or critical process equipment (see 6.5.5).

14.32.1.1.8

HTF piping and component relief valves shall be positioned ~~in such a way~~ that discharges of either liquid or vapor occur at a location that ~~will limit~~ s fire exposure to critical equipment and ~~or~~ adjacent equipment or structures.

Commented [HT8]: Split into separate sections or consider moving some to annex material

Commented [LS9R8]: Will stay in current section

Commented [SK10]: SL: Not sure it should be "Loss of pressure" here, but instead... just "Pressure" because the idea of monitoring is to catch such a loss, correct?

Commented [HT11]: Split into separate sections or consider moving some to annex material

Commented [LS12R11]: Already in Annex Section

Commented [HT13]: Split into separate sections or consider moving some to annex material

Commented [LS14R13]: Will stay in current section

14.32.1.1.9

HTF piping shall be insulated or routed away from combustible materials.

14.32.1.1.10

~~Use of double~~ Double or tandem mechanical seals on pumps shall be used to reduce potential sources of leaks ~~shall be considered~~.

Commented [SK15]: SL: This wasn't a proper requirement...

14.32.1.2 HTF Heater Protection.

14.32.1.2.1

An emergency dump system shall be provided to carry HTF to a safe location.

14.32.1.2.2

A fixed fire extinguishing system shall be provided for the heater, in accordance with ~~systems outlined in either~~ NFPA 13, NFPA 15, NFPA 16, or NFPA 17.

14.32.1.2.3

Burner area fire protection systems shall be provided (see 9.5.1).

Commented [PH16]: To a standard?

14.32.1.2.4

Valving shall be provided to isolate the header supplying HTF to the heater where gravity flow could occur.

Commented [LS17R16]: Any additional fire extinguishing system information can be added in Annex

Commented [LS18R16]: Added NFPA Standards

~~14.2.1.2.5~~

~~The requirements in 4.3.1.2.6 require automatic shutdown of the fuel supply to the heater.~~

Commented [SK19]: SL: This isn't a requirement and I'm not sure it has a place as annex...?

14.32.1.2.56*

Controls and instrumentation safeguards shall be provided for heaters as identified in NFPA 86 and the equipment manufacturer's instructions-recommendations.

A.14.32.1.2.56

~~Consideration should be given to include monitoring~~ Monitoring, alarms, ~~and/or~~ automatic shutdown should be considered for the following conditions:

- (1) Low HTF flow
- (2) High HTF outlet temperature
- (3) Low fuel gas pressure or low liquid fuel flow
- (4) Flame failure
- (5) High exhaust stack temperature

Commented [HT20]: Split into separate sections or consider moving some to annex material

14.32.2* Photovoltaic (PV) Solar Power, ~~solar power~~

A.14.32.2

Commented [LS21R20]: Already in Annex

Photovoltaic solar generating stations are typically located in remote areas.

~~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.~~

~~Photovoltaic (PV) technology involves the conversion of solar radiation into dc electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic (PV) solar power uses PV panels in various arrays by which energy from the sun is converted to dc electrical energy in each of the panels and subsequently converted to ac power for delivery to the grid.~~ This conversion takes place in a PV solar cell that is made of various materials demonstrating ~~photovoltaic~~ PV 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 ~~or~~ 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~~ ~~kV~~) ac cabling and delivered to a local substation where a plant step-up transformer ~~then~~ raises the voltage to match that of the grid being served.

Concentrated photovoltaic (CPV) technology uses optic lenses ~~or~~ 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 like~~ that employed in a flat-panel PV plant. The routing of electrical power out of a CPV plant is ~~similar to like~~ that of a PV plant.

The major hazards associated with ~~Photovoltaic (PV) Solar Power~~ solar power generating plants are as follows:

- (1) ~~Generator step-up (GSU) Transformer-transformer~~ failure fires
- (2) Wildland and ~~Vegetation-vegetation~~ fires around arrays of solar collection assemblies
- (3) Lightning ~~strikes~~ ~~Strikes~~
- (4) Windstorms
- (5) Solar ~~Module-module~~ defects

14.32.2.1

Where required by the FPDDB, ~~water-water~~-based fire protection shall be installed ~~per in accordance with~~ NFPA 1142.

14.32.2.2

Fire department access to the a-solar power site shall ~~be in accordance-comply with the requirements of~~ Section 18.2 ~~on of~~ NFPA 1.

14.43 Hazard Protection.

Commented [SK22]: SL: Combined with para below, with edits.

Commented [PH23]: Move down to the PV section?

Commented [LS24R23]: Will move PV Solar information to Annex Section

Commented [PH25R23]: Not moved yet?

Commented [LS26R23]: Moved to A14.2.2

14.43.1 Concentrated Solar Power (CSP).

14.43.1.1

Supports for steam generator heat exchangers, HTF heaters, and other equipment containing liquid hydrocarbon holdup shall be protected to prevent structural collapse of these units in event of a pool fire.

14.43.1.2*

Protection for supports for adjacent critical equipment, ~~such as pipe supports~~, within 20 ft to 40 ft (6.1 m to 12.2 m), depending on the FPDBD Fire Protection Design Basis Document, shall be provided ~~as required in accordance with~~ NFPA 15.

A.14.4.1.2

An example of adjacent critical equipment would be pipe supports.

14.43.1.3

Structural supports shall be protected with either of the following:

- (1)* A 2-hour fire resistance rating when tested by the UL 1709 time-temperature exposure in accordance with UL 1709, title. ~~If a coating is used for outdoor applications, it should be acceptable for outdoor use.~~

A.14.4.1.3(1)

If a coating is used for outdoor applications, it should be acceptable for outdoor use.

- (2) Water spray protection in accordance with NFPA 15.

14.43.1.4

~~Equipment such as HTF pumps, surge tank areas, steam generator heat exchanger areas, HTF ullage equipment, and ground area where HTF fluid could spray, flow, or accumulate shall be protected Protection by automatic water-based systems in accordance with NFPA 13 or NFPA 15 or foam fire protection systems in accordance with NFPA 15, NFPA 13 for water based systems and NFPA 11 shall be provided for the following; for foam fire protection systems.~~

- (1) Equipment such as HTF pumps
- (2) Surge tank areas
- (3) Steam generator heat exchanger areas
- (4) HTF ullage equipment
- (5) Ground areas where HTF fluid could spray, flow, or accumulate

14.43.2 Photovoltaic (PV) Solar Power.

A vegetation management program shall be developed for all ~~Photovoltaic~~ PV solar power sites.

Commented [PH27]: To a standard?

Commented [LS28R27]: Referenced NFPA 15, 13 and 11 as referenced standards.



Public Input No. 58-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 15]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter15_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 15 based on work by Task Group 3 to update the language to reflect the change from a recommended practice to a Standard.

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Submittal Date: Thu Jan 04 13:58:43 EST 2024
Committee: ECG-AAA

Chapter 15 Geothermal Generation

15.1 General.

Geothermal power plants (i.e., direct steam, flash steam, and binary) shall comply with Chapters 4 through 10, as applicable. Chapter 15 covers fire and explosion hazards recommended protection criteria associated with geothermal power plants.

[ALL NEW TEXT FOLLOWING 15.1]

15.2* Applicability.

The Fire protection Design Basis Document (FPDBD) shall determine which requirements apply to specific Geothermal Generating geothermal generating units.

A.15.2

~~This determination is done.~~ Applicability is determined by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. ~~The remainder of this.~~ This chapter provides recommendations requirements that are not included in other chapters ~~in this recommended practice.~~

~~Additional guidance for geothermal plants includes the following:~~

Geothermal Plants. Geothermal applications use heated fluids obtained by drilling wells in ~~areas-an area~~ where there is a hydrothermal source. Most geothermal resources have temperatures from 300°F to 700°F (149°C to 371°C), but geothermal reservoirs can reach temperatures of nearly 1000°F (538°C). Steam or water from geothermal wells usually ~~contains-contain~~ carbon dioxide, hydrogen sulfide, ammonia, and low concentrations of other constituents such as methane, ethane, propane, nitrogen, and antimony.

The energy conversion technologies are direct steam, flash steam, and binary systems. The type of conversion used depends on the state of the fluid (~~whether-i.e.,~~ steam or water) and its temperature.

Direct Steam Systems. Direct steam systems are also called dry steam systems and direct brine steam systems. Steam taken from the ground is the working fluid. In this case, the plant is typically served by ~~a-number-of~~ many production wells and injection wells.

The steam system typically comes to the turbine building directly from the production wells to supply the steam turbine. The turbine ~~typically~~ exhausts into a condenser. The low-energy steam is condensed back into low-pressure condensate in a contact- or surface-~~type-type~~ condenser and is then ~~typically~~ redirected to the cooling tower. The overall system water balance is ~~typically~~ maintained by condensate injection pumps discharging the excess condensate back into the geothermal reservoir.

Because of the sulfur content (hydrogen sulfide) of the steam, this type of plant might have equipment for removal and ~~for~~ recovery of sulfur. Sulfur is typically converted to elemental form. Stainless steel piping is common, and titanium can be used in the turbine and condenser construction.

Special hazards include hydrogen sulfide abatement systems. Hydrogen sulfide is extracted from the condenser and can be burned in a gas-fired incinerator, depending on the constituents present in the noncondensable gas stream and the overall design characteristics of the abatement system. In addition, there could be arsenic present in the steam that precipitates on equipment components, which needs to be considered during maintenance activities. [See Figure A.15.2(a).]

Figure A.15.2(a) Direct Brine Steam (Dry Steam) Geothermal Power Plant. (Courtesy of Idaho National Laboratory.)

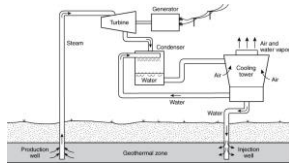
Commented [DL(V1)]: Revised to be similar to Chapter 10

Commented [PH2]: Larry look at the "Typical starting chapters" for 11 and 12. Do we include a 11.2.1 type statement for major fire and explosion hazards associated.... In the annex similar to chapter 11?

Commented [HT3]: Reword or consider as annex material

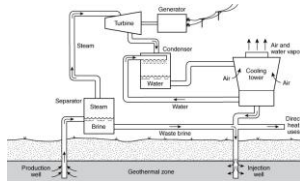
Commented [DL(V4R3)]: Reworded and split

Commented [BS5]: G850-10



Flash Steam Systems. In flash steam systems-plants, the fluid either is pumped or flows under its own high pressure to generation equipment at the surface. The fluid enters a separator as a two-phase mixture of liquid and steam. The mixture is separated, with the vapor being directed to a steam turbine generator. Unflashed brine is typically piped to a second-stage separator, where a drop in pressure allows a second flashing of the brine. The two streams of steam (one high pressure and one lower pressure) drive the turbine generator. The spent steam from the turbine is condensed by circulating water from the cooling tower, and excess fluid from the cooling tower is either injected into the “cold” injection into-system or combined with the brine and injected into the “hot” injection system. The unflashed brine from the second-stage separator is pumped into the “hot” injection pipeline. This pipeline returns the brine to the geothermal reservoir at the outer limits of the reservoir. The injected brine provides both fluid makeup and pressure support to the reservoir. [See Figure A.15.2(b).]

Figure A.15.2(b) Flash Steam Geothermal Power Plant. (Courtesy of Idaho National Laboratory.)



Binary Cycle Systems. Binary cycle plants-systems are plants in which moderate-temperature water from a geothermal field is used to flash a working fluid to vapor, which then drives a turbine. The working fluid is condensed and cycled back to the heat exchanger for renewal of the process. This is a closed-loop system.

The working fluid used is a low flash point flammable liquid (e.g., isobutane, isopentane, and n-pentane). Fluid selection is largely based on water temperature from the field and subsequent efficiency of the process. There could be several thousand gallons of fluid in enclosed systems, depending on the size of the plant. The fluid is condensed in either a water-cooled condenser or an air-cooled condenser. The fluid is recycled to the vaporizer by a fluid cycle pump. Pressure relief valves are installed on the closed-loop piping and set to operate to prevent overpressure in case of process upset or fire exposure. In early designs, multiple small generating units (energy converters) were used to make up a typical binary plant. For modern facilities, power is produced by a limited number of turbine generator sets. [See Figure A.15.2(c).]

Individual power units typically comprise the following:

- (1) Pumps and piping for transfer of flammable organic fluid
- (2) Expander turbine(s) or converter(s) and generator(s)
- (3) Heat exchangers, cooling towers, or air-cooled condensers for providing the cycle heat sink

The fire and explosion Special hazards associated with binary plants are as follows:

Commented [BS6]: G850-11

Commented [DL(V7): Reworded consistent with Chapter 10 statements

(1) Release of flammable liquid above its boiling point with potential fire exposure to other equipment or a potential vapor cloud explosion or fire, with damage to the following:

(a) Process equipment such as turbines or energy converters, heat exchangers, and other nearby process equipment (e.g., motor control centers)

(b) Storage tanks and piping for working fluids

(2) Pool fire from release of flammable liquid

(3) Combustible cooling tower construction

(4) Lubricating and control oil fires

(5) Switchgear and cable fires

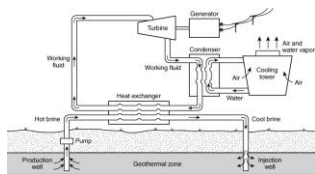
Special hazards include the accidental release of flammable liquid above its boiling point and the formation of a vapor cloud with the potential for a vapor cloud explosion and/or fire with damage to the following:

(1) Process equipment such as turbines/energy converters, heat exchangers, and other nearby process equipment such as motor control centers

(2) Storage tanks and piping for working fluids

[See Figure A.15.2(c)]

Figure A.15.2(c) Binary Cycle Geothermal Power Plant. (Courtesy Idaho National Laboratory.)



Commented [SK8]: SL: Combined text moved from further up with what was already here.

Commented [BS9]: G850-12

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15.3 Design and Equipment Arrangement.

15.3.1* Binary Plants.

Requirements in this section apply to binary plants.

15.3.1.1

Determination shall be made with regard to damage that could be caused by a release of flammable organic fluid as a liquid or as a vapor cloud.

15.3.1.2*

Spacing and design of critical equipment and structures in binary plants shall ~~be such so as to~~ limit damage in the event of explosion or fire exposure.

A.15.3.1.2

Determination shall be made with regard to damage that could be caused by a release of flammable organic fluid as a liquid or as a vapor cloud. NFPA standards containing guidance on

Commented [HT11]: Split into separate sections

Commented [DL(V12R11): Split

Commented [PH13R11]: Also needs it own number.

spacing are ~~See~~ NFPA 30, NFPA 58, NFPA 59, NFPA 59A, NFPA 80A, and API 752, *Management of Hazards Associated with Locations of Process Plant Buildings*.

15.3.2 Location.

15.3.2.1*

~~Prevailing wind direction with regard to arrangement of major~~ Major components shall be ~~arranged such that considered, because this will reduce~~ the possibility of a release exposing critical equipment or adjacent units ~~is reduced~~.

A.15.2

~~The prevailing wind direction where the components are located should be considered.~~

15.3.2.2*

Components containing flammable working fluid shall be located outside or in a ventilated enclosure~~s~~ that limits concentration to less than 25 percent of the LFL.

A.15.3.2.2

~~Working fluid pumps shall and potential fire exposures such as turbine lube oil reservoirs and working fluid storage tanks should be located so as not to expose critical equipment.~~

~~15.3.2.3~~

~~Working fluid pumps shall be located so as not to expose critical equipment.~~

15.3.2.4

~~Potential fire exposures such as turbine lube oil reservoirs and working fluid storage tanks shall be located so as not to expose critical equipment.~~

15.4* Risk Considerations.

15.4.1* Direct Steam and Flash Steam Geothermal Plants.

Where required by the FPDDB, direct steam and flash steam geothermal plants steam turbines shall be designed and protected in accordance with ~~Section~~ 10.3.3.

A.15.4.1

In general, risk considerations for direct steam and flash steam geothermal plants are the same as those for conventional steam turbine power plants.

15.4.2 Binary Geothermal Plants.

~~The fire and explosion hazards associated with binary plants are as follows:~~

- ~~(1) Release of flammable liquid above its boiling point with potential fire exposure to other equipment or a potential vapor cloud explosion~~
- ~~(2) Pool fire from release of flammable liquid~~
- ~~(3) Combustible cooling tower construction~~

Commented [SK14]: SL: Simplify by mentioning binary plants in the requirement statement. Also the determination statement wasn't mandatory; move to Annex A as shown? With all the changes, we can also simplify this to one mandatory statement under 15.3.1 with A.15.3.1.

Commented [PH15]: Annex Statement?

Commented [SK16]: SL: Even with my edits I'm not sure how strong of a requirement this is...

Commented [PH17]: Not sure how this is defined.

Commented [PH18]: Not sure how this is defined.

Commented [SK19]: SL: I agree with the commenter that we can't really define this. Annex A material?

Commented [DL(V20)]: Created charging statement for the text change to Annex material that also directs the reader to the ST section in Chapter 10

Commented [HT21]: Consider as annex material

Commented [DL(V22R21)]: Moved to Annex

Commented [DL(V23)]: Reworded consistent with Chapter 10 statements

~~(4) Lubricating and control oil fires~~

~~(5) Switchgear and cable fires~~

15.5 Hazard Protection.

The FPDBD shall ~~examine~~determine the type of detection ~~needed as well as~~and alarms and emergency shutdown devices (ESDs) that are necessary.

Commented [PH24]: Move this up to A.15.2 for other chapters we have included the typical hazards under x.2 or write as requirements?

Commented [SK25R24]: Moved.



Public Input No. 59-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 16]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter16_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 16 based on work by Task Group 3 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 16 Integrated Gasification Combined-Cycle (IGCC) Technology

16.1* General.

Electric generating stations using integrated gasification combined-cycle (IGCC) technology shall comply with Chapters 4 through 10, as applicable. Chapter 16 identifies fire and explosion hazards associated with integrated gasification combined-cycle (IGCC) electric generating facilities and specifies recommended protection criteria.

Commented [DL(V1)]: Revised to be similar to Chapter 10

A.16.1

The major fire and explosion hazards associated with IGCC facilities to be assessed as part of the FPDBD include, at a minimum, the following:

- (1) Combustible fuels stored and processed in the fuel preparation area and subsequently delivered to the combustor
- (2) Uncontrolled reaction involving oxygen and synthesis fuel gas (syngas) in the gasifier or downstream equipment, often due to loss of combustible fuel without loss of oxygen or inadequate purge procedures
- (3) High temperatures and pressures produced in the gasifier
- (4) Flammable and combustible liquids associated with lubrication and hydraulic oil systems (e.g., compressors, pumps, fans, turbines)
- (5) Hydrogen-enriched fuel gas transferring from the gasifier to the combustion turbine(s)
- (6) Natural gas or fuel oil used as an alternative fuel for the combustion turbine(s) in the combined-cycle power plant
- (7) Electrical components and wiring
- (8) Contaminants in the plant oxygen systems (e.g., hydrocarbons, residual materials from inadequate cleaning, inappropriate materials of construction) that result in detonations
- (9) Propane or other startup or preheat fuels
- (10) Air or oxygen introduced into the flare system

Commented [L2]: The term "hydrogen enriched fuel" was developed for the NFPA 37 update currently in the publication process:

3.3.X* Hydrogen Enriched Fuel. A gas fuel that contains a hydrogen concentration greater than **25%** by volume.

A.3.3.X The 25% threshold is based on the minimum public domain guidance (NFPA, IEC, etc.) regarding a hydrogen content in Natural Gas where the flammability properties of the mixture are considered the same as natural gas. The upper limit for a Hydrogen Enriched Fuel is 95% at which point it is considered as "pure" hydrogen as defined in NFPA 2.

Should we add to Chapter 3 definitions in 850 as well?

IGCC plants typically use one of three partial oxidation reaction processes to produce **synthesis fuel gas** (syngas) for subsequent combustion in gas turbines. ~~The three methods of gasification are moving bed, fluidized bed, and entrained.~~ IGCC technology takes advantages of the efficiencies available via combined-cycle power generation, more readily available carbon-based fuels, and more economical compliance with emission standards. In the simplest of cases, as frequently seen in refineries, derivative gases or oils with adequate heating values are sent directly to a combustion turbine that, in turn, drives an electrical generator while its exhaust gases are sent to a heat recovery steam generator (HRSG) that produces steam to be used in a steam turbine generator. The HRSG design can include **reheat** and a selective catalytic removal (SCR) system, as are common in many power plants. Carbon-based products such as coal, residual oils, petroleum coke, waste sludge, **and** biomass, ~~and so forth~~, can be used as feedstock in the IGCC process. The feedstock is converted into a syngas to be used as fuel in the combustion turbine. This occurs in a gasification unit. A gasification unit operates in a manner very similar to a chemical processing plant.

Commented [SK3]: SL: Reheating?

The three methods of gasification are moving bed, fluidized bed, and entrained. ~~Syngas conversion apparatus includes the following:~~

~~(1) Moving Bed Gasifier-bed gasifier. Oxidant-~~The oxidant is introduced at the bottom of a bed of fuel and moves downward as it is consumed by the gasification reactions at the bottom. Coal is introduced through a lock hopper at the top. These gasifiers produce tars and oils, which are special hazards for plants with these types of gasifiers, because of both fire and personnel exposure to carcinogens.

~~(2) Circulating Fluidized Bed Gasifier-fluidized bed gasifier. Circulating fluidized-bed combustors use h-~~Higher air flows are used to entrain and move the bed material, and nearly all of the bed material is continuously recirculated with adjacent high-volume hot cyclone separators. This approach simplifies feed design, extends the contact between the sorbent and flue gas, reduces the likelihood of heat exchanger tube erosion, and improves sulfur dioxide capture and combustion efficiency. This is the most appropriate design for use with lower-quality fuels such as biomass, lignite, and sub-bituminous coal. Some later designs include a topping combustor in which fuel gas is combusted to add energy to the combustor's flue gas. More advanced designs can include a pressurized carbonizer that converts feed coal into fuel gas and char. The char is then burned to produce steam while the fuel gas from the carbonizer is routed through a topping combustor.

~~(3) Entrained Gasifier-gasifier. Another approach to converting a fuel to syngas is the use of a gasifier in which~~ Prepared feedstock is reacted with a substoichiometric amount of air or oxygen at high temperature [more than 2300°F (1260°C)] and moderate pressure in a reducing atmosphere. The gasification process produces a syngas product that is mostly carbon monoxide and hydrogen, with smaller quantities of carbon dioxide. For air-fired gasifiers, there is also a significant quantity of nitrogen in the resulting syngas. Entrained gasifiers are typically tall refractory-lined cylindrical vessels into which the prepared fuel is fed along with oxygen or air. Ash runs down the refractory-lined walls to a quench tank. The hot gas produced in the gasifier is then cooled in a syngas cooler. This cooler can be incorporated into the gasifier design, or it can be a stand-alone unit. In many designs, the cooling medium is water ~~or~~ steam that is changed to superheated steam in the cooler and then used in the power plant steam cycle or for other support functions in a refinery.

[ALL NEW TEXT FOLLOWING 16.1]

16.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to ~~(IGCC)~~ electric generating facilities.

A.16.2

The different technologies involved in syngas production and the differences in syngas with respect to natural gas must be considered during the development of the FPDBD. ~~This determination is done-~~ Applicability is determined 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 requirements~~ will apply, although there could be particular plants for which some ~~of the recommendations will do~~ 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 (e.g., 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 standard~~ and other ~~applicable~~ documents.

16.3* Design and Equipment Arrangement.

A.16.3

Commented [HT4]: Reads as annex material

Commented [DL(V5R4)]: Reworded and split

~~General Design~~ Depending on the plant design, ~~a number of many~~ different IGCC support systems will be included in addition to the combined-cycle power plant, ~~including the following~~:

~~(1) Fuel Preparation~~. In any IGCC facility, the feedstock fuel will have to be readied for use and delivered to the gasifier. Various types of feedstock could require such actions as heating, mixing, or drying, ~~etc.~~, and will be delivered to the gasifier by various means.

~~(2) Air Separation~~. If oxygen is used for combustion in the gasifier, an air separation unit will typically be needed unless, in a refinery or air products process environment, the oxygen can be made available from another process. Air separation design choices are based on how many products are desired, required product purities, gaseous product delivery pressures, and whether ~~or not~~ products will be produced in liquid form. In most modern applications, cryogenic processes are used for air separation. In such facilities, air separation will involve large gas compressors, numerous pressure vessels, and specially designed heat exchangers and refrigeration cycles. For noncryogenic processes, large gas compressors and numerous pressure vessels will still be found. In either case, the products are oxygen, nitrogen, and argon. Depending on the degree of integration between the air separation plant and other parts of the host facility, these products can be used in many different ways (e.g., nitrogen as a diluent in the fuel gas to the combustion turbine) or stored for commercial sales.

~~(3) Fuel Gas Treatment~~. In addition to being cooled, the fuel gases leaving the gasifier will be cleaned or treated before being directed to the combustion turbines to remove remaining particulates and trace contaminants. This is a significant advantage of the IGCC methodology, because environmental pollutants are removed prior to the gas being burned.

~~(4) Mercury Removal~~. Mercury is most typically removed by passing the fuel gas through towers containing activated carbon. Such processes can remove 90 to 95 percent of mercury in ~~the~~ syngas.

~~(5) Sulfur Removal (often referred to as acid removal system or ARS)~~. ~~A number of Many~~ technologies are being investigated for the removal of sulfur compounds. The compounds are removed by either a physical solvent process or a chemical solvent process. The former allows a higher degree of sulfur removal while also being more effective in removing carbonyl sulfide (COS) and enhances the ability to add an ammonia-based SCR system at the back end for ~~NOx-nitrogen oxide~~ control. In such systems, a COS hydrolysis reactor is employed in which the COS reacts with water in the presence of a catalyst to form carbon dioxide and hydrogen sulfide. A scrubber removes ammonia, hydrogen sulfide, and carbon dioxide. Solvents used can be amines or other combustible fluids. Refrigerated Selexol or Rectisol are common choices for removal of sulfur compounds and the selected capture of carbon dioxide- CO_2 . Rectisol is basically methanol at -40°F (-40°C) operating at high pressure [up to 1000 psi ~~{68 atm}~~], so ~~there will be the possibility of~~ jet fires that can spread to adjacent equipment are possible. Also, acid gas removal units are likely to have refrigeration systems that use hazardous gases such as propane, propylene, or ammonia as refrigerant.

~~(6) Contaminant Recovery~~. Depending on plant design, the remaining plant equipment will vary, based on which of the contaminants will be used in other processes (as in a refinery) or recovered for commercial purposes. ~~As an For~~ example, the hydrogen sulfide removed from the syngas in the scrubber could be recovered as either elemental sulfur or as sulfuric acid.

Commented [DL(V6)]: Existing Annex Material

16.3.1*

Where required by the FPDBD, physical separation shall be provided between the following:

- (1) ~~The feedstock-Feedstock~~ fuel preparation and storage area
- (2) ~~The power-Power~~ plant, including switchyard

- (3) Gasification plant
- (4) Air separation unit
- (5) Syngas cleaning ~~/ or~~ treatment area
- (6) Chemical production areas
- (7)* ~~Adjacent~~ Other adjacent properties ~~(e.g., refinery, process facility, above-ground pipelines, tank farms, or natural gas facilities)~~ that could present a severe exposure}

A.16.3.1

Examples of adjacent properties include refineries, processing facilities, aboveground pipelines, tank farms, and natural gas facilities.

A.16.3.1

~~Fuel-~~The IGCC facility design will be governed by fuel availability; the type of fuel; site-specific considerations, ~~including such as~~ environmental limits; and an engineering firm's typical layout ~~will govern IGCC facility design.~~ This design will include the choice of fuel and the fuel preparation systems needed, the design and layout of the gasification plant, the need for an air separation unit, and the amount of by-product reclamation systems. This, in turn, will dictate how many separate structures or enclosures will be provided in addition to the power plant's gas turbine(s), HRSG(s), and steam turbine generator(s).

16.3.23 Control/Electrical Equipment Enclosures and Buildings.

16.3.23.1*

The ~~facility~~ FPDDB shall determine the appropriate location for the gasification plant and power plant control rooms, or integrated control rooms, as applicable.

A.16.3.23.1

In addition to location, ~~consideration should be given to~~ the need to incorporate blast resistance, building ~~/ or~~ room pressurization, and fire protection into the building ~~/ or~~ room design should be considered.

This analysis should be ~~done~~ conducted in accordance with API 752, *Management of Hazards Associated with Locations of Process Plant Buildings*, and API 753, *Management of Hazards Associated with Location of Process Plant Portable Buildings*.

16.3.34*

The FPDDB shall evaluate the high temperatures, high pressures, and combustible and toxic gas ~~(e.g., hydrogen, hydrogen sulfide, etc.)~~ content of the syngas produced in the gasification plant.

A.16.3.34

Examples of combustible and toxic gases include hydrogen and hydrogen sulfide. Proper control of combustible material in and around the gasifier, syngas cooler, and associated piping and vessels is paramount, as is proper area classification and the use of listed electrical equipment.

16.3.45

Commented [HT7]: Reads as annex material

Commented [DL(V8R7)]: Agree this reads as Annex and appears to reflect the considerations in the original 16.3.2

Commented [DL(V9)]: Existing Annex Material with split from original 16.3.3.1 added

Commented [SK10]: SL: This isn't a strong requirement. Evaluate to what standard/design?

Commented [HT11]: Split into separate sections or consider moving some to annex material

Commented [L12R11]: Split and part moved to Annex

~~The FPDBD shall evaluate the~~ The following hazards involved in the processing, storage, and handling of flammable gas ~~shall be evaluated and confirmed by the FPDBD as complying with per the~~ NFPA 54 and NFPA 55 ~~with respect to the following:~~

- (1) Container, tank, piping, and valve construction safety features
- (2) Instrumentation and controls
- (3) Electrical equipment classification for hazardous atmospheres
- (4) Loading ~~and~~ unloading stations
- (5) Equipment spacing
- (6) Building construction
- (7) Diking, impounding, drainage, and ~~similar so on~~
- (8) Fire protection, including hose streams, monitor nozzles, fixed water spray, ~~and~~ fire extinguishers, ~~and so on~~

16.3.56 Piping.

16.3.56.1*

The requirements in NFPA 30 shall be applied to the following equipment associated with fuel preparation systems, air separation units, and other support functions installed in the combined-cycle power plant:

- (1) ~~gear~~ Gear boxes and lubricating oil sumps,
- (2) ~~reservoirs~~ Reservoirs,
- (3) ~~pumps~~ Pumps,
- (4) ~~coolers~~ Coolers,
- (5) ~~filters~~ Filters, and
- (6) ~~associated~~ Associated piping.

A.16.3.56.1

~~As At~~ a minimum, piping systems supplying flammable and combustible liquids should be designed to minimize hydraulic and lubricating oil piping failures as follows:

- (1) Rigid metal piping should be designed with freedom to deflect with the system ~~or~~ component the piping is serving, in any direction, at the interface with the component. Properly designed metallic hose is an alternative for hydraulic and lube oil lines in high vibration areas to allow relative motion between rigid pipe supply lines and manifolds, and at the associated points of entry.
- (2) In syngas areas, piping and vessels should be appropriately designed with adequate corrosion allowances. Appropriate maintenance and monitoring frequencies should be identified.

Commented [L13]: Does this statement require "improvement"?

Commented [PH14R13]: Need a requirement or shall otherwise annex.

Commented [PH15R13]: Modified, please review

Commented [SK16R13]: Modified further to make a stronger requirement as opposed to requiring evaluation only.

Commented [SK17]: SL: These are long list items. We could remove "as follows:" and just make the list items paragraphs...

(3) Rigid piping connected directly to pumps, sumps, and gearboxes should be supported such that failures will not occur due to the natural frequency of the piping coinciding with the rotational speed of the gearbox, drive shaft, prime mover, and load. ~~Care should be taken in the~~The design of pipe supports should be designed to avoid vibrations induced by other equipment that can excite its natural frequency.

(4) Welded pipe joints should be used where possible. Threaded couplings and flange bolts in oil piping should be assembled using a torque wrench and torqued to the manufacturer's requirements. Threaded fittings should have a positive locking device to prevent unscrewing.

(5) Instrumentation tubing, piping, and gauges should be protected from accidental mechanical damage. Sight glasses should be listed.

(6) Where practical, lubricating oil lines should use "guarded" pipe construction with the pressure feed line located inside the return line. If this not practical, piping sleeves ~~and/or~~ tubing and flange guards should be used to reduce the possibility of oil atomization with subsequent spray fires.

(7) If practical, fluid piping should not be routed above electrical equipment to preclude leaked fluid dripping on the equipment.

16.3.56.2

Piping through which syngas and natural gas is directed shall be constructed in accordance with API RP 941, Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants, and ASME B31.3, Process Piping. ~~the following:~~

~~(1) API RP 941, Steels for Hydrogen Service at Elevated Temperatures and Pressures in Petroleum Refineries and Petrochemical Plants, and~~

~~(2) ASME B31.3, Process Piping.~~

16.3.56.2.1*

The FPDBD shall evaluate the hazards imposed by the high hydrogen concentration within the syngas that is directed to the combustion turbine(s).

A.16.3.56.2.1

The ~~Hydrogen-hydrogen~~ content in syngas is typically in the range of 30 to 40 ~~percent~~%. Hydrogen has the smallest molecules of any known substance and has a propensity to permeate the intermolecular spaces of materials. In doing so, the mechanical properties of the material can be affected in a manner that reduces the structural integrity of the material in a process referred to as "hydrogen embrittlement." ~~The potential deterioration of vessels, piping systems, and various system components included in the system design is a major consideration for hydrogen-enriched fuels. The FPDBD should consider this phenomenon and define the selection of materials by the FPDBD that provide resistance to such deterioration is essential.~~

A primary reference for ~~hydrogen-hydrogen~~-filled components is the ASME report, "Hydrogen Standardization Interim Report for Tanks, Pipes and Pipelines." Additional ~~Hydrogen-hydrogen~~ compatibility and embrittlement information on various materials (~~to include including~~ additional background references) is provided in Sandia National Laboratories SAND2012-7321, "Technical Reference for Hydrogen Compatibility of Materials."

Syngas typically contains significant quantities of toxic constituents such as ~~Hydrogen Sulfide-hydrogen sulfide~~ (H₂S), ~~Sulfur Dioxide-sulfur dioxide~~ (SO₂) and ~~Carbonyl Sulfide-carbonyl sulfide~~ (COS). Of particular concern is

Commented [HT18]: Split into separate sections or consider moving some to annex material. Single should statement should be in charging sentence

Commented [L19R18]: Split and Annex created

Commented [HT20]: Split into separate sections or consider moving some to annex material

Commented [L21R20]: Split. Created a sub clause to address specific risk concerns. Added Annex material to elaborate on those concerns

Commented [SK22]: SL: This isn't a strong requirement. Evaluate to what standard/design?

Commented [SK23]: SL: The addition of the FPDBD part had created two incomplete sentences. Using NFPA 37 as a guide, I've combined them again and added some crucial text that was missing.

the H₂S constituent that, in addition to being highly toxic (exposure is limited to 20 ~~ppm-Parts Per Million (PPM)~~ in accordance with Table Z-2 of 29 CFR 1910.1000, "~~Air Contaminants"-Z-2 Table~~), ~~There are is bound by~~ specific requirements ~~for a system as defined~~ in National Association of Corrosion Engineers (NACE) and American Society of Mechanical Engineering (ASME) standards. ~~Under According to~~ these standards, a gas composition containing 300 ~~ppm-PPM~~ or greater H₂S is classified as a "sour gas."

The specific guidance for these conditions is found in ASME B31.3, *Process Piping*, and *Section VIII, Division I of ASME's Boiler and Pressure Vessel Code, Section VIII, Div I* under which the piping design must meet Category "M" fluid service if the H₂S partial pressure exceeds 0.05 psi () for a system pressure of 65 psi () or greater. ~~As defined by NACE (National Association of Corrosion Engineers), the~~ The piping system must meet the requirements ~~s~~ of the following *NACE* standards:

(1) *ANSI/NACE MR0175/ISO 15156-1, (2017) — Petroleum and natural gas industries — Materials for use in H₂S-containing environments in oil and gas production — Part 1: General principles for selection of cracking-resistant materials*

(2) *ANSI/NACE MR0103/ISO 17945, (2010) — Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments. Petroleum, petrochemical and natural gas industries — Metallic materials resistant to sulfide stress cracking in corrosive petroleum refining environments*

Additionally, purging of the piping following equipment shutdown is ~~required by mandatory under the~~ *NACE* guidelines.

16.3.56.2.2

The FPDBD shall evaluate ~~the~~ the hazards imposed by the toxic constituents within the syngas that is directed to the combustion turbine(s).

16.3.56.3*

Where required by the FPDBD, flare stacks shall be used for venting the various process gases included in the plant design.

A.16.3.56.3

Guidance on flare stack design can be found in API RP 521, *Guide for Pressure Relieving and Depressurizing Systems*, and API 537, *Flare Details for Petroleum, Petrochemical, and Natural Gas Industries*.

16.4.1 Syngas Within Buildings and Enclosures.

16.4.1.1*

When syngas piping and associated appliances are located within a building or enclosure and where required by the FPDBD, ventilation shall be provided ~~per~~ in accordance with NFPA 68 or NFPA 69.

A.16.4.1.1

Syngas contains hydrogen. Hydrogen is more likely to leak from pipe fittings than other gases, ~~increasing which~~ increases the fire and explosion hazard that would be encountered whenever such piping and associated metering and control appliances are installed within a building or enclosure.

~~Additionally leaks~~ Leaks can also contain significant quantities of highly toxic H₂S, thereby creating an unacceptable risk of personnel exposure.

Commented [L24]: Added this recognized hazard

Commented [SK25]: SL: This isn't a strong requirement. Evaluate to what standard/design?

Commented [HT26]: Split into separate sections or consider moving some to annex material

Commented [L27R26]: Split and Annex created

Commented [HT28]: Split into separate sections or consider moving some to annex material

Commented [L29R28]: Split w/ Annex part

Commented [PH30R28]: Ventilation to what requirement? 25% LFL?

Commented [PH31R28]: Modified, please review

Commented [L32]: Added a toxic gas hazard discussion.

16.4.21.2

Electrical classification of equipment shall ~~be in accordance with NFPA 497; API 500, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division II; or API 505, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, and Zone 2, one of the following:~~

- ~~(1) NFPA 497, Recommended Practice for Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas;~~
- ~~(2) API 500, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division I and Division II, or~~
- ~~(3) API 505, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, and Zone 2.~~

Commented [SK33]: SL: We don't need to break this out into a list. NFPA documents don't use full titles anymore and semicolons can break it up cleanly.

16.5 Hazard Protection.

16.5.1*

The FPDBD shall define the requirements for fire detection/suppression within IGCC facilities. Fuel preparation and delivery systems shall be designed in accordance with Chapter 9.

Commented [SK34]: SL: This isn't a strong requirement. Evaluate to what standard/design?

A.16.5.1

The FPDBD should be based on the facility design and layout, including specific equipment and components used in producing syngas as well as power within the facility. This can require separate fire risk evaluations of the gasification plant, gasifier support systems, and combined-cycle power plant.

The gasification plant analysis should examine the need for and location of gas and other types of detectors as well as alarms and ESDs. The location of a flare stack to safely release any flammable gases in the event of a process upset, gas turbine trip, or safety valve actuation should also be considered. Flash tanks ~~or~~ drums that allow direct venting of syngas or other combustible gases to the atmosphere should not be used.

Commented [HT35]: Split into separate sections or consider moving some to annex material

Commented [L36R35]: Split with a portion moved to Annex

16.5.2

The following monitors or trip functions shall be evaluated by the FPDBD for the equipment design to monitor the operations and processes taking place within the facility and initiate a safe shutdown.

- (1) Pressures, temperatures, and flow rates of fuel supplies, reaction enhancers, syngas, and combustion contaminant recovery systems
- (2) Combustion safeguards and reaction control system in the gasifier, combustion turbine generator(s), and heat recovery steam generator(s) (if equipped with duct burners)
- (3) Combustible gas detection in the event of a fuel gas leak
- (4) Flame detection in the event of a fuel gas leak
- (5) Carbon monoxide detectors and warning lights to signal the presence of toxic atmosphere
- (6) Liquid levels in process vessels

Commented [PH37]: Number of subjective statements. Considered, safety, safe shut down. Any specific standards to help define? Maybe annex.

Commented [PH38R37]: Modified, please review.

Commented [SK39R37]: SL: This isn't a strong requirement. Evaluate to what standard/design?

16.5.3*

An IGCC facility will feature many different processes and fuels in the production of syngas and its use in the combined-cycle power plant; therefore, the Fire Protection Design Basis Document The FPDBD shall determine the use of a number of types-type of fire protection system used, with primary reliance on water-based systems.

A.16.5.3

An IGCC facility will feature many different processes and fuels in the production of syngas and its use in the combined-cycle power plant.

16.5.4

Where required by the FPDBD,

16.5.45

The FPDBD shall evaluate the unique geometries associated with some gasifier and syngas cooler for fire main and hydrant/monitor coverage.

16.5.56 Structures.

16.5.56.1

Critical structures within the gasification plant shall be protected in accordance with API 2218, *Fireproofing Practices in Petroleum and Petrochemical Processing Plants*.

16.5.56.2

The FPDBD shall be evaluate any exterior insulation used on structures, vessels, and piping, for external fire hazard on these structures.

16.5.67* Prevention of Internal Explosions in Combustion Turbines.

In addition to those listed the requirements provided in 10.3.2.3, the precautions in 16.5.7.1 and 16.5.7.2 shall apply to combustion turbines.

A.16.65.7

The turbine is typically started on natural gas and then switched to syngas. Syngas has a substantially lower heating value than natural gas, requiring four to five times the volume of fuel to deliver the same rated power. The minimum energy necessary for ignition of hydrogen-laden fuels is greatly reduced, nearly an order of magnitude compared to typical hydrocarbon fuels.

Additionally, to increase the availability of the power plant as well as to provide for the relatively long time it takes to stabilize the gas production process with respect to startup and shutdown, a "startup" fuel (typically natural gas or fuel oil) is used for startup and shutdown of the combustion turbine(s). Where the syngas has independent piping to the combustor, a dedicated inert gas purge should be provided for the piping downstream of the syngas stop valve to prevent the release of unburned syngas into the turbine. This purge prevents possible re-ignition and/or explosion in the gas turbine. Where a common fuel piping system is used for delivering both syngas and a gaseous startup fuel to the combustor, the startup fuel will provide the necessary buffer to prevent unburned syngas from entering the turbine under normal operating conditions.

Commented [HT40]: Split into separate sections or consider moving some to annex material

Commented [L41R40]: Split and reworded

Commented [PH42]: May be better as an annex note.

Commented [PH43]: Subjective term

Commented [PH44R43]: Modified, please review

Commented [SK45R43]: SL: This isn't a strong requirement. Evaluate to what standard/design?

Commented [SK46]: SL: This isn't a strong requirement. Evaluate to what standard/design?

However, in an emergency stop~~/or~~ trip situation, the shutdown occurs without a transfer to the startup fuel, which leaves syngas in the fuel delivery piping. Consequently, a small purging system is needed to avoid the potential for releasing unburned syngas into the turbine.

Modifications to the combustion turbine ~~so as~~ to use syngas for fuel must ~~account for~~ consider the increased fuel flow rate and flame spread rate in terms of combustion dynamics and mechanical loads on the turbine blading.

When an alternative fuel is employed for combustion turbine startup and shutdown, the requisite changes in combustion control need to be ~~accounted for~~ considered as well as the fire and explosion hazards presented by the alternative fuel, including any additional requirements for combustion system purging.

Commented [DL(V47)]: Existing Annex Material

16.5.67.1*

Where syngas has independent piping to the combustor, a dedicated inert gas purge shall be provided for the piping downstream of the last block valve in the control system.

A.16.5.67.1

This purge and block arrangement prevents possible reignition ~~and/or~~ explosion in the gas turbine.

Commented [HT48]: Split into separate sections or consider moving some to annex material

16.5.67.1.1

An inert gas block shall be provided between the last block valve and the next valve upstream to prevent the release of unburned syngas into the turbine.

Commented [L49R48]: Split with part moved to Annex

16.5.67.2

Where a common fuel piping system is used for delivering both syngas and a gaseous startup fuel to the combustor, the following features shall be included in the control system:

- (1)* A dedicated inert gas purge shall be provided for the common piping.

A.16.5.67.2(1)

The startup fuel will provide the necessary buffer to prevent unburned syngas from entering the turbine under normal operating conditions. However, in an emergency stop/trip situation, the shutdown occurs without a transfer to the startup fuel, which leaves syngas in the fuel delivery piping. Consequently, an inert purging system is needed to avoid the potential for releasing unburned syngas into the turbine.

Commented [HT50]: Split into separate sections or consider moving some to annex material

Commented [L51R50]: Split, modified and expanded

- (2) A double block and bleed arrangement shall be provided for the gaseous startup fuel.

- (3) If the syngas pressure is higher than the startup fuel pressure, an inert purge and block function between the block valves shall be provided to prevent ~~back-back~~ flow of the syngas.

Commented [L52]: Do we agree we must go to this type block?

Commented [PH53R52]: Present to the committee?

- (4) A double block and bleed arrangement shall be provided for the syngas fuel with an inert purge and block function between the block valves to prevent the release of unburned syngas into the turbine when the turbine is not running.

Commented [L54]: Do we agree we must go to this type block?

Commented [PH55R54]: Present to the committee?



Public Input No. 60-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 17]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter17_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 17 based on work by Task Group 3 to update the language to reflect the change from a recommended practice to a Standard.

Submitter Information Verification

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Submittal Date: Thu Jan 04 14:01:49 EST 2024
Committee: ECG-AAA

Chapter 17 Hydroelectric Generation

17.1 General.

Hydroelectric generating stations shall comply with Chapters 4 through 10, as applicable.

~~17.1.1~~

~~Chapter 17 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.~~

[ALL NEW TEXT FOLLOWING 17.1]

17.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which requirements apply to a specific hydroelectric generating station.

A.17.2

~~Such Hydroelectric generating~~ facilities include both dam-type facilities using penstocks to direct water to vertical-type hydroelectric turbine generators and run-of-the-river facilities in which river water is channeled through axial-type hydroelectric turbine generators. In addition, pumped-storage hydroelectric facilities operate as normal vertical (upper storage to lower storage) hydroelectric stations to produce electrical power and pump water from the lower storage to the upper storage.

The major ~~Fire fire~~ and explosion ~~Hazards hazards~~ associated with ~~Hydroelectric hydroelectric~~ generating plants are as follows:

- (1) Flammable and combustible fuels
- (2) Hydraulic and lubricating oils
- (3) Electrical and control equipment
- (4) Filter media
- (5) Combustible enclosure insulation

~~This determination is done~~ Applicability is determined 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 requirements~~ will apply to all hydroelectric generating stations.

17.3* Design and Equipment Arrangement.

~~17.3.1*~~

Where required by the FPDBD, adequate separation shall be provided throughout the plant design.

A.17.3.1

Commented [PH1]: Please review.

The ~~following should be considered as part of the~~ FPDBD ~~should consider the following~~:

- (1) Separation of high voltage electrical equipment from potential flood areas-
- (2) Separation of ~~the~~ intake hoist housing from generator floor area and from adjacent areas
- (3) Separation between dam and spillway hoists, including ~~the~~ main power and backup power bus, from adjacent areas such as spillway electrical distribution rooms
- (4) Separation of ~~the~~ tailrace service gallery from turbine ~~/or~~ generator floors and governor hydraulic equipment

17.4 Hazard Protection.

17.4.1 General.

Where required by the FPDBD, protection of combustible oils and generator windings bearings shall be provided.

17.4.2 Generator Pit and Windings.

17.4.2.1*

Where required by the FPDBD, protection of generator windings consisting of materials that will not extinguish when de-energized shall be automatically provided by at least one of the following:

- (1) ~~gaseous~~-Gaseous extinguishing systems ~~per in accordance with~~ NFPA 2001,
- (2) ~~hybrid~~-Hybrid fire-extinguishing systems ~~per in accordance with~~ NFPA 770,
- (3) ~~water~~-Water mist systems ~~per in accordance with~~ NFPA 750,
- (4) ~~water~~-Water spray rings ~~per in accordance with~~ NFPA 15, ~~or~~
- (5) a combination thereof.

A.17.4.2.1

Fires occurring where a generator is in operation are caused by an electrical fault in the generator, ~~though not~~. ~~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.e.g.~~, asphalt, cloth ribbon, polyester) have resulted in self-supporting fires. Damage and downtime have been reduced ~~by the use of by~~ fire suppression systems. Fires in generators with thermoset insulation (~~i.e.e.g.~~, fiberglass, epoxy resin) have been less frequent. Incidents have been reported where a 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 (~~i.e.~~, 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.

17.4.2.2

Fire detection for generator winding shall be provided.

17.4.2.3*

Commented [PH2]: To a standard?

Commented [SK3]: SL: If these are only some of the examples, "e.g." is correct, "i.e." is not.

Commented [SK4]: SL: If these are only some of the examples, "e.g." is correct, "i.e." is not.

Commented [DL(V5): Existing Annex Material

Where required by the FPDBD, protection of generator pits containing auxiliary circuits ~~such as protection current transformers (CTs), neutral transformers, and grounding resistors~~ that are associated with generator protection shall be automatically provided by one of the following:

- (1) ~~gaseous~~ Gaseous extinguishing system ~~per in accordance with~~ NFPA 2001,
- (2) ~~hybrid~~ Hybrid fire-extinguishing system ~~per in accordance with~~ NFPA 770,
- (3) ~~water~~ Water mist system ~~per in accordance with~~ NFPA 750, ~~or~~
- (4) ~~water~~ Water spray system ~~per in accordance with~~ NFPA 15.

A.17.4.2.3

Examples of auxiliary circuits that are associated with generator protection include protection current transformers, neutral transformers, and grounding resistors.

17.4.2.4

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

17.4.2.5*

Operation of water spray rings shall be interlocked so that the unit will trip before the water spray system activates.

A.17.4.2.5

Immediately after the generator has been sprayed with a water-based system, it should be mechanically run (i.e., electrically isolated and without excitation) for at least 24 hours to avoid creating stator ground faults on both types of winding materials. Manufacturer should be consulted as to exact drying requirements.

Commented [SK6]: SL: The acronym "CT" is already used for "combustion turbine" elsewhere. We can't have two meanings...

Commented [PH7]: To a standard?



Public Input No. 61-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 18]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter18_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 18 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 18 High-Voltage Direct Current (HVDC) Converter Stations

18.1 General.

High-voltage direct current (HVDC) converter stations, which include AC and DC converters, static var compensator (SVC) and static var generator (SVG) facilities, and variable frequency transformers (VFTs) shall comply with Chapters 4 through 11, as applicable. Chapter 18 identifies the fire hazards and specifies recommended protection criteria for high-voltage direct current (HVDC) converter stations, which include both alternating and direct current converters, static var compensator/static var generator (SVC/SVG) facilities, and variable frequency transformers (VFTs).

Commented [HT1]: Split into separate sections or consider moving some to annex material

Commented [LS2R1]: Already moved some of 18.1 into annex

Commented [HT3]: Split into separate sections or consider moving some to annex material

[ALL NEW TEXT FOLLOWING 18.1]

18.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to specific HVDC or SVC ~~/ or SVG facilities-facility.~~

A.18.2

This ~~section-chapter~~ identifies fire hazards ~~that are~~ associated with the operation of HVDC and AC converter stations, SVC ~~/ and~~ SVG facilities, and VFTs.

Conditions that could cause a fire in high-voltage equipment include the following:

- (1) Loose electrical connections
- (2) Electrical insulation or resistance breakdowns
- (3) Overheated components
- (4) Water leakage or intrusion (e.g., cooling system malfunction, roof leak)
- (5) Foreign objects (e.g., tools, metal scrap, rubbish, vermin)

The major fire and explosion hazards associated with converter stations include the following:

- (1) Converter valve assemblies
- (2) Valve base electronics and thyristor fault monitoring controls
- (3) Thyristor switched capacitors (TSC) control equipment
- (4) Thyristor controlled reactor (TCR) control equipment
- (5) VFT ~~de-DC~~ drive
- (6) Oil-filled wall bushings
- (7) Capacitors containing combustible dielectric fluids ~~s~~ or polymers
- (8) Transformers
- (9) Station services and auxiliary high-voltage equipment

Commented [HT4]: Split into separate sections or consider moving some to annex material

Commented [LS5R4]: Already moved to annex

18.3 Design and Equipment Arrangement.

18.3.1*

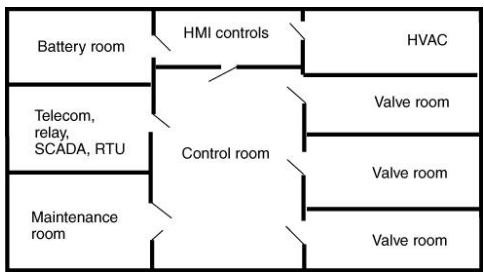
Each thyristor valve hall, TSC/~~or~~ TCR valve hall, and VFT hall shall be a separate fire area. ~~Each hall shall be~~ separated from adjacent fire areas by fire area boundaries in accordance with 6.1.1.3.

A.18.3.1

Unless ~~consideration of~~ the factors ~~of in~~ 6.1.1.2 ~~indicates indicate~~ otherwise, it is recommended that fire area boundaries be provided (see Figure A.18.3.1) to separate the following:

- (1) Service building
- (2) Main control room
- (3) Valve electronics rooms
- (4) Valve control and pole control equipment room
- (5) VFT rotating transformers
- (6) Human-machine interface (HMI) controls room
- (7) Heating, ventilation, and air conditioning (HVAC) equipment rooms
- (8) Relay room, supervisory control and data acquisition (SCADA) room, and remote terminal unit room (RTU)
- (9) Control equipment room
- (10) Electrical equipment/~~or~~ switchgear room
- (11) 125/250 V~~DC-de~~ control relay room
- (12) Cable tunnel, ~~vault, or~~ room(s)

Figure A.18.3.1 Typical Fire Area Separation for Converter Stations.



18.3.2*

Converter valves and associated support equipment shall use be constructed of noncombustible or limited-combustible materials.

A.18.3.2

Commented [HT6]: Split into separate sections or consider moving some to annex material

Commented [LS7R6]: Made 18.3.1 a shall requirement for fire areas, added annex section

Commented [BS8]: G850-7

Where noncombustible or limited-combustible materials are not used, fire-retardant separation barriers should be installed between the following equipment areas:

- (1) Valve tier levels, by adding to the bottom tray on each level
- (2) Valve modules, by adding to the side of each tray section
- (3) Grading capacitors, snubber circuits, and power supplies

18.3.3

Smoke or heat vents shall be provided in accordance with 6.4.1.

18.3.4*

Heating, ventilating, and air-conditioning (HVAC) systems for the valve hall shall be provided with fire, ~~or~~ smoke dampers arranged to shut down to preclude the entry of smoke from sources outside the valve hall structure.

A.18.3.4

Separate dedicated HVAC and smoke management systems should serve each valve hall.

18.3.5

Outdoor converter transformers and oil-filled smoothing reactor(s) should be arranged in accordance with 6.1.4 and 6.5.5.

18.3.6*

Drainage provisions shall be provided for indoor and outdoor oil-filled wall bushings. ~~Drainage should be arranged in accordance with Section 6.5. Indoor oil-filled wall bushings should be provided with means to prevent the spread of oil to adjacent equipment.~~

A.18.3.6

Where the converter bushings penetrate the valve hall, provisions should be made to prevent the oil contents of the transformer from entering the valve hall.

18.3.6.1

~~Drainage should~~ shall be arranged in accordance with Section 6.5.

18.3.6.2

~~Indoor oil-filled wall bushings should~~ shall be provided with means to prevent the spread of oil to adjacent equipment.

18.3.7

Mercury arc converters ~~should-shall~~ be arranged to minimize the effects of a hazardous material spill or airborne contamination from mercury ~~that could impede fire-impeding fire~~ fighting efforts and restoration activities.

18.3.8

Commented [HT9]: Split into separate sections or consider moving some to annex material

Commented [LS10R9]: Made 18.3.2 a shall requirement, added annex section

Commented [SK11]: SL: Should this be annex material? Or a requirement?

Commented [LS12]: Made 18.3.3 a shall requirement

Commented [HT13]: Split into separate sections or consider moving some to annex material

Commented [LS14R13]: Made 18.3.4 a shall requirement, added annex section

Commented [HT15]: Split into separate sections or consider moving some to annex material

Commented [LS16R15]: Made 18.3.6 a shall requirements, added annex section

Air core reactors shall be considered permitted as an alternative to oil-filled reactors to eliminate the fire risk associated with oil-filled equipment.

18.4 Hazard Protection.

18.4.1

Periodic cleaning of the valve and the valve hall structure should be performed in accordance with the manufacturer's instructions for maintaining clean equipment and a clean building environment.

18.4.2

Oil-filled wall bushings shall be protected with automatic fire suppression system(s). The fire suppression system design shall ensure that the fire suppression agent does not affect the converter valve, the arresters, or other energized electrical equipment.

18.4.3*

Dry-type ~~ac/dc~~ AC or DC wall bushings, ~~which do not necessitate fire detection or suppression systems, should shall~~ be considered permitted to eliminate the fire risk associated with oil-filled equipment.

A.18.4.3

Dry-type AC or DC wall bushings do not necessitate fire detection or suppression systems.

18.4.4*

The valve hall shall be provided with a very early warning fire detection (VEWFD) system.

A.18.4.4

~~Consideration should also be given to providing~~ Providing a second reliable fire detection system such as ionization, photoelectric, projected beam, flame detection, or video cameras should be considered. The interlock of VEWFD and the redundant fire detection system should be considered to initiate a fast-switch-off or emergency-switch-off of the respective valve group, TSC valves and TCR valves.

18.4.5*

~~For the protection of the converter station equipment and the building, water~~ Water-based or gaseous agent suppression systems shall be installed for the protection of the converter station equipment and the building.

A.18.4.5

The type and design of the suppression systems should be reviewed in consultation with the equipment manufacturer ~~and as~~ as outlined in the FPDBD.

Commented [HT17]: Split into separate sections or consider moving some to annex material

Commented [LS18R17]: Made 18.5.2 a shall requirement

Commented [SK19]: SL: Should "and" be "or"? Or is this a list of three things and we need a comma after the "TSC valves"?

Commented [HT20]: Split into separate sections or consider moving some to annex material

Commented [LS21R20]: Made 18.5.4 a shall requirement, added annex section

Commented [LS22]: Added additional text to A18.5.5 in annex



Public Input No. 62-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 19]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter19_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 19 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 19 Flywheel Energy Systems

19.1 General.

~~19.1.1*~~ [move text to 19.1]

~~The applicable requirements contained in Chapters 4 through 11 shall apply to flywheel-Flywheel energy systems and associated equipment shall comply with Chapters 4 through 11, as applicable.~~

~~A.19.1.1~~

~~Flywheel energy systems are energy systems composed of a spinning mass referred to as a rotor, rotor bearings, a motor generator to convert the mechanical energy to electrical energy, a power conversion system to convert the electrical energy to a form usable by the grid, and a protective housing to contain the rotating portions of the system. They are also known as synchronous condensers. There are other balance-of-plant components, including controls and monitoring equipment, a vacuum system to reduce effects of friction on the rotor, and cooling systems to reduce the heat that develops from the operation of the rotor. There are primarily two types of rotor constructions: solid metal mass design and composite fiber design. The rotor stresses, rotor dynamic behavior, and operating conditions are dependent on a combination of parameters. These parameters include rotor construction and the speed of rotation and must be engineered to ensure safe and reliable operation. There are also several different types of bearing constructions: a mechanical bearing design, a magnetic bearing design, and a hybrid mechanical/magnetic bearing design. The magnetic bearings can use passive type magnets or an active type that relies on a controlled magnetic field that can be varied depending on the forces acting on the rotor.~~

~~Flywheel energy facilities consist of a number of flywheel energy systems with electrical outputs tied together with the electrical power voltage stepped up to match grid voltage. The particular design of the flywheel energy systems can vary as noted, as will that of the configuration of the power output circuitry and components. Therefore, some recommendations might be more suitable for one type of flywheel energy system facility than another. Many of the specific guidelines herein might require modification after due consideration of all local factors involved.~~

~~Vacuum or inert gas systems are often used to reduce friction on moving parts, and coolant systems can be employed to reject the heat from high speed rotating parts, motor/generators, and power converters.~~

~~19.1.2~~

~~The emphasis of this guideline is on prevention of fire by design with the addition of fire suppression equipment to be guided by the Fire Protection Design Basis Document as well as a cost-benefit analysis to determine the extent to which fire protection is justified.~~

[ALL NEW TEXT FOLLOWING 19.1]

19.2* Applicability.

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to specific flywheel energy systems or facilities.

A.19.2

~~The emphasis of this guideline is on~~This chapter focuses on fire prevention ~~of fire~~ by design with the addition of fire suppression equipment to be guided by the ~~Fire Protection Design Basis Document (FPDBD)~~ as well as a cost-benefit analysis to determine the extent to which fire protection is justified.

~~This determination is done~~ Applicability is determined by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For flywheel energy facilities, it is expected that most of the ~~recommendations-requirements~~ will apply, although there could be particular flywheel energy systems and output circuit designs for which some of ~~the recommendations-this chapter~~ will not apply since the hazards described might not exist (e.g., no transformer in the flywheel systems).

Adequate separation ~~shall~~ should be provided between the following, as determined by the FPDBD-Fire Protection Design Basis Document:

- (1) Adjacent flywheel energy units consistent with land and wind topography constraints
- (2) Adjacent structures or exposures, including transformers
- (3) Adjacent properties (e.g., aboveground pipelines, tank farms, or natural gas facilities that could present a severe exposure)

19.3* Design and Equipment Arrangement.

A.19.3

~~Determination of the need for fire detection~~ Fire detection or fire suppression needs and associated flywheel energy system safe shutdown sequence needs for flywheel energy system facilities ~~shall be based-is determined based~~ on the facility design and layout, including specific equipment and components used in producing power within the facility.

The approach can ~~also~~ also depending on whether the flywheel energy system is located outdoors or indoors. This should be addressed in the ~~Fire Protection Design Basis Document with regard to FPDBD regarding~~ the flywheel energy units ~~as well as and~~ power delivery and control circuits. In addition, ~~consideration should be given to~~ the consequences of failure of a flywheel energy unit or multiple units as well as the vulnerability of adjacent structures and equipment to damage should be considered.

19.3.1*

Site-specific ~~considerations-factors~~ or a manufacturer's typical layout shall govern flywheel energy system facility design.

A.19.3.1

~~This should include the~~ The flywheel energy system design and containment system, power output, and load control circuitry should be considered. This should dictate how many separate structures or enclosures will be provided.

19.3.2

Flywheel energy systems shall be provided with a ~~means-of-a~~ full containment structure surrounding the rotating portion of the system to prevent exposure to sparks, and projectiles; in the event of a mechanical failure of the rotor ~~and/or~~ bearing assembly.

19.3.3*

Special-purpose electrical heaters shall be listed.

A.19.3.3

Commented [HT1]: Split into separate sections or consider moving some to annex material

Commented [HT2]: Split into separate sections or consider moving some to annex material

Special-purpose electrical heaters can be used in flywheel energy systems to provide for oil sump and space heating.

19.3.4*

~~Spatial~~ ~~Where required by the FPDBD, spatial~~ separation and protection from the potential of wildland and vegetation fires shall be ~~provided for~~ ~~considered where~~ flywheel energy systems ~~are located~~.

A.19.3.4

~~Guidance regarding vegetation~~ ~~Vegetation~~ clearance, separation distance, and emergency planning requirements can be found in NFPA 1143 and 1144.

19.4 Risk Consideration.

19.4.1*

In the event of a ~~problem-fault~~ within a flywheel energy system, automatic shutdowns or ~~idling-idle shall be provided~~ to bring the system to a safe state, ~~resulting shall be provided that results~~ in slowing ~~/ or~~ stopping of shaft rotation ~~and/or~~ isolation of electrical power to or from the motor ~~/ or~~ generator as dependent on the system design.

A.19.4.1

Different methods of equipment shutdown and isolation, operating independently, should be provided. These can include speed control as well as power isolation in concert with electronic control termination.

19.4.2

Vacuum or inert gas systems employed to lower friction losses of rotating parts ~~as well as and~~ cooling systems ~~employed~~ to prevent overheating of the flywheel motor/generators and their power converters shall be monitored and produce an orderly shutdown (i.e., spin down of the rotor) should these systems ~~not be operating-operate im~~properly or fail.

19.4.3

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine the need for fire detection ~~/ or fire~~ suppression and ~~an~~ associated flywheel energy system safe shutdown sequence for flywheel energy system facilities.

19.4.3.1*

Fire detection, ~~when where~~ provided, shall be arranged to activate alarms at a ~~constantly~~ attended location or via ~~the provision of~~ remote operator circuits in accordance with ~~the requirements outlined in~~ NFPA 72.

A.19.4.3.1

This applies to flywheel energy units, electrical equipment enclosures, and buildings.

19.4.3.2*

Commented [SK3]: SL: Correct? We can't just require "consideration"...

Commented [HT4]: Split into separate sections or consider moving some to annex material

Commented [MD5]: Moved this information to Appendix for 19.2

Commented [SK6]: SL: I'm not sure if "fault" is the correct replacement, but I think we need to be a bit more specific than "problem"....

Commented [HT7]: Split into separate sections or consider moving some to annex material

Commented [PH8]: To NFPA 72?

Commented [LS9R8]: Reworded 19.4.3.1

Commented [HT10]: Split into separate sections or consider moving some to annex material

~~If the Fire Protection Design Basis Document indicates a need for the use of~~ Where water suppression systems ~~are required by the FPDBD, these systems they~~ shall follow the general requirements in Chapter 9.

A.19.4.3.2

~~See NFPA 1142 for more on firefighting capabilities using water.~~

For remote location of flywheel energy facilities where there is a lack of abundant water supplies, the use of water-based fire protection systems is unlikely. 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 9.

~~19.4.3.3~~

~~If the FPDBD indicates a need for fire fighting capability using water, follow the requirements in NFPA 1142.~~

19.5 Hazard Protection.

19.5.1*

Piping systems supplying flammable and combustible liquids shall be designed to prevent hydraulic and lubricating oil piping failures in accordance with ~~the requirements in~~ NFPA 30.

A.19.5.1

In general, ~~the principles outlined in~~ NFPA 30 should be applied to gearboxes and lubricating or coolant oil sumps, pumps, coolers, filters, and associated piping. ~~As At~~ a minimum, piping systems supplying flammable and combustible liquids ~~shall should~~ be designed to minimize hydraulic and lubricating oil piping failures as follows:

- (1) If rigid metal piping is used, it should be designed with freedom to deflect with the gearbox, in any direction, at the interface with the gearbox. This recommendation also should apply to hydraulic lines that are connected to accessory gearboxes or actuators mounted directly in the nacelle. Properly designed metallic hose is an alternative for hydraulic and lube oil lines in high vibration areas to allow relative motion between rigid pipe supply lines and manifolds and at the points of entry at the gearbox and system interfaces.
- (2) Rigid piping connected directly to the gearbox should be supported such that failures will not occur due to the natural frequency of the piping coinciding with the rotational speed of the gearbox, drive shaft and hub, and flywheel energy system. ~~Care should be taken in the design of pipe~~ Pipe supports ~~should be designed~~ to avoid vibrations induced by other equipment that can excite its natural frequency.
- (3) Welded pipe joints are preferred. Threaded couplings and flange bolts in oil piping should be assembled using a torque wrench and torqued to the manufacturer's requirements. Threaded fittings should have a positive locking device to prevent unscrewing.
- (4) Instrumentation tubing, piping, and gauges should be protected from accidental mechanical damage. Sight glasses should be listed.
- (5) Lubricating oil lines should use "guarded" pipe construction with the pressure feed line located inside the return line. Where guarded pipe construction is not used, piping sleeves should be used to reduce the possibility of oil atomization. All mechanical connections should be guarded.

(6) Containment and drainage should be provided ~~so as~~ to minimize the spread of oil within the flywheel energy system or externally, which poses a risk to equipment.

(7) All fluid piping should be routed below all electrical equipment to preclude leaked fluid dripping on the equipment.

Commented [MD11]: This section was combined with section 19.3.2 and moved to section 19.3.2.

19.5.2*

~~For flywheel energy systems~~In the event of the following abnormal operating conditions or parameters, monitors ~~and/or~~ trip functions shall be provided ~~for flywheel energy systems~~ to monitor and ~~control the operation of flywheel energy systems and~~ initiate a safe state ~~(e.g., spin down, idling condition)~~ dependent on the system design, ~~for abnormal operating conditions or parameters as noted in the following list:~~

- (1) Grid disturbance
- (2)* Abnormal condition ~~(e.g., locking up, breakage, bearing damage)~~ of rotor ~~and/or~~ bearings

A.19.5.2

Examples of abnormal conditions of the rotor or bearings include locking up, breakage, or bearing damage.

- (3) Abnormal vibration
- (4) Loss of vacuum
- (5) Loss of cooling
- (6) Overheating of rotor assembly
- (7) Overspeed
- (8) Temperature faults (of critical components)
- (9) Loss of ~~/ or~~ faulted magnetic field for magnetic bearings
- (10) Oil condition (i.e., gearbox/lubrication and hydraulic)
- (11) Motor-generator protection
- (12) Loss of communication between ~~flywheel energy~~ units of a system or with control center
- (13) Battery status
- (14) Activation of smoke or heat detectors or sensors detecting abnormal conditions within the ~~flywheel energy~~ system

A.19.5.2

A safe state would include a spin down or idling condition.

19.5.3*

Electrical power delivery and control systems ~~as well as and~~ communications systems, ~~including and their~~ cabling, wiring, insulation, fans/motors, and cabinetry, shall meet the applicable industry design standards for the use intended and duty cycle specified.

A.19.5.3

Such standards should be applied to systems within the flywheel energy unit as well as those associated with moving power from the flywheel energy units to the grid. As such, this includes power cables and lines, transformers, and power conditioning systems and ~~for~~ components. Electrical equipment faults are the most likely source of ignition for combustible materials.

19.5.4

Electrical equipment shall consist of listed arc-resistant switchgear.

19.5.5*

Materials of construction shall be noncombustible whenever possible.

A.19.5.5

Such principles should be applied to flywheel energy unit full containment structures, ~~operations and maintenance (O&M)~~ ~~or~~ control buildings, and other support structures such as relay houses, switchyard control buildings, and power conditioning buildings.

Commented [HT12]: Split into separate sections or consider moving some to annex material

Commented [SK13]: SL: The "whenever possible" makes this requirement impossible to enforce...

Commented [HT14]: Split into separate sections or consider moving some to annex material



Public Input No. 63-NFPA 850-2024 [Global Input]

[See attached word document for proposed revisions to Chapter 20]

Additional Proposed Changes

<u>File Name</u>	<u>Description</u>	<u>Approved</u>
850_ECG_AAA_FDM_Chapter20_SK.docx		

Statement of Problem and Substantiation for Public Input

Revise Chapter 20 based on work by Task Group 4 to update the language to reflect the change from a recommended practice to a Standard.

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Committee: ECG-AAA

Chapter 20 Compressed Air Energy Storage (CAES)

20.1* General.

~~20.1.1~~

~~Compressed air energy storage (CAES) systems and associated equipment shall comply with Chapters 4 through 11, as applicable. Chapter 20 identifies fire and explosion hazards of compressed air energy storage (CAES) systems and associated equipment and specifies recommended protection criteria.~~

A.20.1

CAES systems are power generation systems that store compressed air in large reservoirs, ~~(typically underground caverns such as salt domes),~~ and use the compressed air as an energy source to drive a turbine-generator to produce power for peaking purposes.

The generator is typically a dual function motor-generator unit that can be reversed to drive the compressors during the nonpeak power periods and then returned to ~~the~~ generator mode to produce power when using the compressed air to drive the turbine unit.

During operation, the compressed air is released from the reservoir where the air temperature is increased by heat exchangers and fuel-fired heaters.

~~20.1.2~~ [move text to A.20.1.1, 1st para]

~~CAES systems are power generation systems that store compressed air in large reservoirs, typically underground caverns such as salt domes, and use the compressed air as an energy source to drive a turbine generator to produce power for peaking purposes.~~

~~20.1.2.1~~ [move text to A.20.1.1, 2nd para]

~~The generator is typically a dual function motor-generator unit that can be reversed to drive the compressors during the nonpeak power periods and then returned to the generator mode to produce power when using the compressed air to drive the turbine unit.~~

~~20.1.2.2~~ [move text to A.20.1.1, 3rd para]

~~During operation the compressed air is released from the reservoir where the air temperature is increased by heat exchangers and fuel-fired heaters.~~

[ALL NEW TEXT FOLLOWING 20.1]

20.2* ~~Applicability~~ Fire Protection Design Basis Document (FPDBD).

The ~~Fire Protection Design Basis Document (FPDBD)~~ shall determine which protection methods apply to ~~compressed air energy storage (CAES)~~ systems and associated equipment.

A.20.2

~~The requirements contained in Chapters 4 through 10 can apply to CAES system facilities. This determination is done.~~ Applicability is determined by evaluating the specific hazards that exist in the facility and evaluating the level of acceptable risk for the facility. For CAES system facilities, it is expected that most of these requirements will apply.

Commented [HT1]: Split into separate sections or consider moving some to annex material

Commented [LS2R1]: Already in Annex

Areas within a CAES unit that could require fire suppression ~~and/or~~ fire detection systems ~~may include the~~ following:

- (1) Rotating equipment lubricating oil systems above and below the operating floor
- (2) Lubricating oil storage tanks or room enclosures with oil storage tanks
- (3) Motor, ~~generator,~~ or turbine bearings
- (4) Hydraulic control systems
- (5) Control, computer, and communications rooms
- (6) Cable spreading rooms and cable tunnels
- (7) Grouped electrical cables — cable trays
- (8) Switchgear and relay rooms
- (9) Battery rooms
- (10) Maintenance equipment shop
- (11) Warehouse storage locations

Design discharge rates and duration for fire suppression systems should be such that cooling and shutdown occur to prevent ~~re-re~~ignition of the fire. Densities should be in accordance with Chapter 7.

20.3* Design and Equipment Arrangement.

Adequate separation and containment shall be provided as determined by Chapter 6 and the FPDBD.

A.20.3

Site-specific ~~considerations-factors~~ or a manufacturer's typical layout ~~will~~ should govern the CAES system facility design. If on-site heaters are used to heat the air prior to compression, there are other considerations that might need to be addressed based on how the air is heated. If fuel-fired heaters are used, other NFPA codes and standards relative to the fuel used should apply.

Areas that should be addressed include the following:

- (1) Flammable and combustible liquids storage and containment
- (2) Adjacent structures or exposures, including transformers
- (3) Adjacent properties, including aboveground pipelines, tank farms, other generation units or natural gas, or other fuel facilities that could present an exposure hazard

20.2.1

~~Discharge rates and duration should be such that cooling and shutdown occur to prevent re-ignition of the fire. Densities should be in accordance with Chapter 7.~~

Commented [HT3]: Split into separate sections or consider moving some to annex material

Commented [LS4R3]: Already in Annex

Commented [SK5]: SL: First sentence was covered in Annex A for Section 20.2. I have moved the second sentence up there as well.



Public Input No. 34-NFPA 850-2024 [Section No. 1.2.1]

1.2.1

~~This document is prepared for the guidance of those charged with the~~
The purpose of t his standard is to provide the minimum fire protection
requirements for the design, construction, installation , commissioning,
operation, and
protection
maintenance _ of electric generating plants and high voltage direct current
converter stations
that are covered by the scope of this document

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Statement of Problem and Substantiation for Public Input

Modified purpose to revise language to a standard as well as revised statement to reflect current scope and remove decommissioning (Submittal for TG 1)

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Committee: ECG-AAA



Public Input No. 35-NFPA 850-2024 [Section No. 1.3.2]

1.3.2

~~The recommendations contained~~ requirements contained in this document ~~are intended for new installations, as the application to existing installations might not be practicable. However, the recommendations contained in this document represent good industry practice and should be considered for existing installations.~~ standard shall apply to new facilities, and modifications to existing facilities that introduce a new or different hazard.

Statement of Problem and Substantiation for Public Input

Changes application to include certain modifications to existing facilities where the hazard is increased (TG 1)

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 36-NFPA 850-2024 [New Section after A.3.2.1]	

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Committee: ECG-AAA



Public Input No. 15-NFPA 850-2023 [Section No. 2.2]

2.2 NFPA Publications.

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

NFPA 1, *Fire Code*, 2018 [edition](#).

NFPA 2, *Hydrogen Technologies Code*, 2020 [edition](#).

NFPA 10, *Standard for Portable Fire Extinguishers*, 2018 [edition](#).

NFPA 11, *Standard for Low-, Medium-, and High-Expansion Foam*, 2016 [edition](#).

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*, 2018 [edition](#).

NFPA 12A, *Standard on Halon 1301 Fire Extinguishing Systems*, 2018 [edition](#).

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2019 [edition](#).

NFPA 14, *Standard for the Installation of Standpipe and Hose Systems*, 2019 [edition](#).

NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*, 2017 [edition](#).

NFPA 16, *Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems*, 2019 [edition](#).

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 [edition](#).

NFPA 18A, *Standard on Water Additives for Fire Control and Vapor Mitigation*, 2017 [edition](#).

NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*, 2019 [edition](#).

NFPA 22, *Standard for Water Tanks for Private Fire Protection*, 2018 [edition](#).

NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*, 2019 [edition](#).

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2020 [edition](#).

NFPA 30, *Flammable and Combustible Liquids Code*, 2018 [edition](#).

NFPA 30A, *Code for Motor Fuel Dispensing Facilities and Repair Garages*, 2018 [edition](#).

NFPA 31, *Standard for the Installation of Oil-Burning Equipment*, 2020 [edition](#).

NFPA 37, *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, 2018 [edition](#).

NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*, 2019 [edition](#).

NFPA 54, *National Fuel Gas Code*, 2018 [edition](#).

NFPA 55, *Compressed Gases and Cryogenic Fluids Code*, 2020 [edition](#).

NFPA 56, *Standard for Fire and Explosion Prevention During Cleaning and Purging of Flammable Gas Piping Systems*, 2020 [edition](#).

NFPA 58, *Liquefied Petroleum Gas Code*, 2020 [edition](#).

NFPA 59A, *Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)*, 2019 [edition](#).

NFPA 68, *Standard on Explosion Protection by Deflagration Venting*, 2018 [edition](#).

NFPA 69, *Standard on Explosion Prevention Systems*, 2019 [edition](#).

NFPA 70[®], *National Electrical Code*[®], 2020 [edition](#).

NFPA 72[®], *National Fire Alarm and Signaling Code*[®], 2019 [edition](#).

NFPA 75, *Standard for the Fire Protection of Information Technology Equipment*, 2020 [edition](#).

NFPA 77, *Recommended Practice on Static Electricity*, 2019 [edition](#).

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2019 [edition](#).

NFPA 80A, *Recommended Practice for Protection of Buildings from Exterior Fire Exposures*,

2017 [edition](#).

NFPA 85, *Boiler and Combustion Systems Hazards Code*, 2019 [edition](#).

NFPA 86, *Standard for Ovens and Furnaces*, 2019 [edition](#).

NFPA 90A, *Standard for the Installation of Air-Conditioning and Ventilating Systems*, 2018 [edition](#).

NFPA 90B, *Standard for the Installation of Warm Air Heating and Air-Conditioning Systems*, 2018 [edition](#).

NFPA 92, *Standard for Smoke Control Systems*, 2018 [edition](#).

NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, 2017 [edition](#).

NFPA 101[®], *Life Safety Code*[®], 2018 [edition](#).

NFPA 110, *Standard for Emergency and Standby Power Systems*, 2019 [edition](#).

NFPA 120, *Standard for Fire Prevention and Control in Coal Mines*, 2020 [edition](#).

NFPA 204, *Standard for Smoke and Heat Venting*, 2018 [edition](#).

NFPA 214, *Standard on Water-Cooling Towers*, 2016 [edition](#).

NFPA 220, *Standard on Types of Building Construction*, 2018 [edition](#).

NFPA 241, *Standard for Safeguarding Construction, Alteration, and Demolition Operations*, 2019 [edition](#).

NFPA 252, *Standard Methods of Fire Tests of Door Assemblies*, 2017 [edition](#).

NFPA 253, *Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source*, 2019 [edition](#).

NFPA 257, *Standard on Fire Test for Window and Glass Block Assemblies*, 2017 [edition](#).

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2018 [edition](#).

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*, 2017 [edition](#).

NFPA 499, *Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas*, 2017 [edition](#).

NFPA 501A, *Standard for Fire Safety Criteria for Manufactured Home Installations, Sites, and Communities*, 2017 [edition](#).

NFPA 600, *Standard on Facility Fire Brigades*, 2020 [edition](#).

NFPA 601, *Standard for Security Services in Fire Loss Prevention*, 2020 [edition](#).

NFPA 652, *Standard on the Fundamentals of Combustible Dust*, 2019 [edition](#).

NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids*, 2020 [edition](#).

NFPA 664, *Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities*, 2020 [edition](#).

NFPA 701, *Standard Methods of Fire Tests for Flame Propagation of Textiles and Films*, 2019 [edition](#).

NFPA 704, *Standard System for the Identification of the Hazards of Materials for Emergency Response*, 2017 [edition](#).

NFPA 750, *Standard on Water Mist Fire Protection Systems*, 2019 [edition](#).

NFPA 770, *Standard on Hybrid Fire Extinguishing Systems*, 2021 [edition](#)

NFPA 780, *Standard for the Installation of Lightning Protection Systems*, 2020 [edition](#).

NFPA 804, *Standard for Fire Protection for Advanced Light Water Reactor Electric Generating Plants*, 2020 [edition](#).

NFPA 805, *Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants*, 2020 [edition](#).

NFPA 853, *Standard for the Installation of Stationary Fuel Cell Power Systems*, 2020 [edition](#).

NFPA 1142, *Standard on Water Supplies for Suburban and Rural Fire Fighting*, 2017 [edition](#).

NFPA 1143, *Standard for Wildland Fire Management*, 2018 [edition](#).

NFPA 1144, *Standard for Reducing Structure Ignition Hazards from Wildland Fire*, 2018 [edition](#).

NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, 2019 [edition](#).

NFPA 1901, *Standard for Automotive Fire Apparatus*, 2016 [edition](#).

NFPA 1962, *Standard for the Care, Use, Inspection, Service Testing, and Replacement of Fire Hose, Couplings, Nozzles, and Fire Hose Appliances*, 2018 [edition](#).

NFPA 1971, *Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting*, 2018 [edition](#).

NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus (SCBA) for Emergency Services*, 2019 [edition](#).

NFPA 1982, *Standard on Personal Alert Safety Systems (PASS)*, 2018 [edition](#).

NFPA 2001, *Standard on Clean Agent Fire Extinguishing Systems*, 2018 [edition](#).

NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*, 2020 [edition](#).

NFPA 5000[®], *Building Construction and Safety Code*[®], 2018 [edition](#).

NFPA Fire Protection Handbook, 2008, 20th [edition](#).

Statement of Problem and Substantiation for Public Input

Now that NFPA 770 is published it should be referenced to provide guidance to support the references in the document to Hybrid Fire Extinguishing Systems

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Public Input No. 16-NFPA 850-2023 [Section No. 2.3.3]

2.3.3 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D92, *Standard Test Method for Flash and Fire Points by Cleveland Open Cup Tester*, 2018.

ASTM D448, *Standard Classification for Sizes of Aggregate for Road and Bridge Construction*, 2017 2012 (reapproved 2022) .

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2019a 2022 .

ASTM E108, *Standard Test Methods for Fire Tests of Roof Coverings*, 2017 2020a .

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2018ce1 2022 .

ASTM E136, *Standard Test Method for Behavior of Materials in a Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750°C*, 2019 2022 .

ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, 2013a (reapproved 2017) .

ASTM E1248, *Standard Practice for Shredder Explosion Protection*, 1990 (reapproved 2017) .

ASTM E1725, *Standard Test Methods for Fire Tests of Fire-Resistive Barrier Systems for Electrical System Components*, 2014e1 2019 .

ASTM SI10, *American National Standard for Use of the International System of Units (SI): The Modern Metric System*, 2016.

Statement of Problem and Substantiation for Public Input

date and title updates

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Public Input No. 13-NFPA 850-2022 [Section No. 2.3.7]

2.3.7 UL Publications.

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

UL 263, ~~Standard for Fire Tests of Building Construction and Materials~~, 2011, revised 2018 2021 .

UL 723, ~~Test for Surface Burning Characteristics of Building Materials~~, 2008, revised 2018.

UL 790, ~~Tests for Fire Resistance of Roof Covering Materials- 2004~~ 2015 , revised 2014 2022 .

UL 900, ~~Standard for Safety Test Performance of Air Filters, 2004~~ 2015 , revised 2015 2022 .

UL 1479, ~~Standard for Fire Tests of Through-Penetration Firestops, 2003~~ 2015 , revised 2015 2022 .

UL 1709, ~~Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel, 2017~~ 2022 .

Statement of Problem and Substantiation for Public Input

The term "Standard for" is redundant and unnecessary. All references to UL are standards. This PI updates current UL references.

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Public Input No. 32-NFPA 850-2023 [Section No. 3.3.14]

3.3.14— Fire-Risk-Evaluation. Fire Protection Design Basis Document

An evaluation of the plant-specific considerations regarding design, layout, and anticipated operating requirements. The evaluation should result in a list of recommended fire prevention features to be provided based on acceptable means for separation or control of common and special hazards, the control or elimination of ignition sources, and the suppression of fires.

Statement of Problem and Substantiation for Public Input

As 850 is moving to a standard, The use of Risk assessment is limited. The common term is Fire Protection Design Basis Document is used to reflect the evaluation of the Hazard. Committee first draft is reflective of the new term, however, the definition change should go thru PI separately from Committee input.

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Committee: ECG-AAA



Public Input No. 18-NFPA 850-2023 [Section No. 3.3.22]

3.3.22 Limited Combustible.

~~A building construction material not complying with the definition of noncombustible material that, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), where tested in accordance with NFPA 259 and complies with (a) or (b): (a) materials having a structural base of noncombustible material, with a surfacing not exceeding a thickness of 0.127 in. (3.2 mm) that has a flame spread index not greater than 50; and (b) materials, in the form and thickness used, other than as described in (a), having neither a flame spread index greater than 25 nor evidence of continued progressive combustion and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion. (Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition are considered combustible.) (see 4.6.2).~~

Statement of Problem and Substantiation for Public Input

SEE PI 17. This definition and the one for noncombustible material are being proposed to be deleted because they are inconsistent with other NFPA documents and in a section that is not enforceable.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 17-NFPA 850-2023 [Chapter 4]	
Public Input No. 17-NFPA 850-2023 [Chapter 4]	
Public Input No. 19-NFPA 850-2023 [Section No. 3.3.26]	

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Public Input No. 19-NFPA 850-2023 [Section No. 3.3.26]

3.3.26 Noncombustible.

A material that, in the form in which it is used and under the conditions anticipated, will not aid combustion or add appreciable heat to an ambient fire. Materials when tested in accordance with ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, and conforming to the criteria contained in Section 7 of the referenced standard are considered noncombustible. (See 4.6.1)

Statement of Problem and Substantiation for Public Input

SEE PI 17. This definition and the one for limited combustible material are being proposed to be deleted because they are inconsistent with other NFPA documents and in a section that is not enforceable.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 17-NFPA 850-2023 [Chapter 4]	
Public Input No. 18-NFPA 850-2023 [Section No. 3.3.22]	
Public Input No. 17-NFPA 850-2023 [Chapter 4]	

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Public Input No. 30-NFPA 850-2023 [New Section after 3.3.30]

3.3.xx Registered Design Professional

An individual who is registered or licensed to practice fire protection engineering as defined by the statutory requirements of the professional registration laws of the jurisdiction in which the project is to be constructed, with experience in Electric generating plants and HVDC converter stations and their respective safety systems.

Statement of Problem and Substantiation for Public Input

Moving the code from a recommended practice to a standard requires a higher level of validation. Documents that were acceptable as "reviewed" should now require a certified/registered competency. Example in the US of a PE licensed specific to the power and fire protection experience. Change will require modification in the body text to reflect use of the new term.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 33-NFPA 850-2023 [Section No. 4.1.1]	

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Public Input No. 31-NFPA 850-2023 [New Section after 3.3.30]

3.3.xx Qualified /Competent Person(s).

One with skills, knowledge training, and experience, related to the construction, operation and installations of Electric generating plants and HVDC converter stations and has received training to recognize and eliminate the hazards involved.

Statement of Problem and Substantiation for Public Input

The new definition is used to apply consistence to the use of trained individuals specific to the need of the application. Example shop drawings should be design by a NICET individual in the specific trade of alarm, sprinkler or special hazards.

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Public Input No. 17-NFPA 850-2023 [Chapter 4]

Chapter 4 Fire Protection Design Process

4.1 General.

4.1.1

The fire protection design process should be initiated under the direction of someone experienced in the area of fire protection engineering and having extensive knowledge and experience in power plant operation of the type of plant under consideration.

4.1.2

The creation of the fire protection design basis should be initiated as early in the plant design process as practical to ensure that the fire prevention and fire protection recommendations as described in this document have been evaluated in view of the plant-specific consideration regarding design, layout, and anticipated operating requirements.

4.1.3

Applicable process safety management (PSM) techniques should be considered.

4.1.4

The purpose of the Fire Protection Design Basis Document (DBD) is to provide a record of the decision-making process in determining the fire prevention and fire protection for specific hazards.

4.1.5

The Fire Protection Design Basis Document should be a living document that continues 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 5.4.3).

4.2 Stakeholders.

4.2.1

The stakeholders with an interest in the scope and applicability of the fire protection design should be identified early in the process.

4.2.2

Stakeholders establish goals and objectives and evaluate whether the recommendations of NFPA 850 are adequate to meet those goals and objectives. The criteria for acceptability of the level of fire protection should consider the perspective of the various stakeholders.

4.3 Inputs to the Design Process.

4.3.1 General Inputs.

In addition to the guidelines in this document, the following list should be reviewed for applicability:

- (1) Codes
 - (2) [Building codes — state and local](#)
 - (3) [Fire codes — state and local](#)
- (4) Standards
 - (5) [Industry standards](#)
 - (6) [Utility company standards](#)
 - (7) [Insurance requirements](#)
 - (8) [Applicable NFPA documents \(See Chapter 2.\)](#)
- (9) Regulations
 - (10) [Environmental](#)
 - (11) [OSHA](#)
- (12) Other references
 - (13) [SFPE Handbook of Fire Protection Engineering and journals](#)
 - (14) [SFPE Engineering Guide to Fire Risk Assessment \(Chapters 14 and 15\)](#)
 - (15) [Best Practices: EEL, EPRI, IEEE](#)
 - (16) [NFPA Fire Protection Handbook](#)
 - (17) [NFPA 805 \(Performance-Based Criteria in Chapter 4\)](#)
- (18) Design documents
- (19) Stakeholder inputs

4.3.2* Project-Specific Inputs.

Each facility will have its own special conditions that impact on the nature of the installation. Many of the specific criteria herein might require modification, due to the consideration of all project-specific factors involved. The project-specific inputs utilized in the design basis process include but are not limited to the following:

- (1) Base load/peaking unit
- (2) Personnel levels
 - (3) Unattended
 - (4) Low level of occupancy
 - (5) High level of occupancy
- (6) Fuel types and volatility
- (7) Plant layout and geographic location
- (8) Equipment availability/redundancy
- (9) Availability of water supply
- (10) Capability of emergency responders
- (11) Storage configuration (short term and long term)
- (12) Historical loss information/lessons learned/fire reports (*See Annex B and Annex D.*)

4.4 Fire Protection Design Basis Process.

4.4.1

Stakeholder establishes goals and objectives and evaluates whether the recommendations of NFPA 850 are adequate to meet those goals and objectives. The criteria for acceptability of the level of fire protection should consider the perspective of the various stakeholders.

4.4.2

The general arrangement and plant layout should be provided to clearly reflect the separation of hazards. If layout is not acceptable, a fire risk evaluation should be developed to ensure objectives are met, and then return to the review process.

4.4.3

Each hazard/area is reviewed against the goals and objectives and NFPA 850. If the hazards control is not acceptable, then a fire risk evaluation should be developed to ensure objectives are met, and then return to the review process.

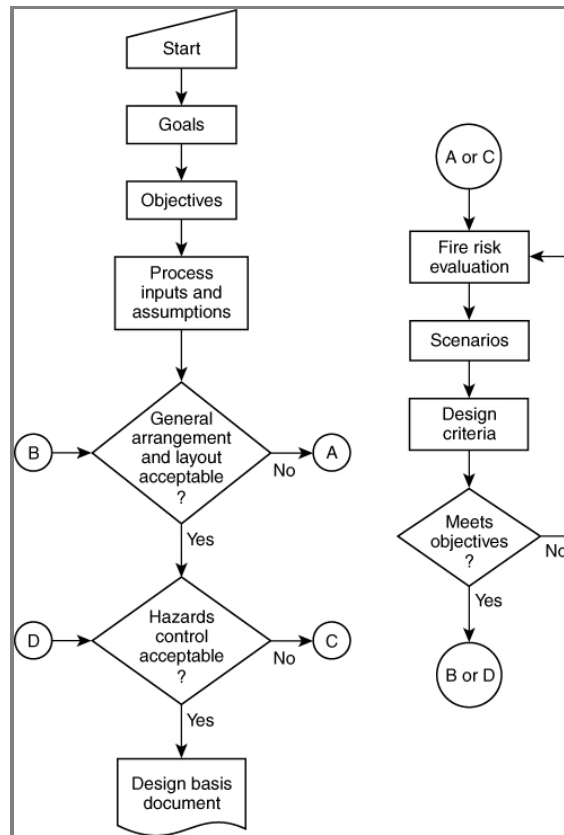
4.4.4

A DBD is developed.

4.4.5

As the project evolves, the DBD should be reviewed and updated as necessary to incorporate changes and revisions. (See Figure 4.4.5.)

Figure 4.4.5 Fire Protection Design Basis Process Flow Chart.



4.5 Fire Protection Design Basis Document (Deliverables).

4.5.1

The scope of the DBD is to establish the fire protection design criteria for the facility. The development of the DBD will be an iterative process. The DBD will be revised as the design progresses, based on dialogue among the stakeholders. The DBD should outline the fire protection/prevention design basis for achieving the fire hazard control objectives agreed upon by the stakeholders, including the following:

- (1) Identify assumptions (including items in 4.3.2).
- (2) Identify source documents.
- (3) Identify each hazard, identify which fire prevention/protection features are to be provided or omitted, and summarize the decision-making process.
- (4) Identify where operational and administrative controls are assumed to be in place to mitigate the need for fire protection features.

4.5.2

During the various stages of the design development and the development of the DBD, assumptions will be made when inadequate or insufficient information is available. These assumptions should be clearly identified and documented in accordance with Section 4.5. As additional information becomes available, the assumptions should be updated or replaced with actual design information and the DBD should be amended as necessary to reflect the more definitive information.

4.5.3

The process identified in 4.5.1 and 4.5.2 should be documented. The format of the document is a statement on general fire protection philosophy for the facility and a comparison of the facility fire protection features to the guidelines in the design chapters; for example, protection of oil hazards and also addressing containment and drainage. A sample table of contents for the DBD is contained in Annex E.

4.6 Material

4.6.1 Noncombustible material [NFPA 101]

4.6.1.1 A material that complies with any one of the following shall be considered a noncombustible material:

(1) The material, in the form in which it is used, and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat

(2) The material is reported as passing ASTM E 136, Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 Degrees C

(3) The material is reported as complying with the pass/fail criteria of ASTM E 136 when tested in accordance with the test method and procedure in ASTM E 2652, Standard Test Method for Assessing Combustibility of Materials Using a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C [NFPA 101]

4.6.2 Limited-Combustible Material. A material shall be considered a limited-combustible material where one of the following is met: [NFPA 101]

(1) The conditions of 4.6.2.1 and 4.6.2.2, and the conditions of either 4.6.2.3 or 4.6.2.4, shall be met.

(2) The conditions of 4.6.2.5 shall be met.

4.6.2.1 The material does not comply with the requirements for noncombustible material in accordance with 4.6.1.

4.6.2.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg) where tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials* .

4.6.2.3 The material shall have a structural base of noncombustible material with a surfacing not exceeding a thickness of 1/8 in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials* , or UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials* .

4.6.2.4 The material shall be composed of materials that in the form and thickness used neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723 and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or UL 723.

4.6.2.5 Materials shall be considered limited-combustible materials where tested in accordance with ASTM E2965, *Standard Test Method for Determination of Low Levels of Heat*

Release Rate for Materials and Products Using an Oxygen Consumption Calorimeter , at an incident heat flux of 75 kW/m² for a 20-minute exposure, and both the following conditions are met:

(1) The peak heat release rate shall not exceed 150 kW/m² for longer than 10 seconds.

(2) The total heat released shall not exceed 8 MJ/m² .

4.6.2.6 Where the term *limited-combustible* is used in this document, it shall also include the term *noncombustible* .

Statement of Problem and Substantiation for Public Input

The problem being addressed here is that the definitions of noncombustible and limited combustible are incorrect and are in a section that is not enforceable. With regard to noncombustible, note that the first sentence of the definition says that the material cannot ignite or burn and the second sentence says that it must meet ASTM E136. However, materials can meet ASTM E136 and burn for a limited period, so the two sentences have contradictions. With regard to limited combustible, a new test method has been added which is easier to use because it requires a much smaller sample than the one needed for ASTM E84. The information in 4.6.1 and 4.6.2 has all been extracted from NFPA 101 for both of them. In conjunction with this PI the definitions in chapter 3 are proposed to be deleted and to reference this section, in associated PIs.

This change is consistent with NFPA 101, NFPA 5000, NFPA 1 and most other NFPA codes and standards.

This will require adding ASTM E2652 and ASTM E2965 to chapter 2 on ASTM references. Both standards have 2022 dates.

Note that no changes are being proposed to this chapter other than the new language; changes to existing language are a Terra artifact.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 18-NFPA 850-2023 [Section No. 3.3.22]	
Public Input No. 19-NFPA 850-2023 [Section No. 3.3.26]	
Public Input No. 18-NFPA 850-2023 [Section No. 3.3.22]	
Public Input No. 19-NFPA 850-2023 [Section No. 3.3.26]	
Public Input No. 21-NFPA 850-2023 [Section No. 6.3.3]	

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Public Input No. 33-NFPA 850-2023 [Section No. 4.1.1]

4.1.1

The fire protection design process ~~should~~ shall be initiated under the direction of ~~someone~~ experienced in the area of fire protection engineering and having extensive knowledge and experience in power plant operation of the type of plant under consideration. a registered design professional.

Statement of Problem and Substantiation for Public Input

Moving to a standard requires a greater standard of care. The registered Design professional requires a certifications not currently required by the wording.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 30-NFPA 850-2023 [New Section after 3.3.30]</u>	RDP

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Public Input No. 37-NFPA 850-2024 [Section No. 4.1.4]

4.1.4

The purpose of the Fire Protection Design Basis Document (DBD) is to provide a record of the decision-making process in determining the fire prevention and fire protection for specific hazards. FPDBD shall be maintained and revised for the life of the plant

A.4.1.4

The FDDBD should be a living document that continues to evolve as the plant design is refined. Where a FPDBD exists, it should be revised for any new modifications to the plant, even for a single modification or portion of the plant. The FPDBD is key to the management of change process (see 5.4.3). New facilities and new modifications to existing facilities introducing increased hazards impacting the purpose of this standard (Section 1.2)

Statement of Problem and Substantiation for Public Input

Clarifies purpose and evolution of FPDBD (TG1)

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Public Input No. 38-NFPA 850-2024 [Section No. 4.2]

4.2 Stakeholders- FPDBD Team Members

4.2.1

~~The stakeholders- Members of the FPDBD team shall be identified early in the process and consist of a subset of stakeholders with an interest in the scope and applicability of the fire protection design- should be identified early in the process .~~

~~4 A4 .2. 2—~~

~~Stakeholders establish goals and objectives and evaluate whether the recommendations of NFPA 850 are adequate to meet those goals and objectives. The criteria for acceptability of the level of fire protection should consider the perspective of the various stakeholders.~~

1

Members of the FPDBD team would not include all stakeholders. Stakeholder involvement in the decision-making process is determined on a site/project specific basis.

FPDBD Team Members would typically include first responders, employees, owner/investor(s), operator(s), insurer(s), regulator(s), and project design team.

Statement of Problem and Substantiation for Public Input

Clarifies that some stakeholders (as defined in this standard) may not be a part of the FPDBD team (TG 1 Submittal)

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**Public Input No. 14-NFPA 850-2023 [Section No. 5.4.1.2]****5.4.1.2***

All fire protection systems and equipment should be periodically inspected, tested, and maintained in accordance with applicable *National Fire Codes*. (See Table 5.4.1.2 for guidance.)

Table 5.4.1.2 Reference Guide for Fire Equipment Inspection, Testing, and Maintenance

	<u>NFPA</u>
<u>Item</u>	<u>Document No.</u>
Supervisory and fire alarm circuits	72
Fire detectors	72
Manual fire alarms	72
Sprinkler water flow alarms	25/72
Sprinkler and water spray systems	25/72
Foam systems	11/16/25
Halogenated agent, chemical and CO ₂ systems	12/12A/17/2001
Fire pumps and booster pumps	25/72
Water tanks and alarms	25/72
PIVs and OS & Y valves	25/72
Fire hydrants and associated valves	13/24
Fire hose and standpipes and hose nozzles	25/1962
Water additives	18A
Portable fire extinguishers	10
Fire brigade equipment	1971/1981/1982
Fire doors and dampers	80/90A
Smoke vents	204
Emergency lighting	110
Radio communication equipment	1221
<u>Audible and visual signals</u>	<u>72</u>
<u>Hybrid Fire Extinguishing Systems</u>	<u>770</u>
Water mist fire protection systems	750

Statement of Problem and Substantiation for Public Input

Hybrid Fire Extinguishing systems are now covered by NFPA 770 and NFPA 770 should be referenced for their inspection, testing, and maintenance.

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Public Input No. 39-NFPA 850-2024 [Section No. 5.4.2.1]

5.4.2.1

A written procedure should be established to address impairments to fire protection systems and other plant systems that impact the level of fire hazard (e.g., dust collection systems, HVAC systems). As a minimum this procedure should address the following:

- (1) Identify equipment not available for service
- (2) Identify personnel to be notified (e.g., plant fire brigade leader, public fire department, plant fire protection coordinator, control room operator)
- (3) Increase fire surveillance as needed [see 5.3.1(6)]
- (4) Provide additional protected measures as necessary (e.g., temporary water supplies, additional hose)
- (5) Determine whether unit shutdown should occur

Statement of Problem and Substantiation for Public Input

As part of the impairment process, it should be decided whether or not the unit should still operate while the impairment is occurring (TG 1 Submittal)

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Public Input No. 24-NFPA 850-2023 [Section No. 6.1.4.2]

6.1.4.2

Determination of the type of physical separation to be used between transformers, control equipment, and building structures should be based on 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, and so forth.
- (5) ~~Power rating of the transformer~~
~~Fire suppression systems provided~~
- (6) * The existence of fast depressurization systems
- (7) Type of electrical protective relaying provided
- (8) Fire suppression systems provided
- (9) Power rating of the transformer
- (10) Availability of replacement transformers (long lead times)
- (11) ~~* 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.

Statement of Problem and Substantiation for Public Input

It is proposed a re-ordering of the topics to be considered in the detailed analysis and decisions for the Fire Protection Design Basis Document. For example, if a replacement transformer is available, it does not imply therefore in reducing the protection means to be considered. The new order has more logical common sense in term of the analysis of the possible consequence of a fire event and the consideration of the technical means to completely avoid or to mitigate.

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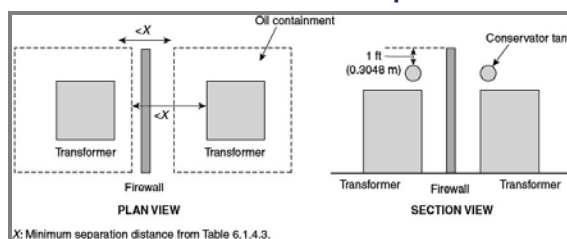
**Public Input No. 40-NFPA 850-2024 [Section No. 6.1.4.4]****6.1.4.4**

Unless consideration of the factors in 6.1.4.2 indicates otherwise, it is recommended that adjacent oil-insulated transformers containing 500 gal (1893 L) or more of oil be separated from each other by a 2 hour-rated firewall or by spatial separation in accordance with Table 6.1.4.3. When the oil containment, as shown in Figure

6.1.4.4, 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 6.5.6 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 6.1.4.4 for an illustration of the recommended dimensions for a firewall.) 5

Outdoor containment areas containing more than one oil-filled transformer shall be provided with means to prevent oil from one transformer migrating to another.

Figure 6.1.4.4 Outdoor Oil-Insulated Transformer Separation Criteria.

**Statement of Problem and Substantiation for Public Input**

Simplified the language for multiple xfmr's in a given dike (TG 1 Submittal)

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Public Input No. 41-NFPA 850-2024 [Section No. 6.1.5]

6.1.5 Indoor Transformers and Other Oil-Filled Electrical Equipment.

A6.1.5

This section addresses all types of transformer and oil filled electrical equipment installed indoors.

6.1.5.1

Dry-type transformers and other non-oil-filled electrical equipment are preferred for indoor installations. Dry-type capacitors or capacitors filled with a less flammable liquid should be considered to minimize the fire risk associated with oil-filled equipment.

6.1.5.2*

Oil-insulated transformers or other oil-filled electrical equipment of greater than 100 gal (379 L) oil capacity installed indoors should be separated from adjacent areas by fire barriers of 3-hour fire resistance rating.

6.1.5.3

Transformers having a rating greater than 35 kV, insulated with a less flammable liquid or nonflammable fluid, and installed indoors should be separated from adjacent areas by fire barriers of 3-hour fire resistance rating.

6.1.5.4

Where transformers or other oil-filled electrical equipment are protected by an automatic fire suppression system, the fire barrier fire resistance rating should be permitted to be reduced to 1 hour.

6.1.5.5

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, according to the hazard analysis, to warrant a fixed fire suppression system, automatic fire detection should be considered (see 7.7.2).

Statement of Problem and Substantiation for Public Input

Added clarifying annex material (TG 1 Submittal)

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Public Input No. 26-NFPA 850-2023 [New Section after 6.1.5.5]

6.1.5.6 Fast depressurization system should be considered to prevent indoor transformer explosion due to internal electrical arc for all application of oil-filled transformer with mineral oil, less flammable liquid or nonflammable liquid.

Statement of Problem and Substantiation for Public Input

1. Introduction:

The Indoor and Underground substations will have a key role in the electricity distribution for tomorrow, mainly in urban area.

The impact of Transformer Explosion on building structures must be considered in the risk evaluation in addition to fire. When the risk evaluation is considering the building damage due to transformer explosion, the implementation of an efficient explosion prevention system is generally considered by the utility.

Some companies may choose to use dielectric fluids made from natural or synthetic esters because of their environmentally friendly profile and high flash points. Studies have shown that although the risk of fire from an ester-filled transformer is reduced, but the risk of tank rupture and explosion is not.

Numerous studies have shown that arc discharges within esters will produce hydrogen and acetylene, the same gases produced by arcs in mineral oil. Furthermore, the amount of gas generation and rate of generation has been found to be comparable to that of arcs taking place in mineral oil (R. Frotscher et al., 2012) [1].

Consequently, the pressure rises in a transformer tank will obey similar patterns than the mineral oil-filled transformer.

In conclusion, the natural and synthetic ester provides alternatives to mineral oil. Together with other limitations presented by transformer and tap changers specialist [3], these alternative dielectric liquids do not reduce the risk of transformer explosion in the case of a low impedance internal fault. Therefore, if a fast depressurization system is not installed, the ester-filled transformer tank is at risk of explosion.

2. Explosion Risk:

To better understand the problems associated to transformer explosions inside buildings, a comparison can be made with dynamite and TNT.

A 20 MJ short-circuit energy is comparable to the energy developed by 10 sticks or 2.6 kg of dynamite or 5.3 kg of TNT. In this context, it is of utmost importance to protect indoor substation and generating transformers against explosions to avoid building structures damages. To check this matter, the USA Federal Emergency Management Agency (FEMA) has issued a guideline for people protection against the effect of explosions inside buildings. Chapter 4 of this document “discusses blast effects, potential school damage, injuries, levels of protection, stand-off distance, and predicting blast effects.”:

- https://www.fema.gov/pdf/plan/prevent/rms/428/fema428_ch4.pdf [4]

In this FEMA Guideline, the Table 4-3 presents the type of damages generally occurring to buildings due to the overpressure from explosion. To correlate a specific case, the curves provided in Figure 4-6 of the same guideline are giving the explosions overpressure as a function of stand-off distance and net explosive weight.

As often, the pipes of the Water Spray Fire Extinguishing System will be damaged by the transformer explosion and render useless this important protection for extinguishing the oil fire in its water allotting area. Hence, it is also of utmost importance to protect Water Spray Systems from transformer explosions for saving the building structures and all other oil fire and heat damages.

3. Building Collapsing Risks

An example has been considered of transformers on first floor of a building. A similar evaluation could be made for underground transformers.

The following distance from transformer short circuits to the building supports have been calculated from the size of the transformer rooms:

- 120MVA = [12 x 9.5] meter
- 50MVA = [(7.5 to 10) x 8] meter

Then, the maximum short circuit distance from the building supports to the center of transformer (C):

- 120MVA C = 7.3 m
- 50MVA C = 5.5 m

To calculate the structure for avoiding the building to collapse, architects should have taken the closest distance from the short circuit to the building supports. So, it is considered here that a short circuit happens at the transformer center, plus at 1 and 2 meters from the transformer center. This gives distances between short circuit and building supports from maximum 5m for the 120 MVA to minimum 4m for the 50MVA.

Applying the data given in Chapter “4.3.1. Explosion Power” of the USA Federal Emergency Management Agency (FEMA) Guideline [4] for a 20 MJ short circuit equivalent energy of 5.6 kg of TNT (12 Lbs.), the graph (Figure 4-6 in [4]) provides the explosion overpressures based on distances from explosion origin to building supports.

From the FEMA Guideline Figure 4-6, 12 Lbs. of TNT corresponds to a short circuit explosion overpressure higher than 10 psi to the building supports in less than 8 meters. As calculated above, the distances between short circuit and building supports are varying from 5 m for the 120 MVA transformer to 4 m for the 50MVA.

Then, for more than 10 to 12 psi (0.7 to 0.8 bar), the FEMA Guideline Table 4-3 predicts the “Probable total destruction of most buildings”.

https://www.fema.gov/pdf/plan/prevent/rms/428/fema428_ch4.pdf [4]

Most important and because the building supports are adjacent to the transformers, the graph shows that even 1 Lbs of TNT (0.45 kg) would also lead to the building destruction. Consecutively, if we consider that the short circuit energy is proportional to the TNT mass, a short circuit energy as low as 2 MJ would generate on the building supports an explosion over pressure of 10 psi (0.7 bar) for which the FEMA Guideline Table 4-3 predicts the “Probable total destruction of most buildings”.

4. Solution

Transformer Explosions impact on building structures must be considered in the risk evaluation in addition to fire for indoor transformer. When such risk evaluation is considering this item, the implementation of an efficient explosion prevention system is generally considered by the utility. This evaluation and decision have already been made by several utilities worldwide.

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Public Input No. 42-NFPA 850-2024 [Section No. 6.2.4]

6.2.4

~~In the event of a plant fire, explosion, or other incident that would require evacuation of a turbine hall or boiler house (or any other occupied area) during an outage, evacuation~~
Evacuation plans and emergency plans in general should be developed that would shall
take into consideration the increased occupancy load in these areas during major
plant maintenance and outage periods .

Statement of Problem and Substantiation for Public Input

Simplified language (TG 1 Submittal)

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Public Input No. 23-NFPA 850-2023 [Section No. 6.3.1]

6.3.1

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 standards:

- (1) NFPA 220, when dealing with types of building construction
- (2) ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, or UL 263, *Standard Test Methods for Fire Tests of Building Construction and Materials*, when considering fire resistance ratings for protection of a compartment from fire originating outside of the compartment
- (3) NFPA 253, when dealing with floor coverings
- (4) NFPA 259, when dealing with limited combustible materials
- (5) ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, when considering flame spread and smoke development of interior materials
- (6) ASTM E1354, *Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter*, when dealing with heat release, ignitability, or smoke development of materials, particularly interior materials.

Statement of Problem and Substantiation for Public Input

This PI adds some information as to what to look for considering the various standards. More importantly, it adds ASTM E1354 (cone calorimeter, latest edition 2022), which is the most important test to assess heat release, ignitability, and smoke release from materials. It also uses a small test specimen (100 mm x 100 mm) which is much easier to deal with than the large (24 ft x 2 ft) test specimen needed for ASTM E84. Nowadays it is understood that heat release is the most critical fire property to consider for fire hazard assessment.

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Public Input No. 21-NFPA 850-2023 [Section No. 6.3.3]

6.3.3

The use of material that does not meet the ~~definition of~~ requirements for *noncombustible material* or *limited combustible material* in section 4.6 , such as translucent reinforced plastic panels, is permitted in limited applications if the Fire Protection Design Basis Document and/or fire risk evaluation demonstrate that the material is acceptable.

Statement of Problem and Substantiation for Public Input

The definitions of noncombustible and limited combustible are proposed to be moved to section 4.6 by another PI.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 17-NFPA 850-2023 [Chapter 4]	

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Public Input No. 22-NFPA 850-2023 [Section No. 6.3.5.1]

6.3.5.1

Cellular or foamed plastic materials (as defined in Annex A of NFPA 101) should not be used as interior finish.

Statement of Problem and Substantiation for Public Input

The definition has been moved to chapter 3 in NFPA 101.

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Committee: ECG-AAA



Public Input No. 43-NFPA 850-2024 [Section No. 6.5.1 [Excluding any Sub-Sections]]

Provisions should be made in all fire areas of the plant for removal of liquids directly to safe areas or for containment in the fire area without flooding of equipment and without endangering other areas. (See *Annex A of NFPA 15*.) Drainage and prevention of equipment flooding should be accomplished by one or more of the following:

- (1) Floor drains
- (2) Floor trenches
- (3) Open doorways or other wall openings
- (4) Curbs for containing or directing drainage
- (5) Slopes for directing drainage
- (6) Equipment pedestals
- (7) Pits, sumps, and sump pumps
- (8) Porous ground surfaces such as stone or soil
- (9) Other means as approved by the AHJ

Statement of Problem and Substantiation for Public Input

Added additional options for drainage / containment

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Public Input No. 2-NFPA 850-2020 [New Section after 9.7.8]

7.8.5.1

- (1) Battery rooms shall be separated from other areas of the plant by fire barriers having a 1-hour minimum rating.
- (2) Direct current switchgear and inverters shall not be located in the battery rooms
- (3) Fire detection shall be provided
- (4) Fire hose stations and portable fire extinguishers shall be available outside the room
- (5) Large battery rooms shall be protected in accordance with NFPA 855. If automatic sprinkler systems are provided for battery rooms, they shall be designed for a minimum density of 0.30 gpm/ft^2 ($12.2 \text{ L/min}\cdot\text{m}^2$) over the entire area of the room or $2,500 \text{ sq ft}$ (232 m^2), whichever is smaller.

Statement of Problem and Substantiation for Public Input

This proposal is to be consistent with the new development of NFPA 855 (Standard for the Installation of Stationary Energy Storage Systems) and with some requirements from NFPA 804.

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Public Input No. 4-NFPA 850-2020 [New Section after 9.13]

9.16 Filters

9.16.1 High Efficiency Particulate Air (HEPA) Filters

9.16.1.1 Rate compensated type heat detectors or pilot sprinkler heads shall be provided inside ducts prior to final filter enclosures. Airflow should be considered when determining detector or pilot head location.

9.16.1.2 Detectors should be of the 190°F (90°C) temperature range unless operations require higher temperature air flows.

9.16.1.3 Heat detectors or pilot sprinkler heads shall also be provided in the final filter enclosures.*

***9.16.1.3** If filter plenum automatic deluge spray systems are actuated by pilot sprinkler heads, heat detectors are not required in the ducting or the filter enclosure

9.16.1.4 Automatic and manual water deluge spray systems should be provided inside all final filter plenums for protection of the filters where they have a leading filter surface area greater than 16 sq ft (1.4 m²).

Automatic water deluge spray systems should be provided inside all final filter plenums having a leading surface area of 16 sq ft (1.4 m²) or less when the filter plenum is not separated by fire rated construction.

9.16.1.5 Deluge sprinkler systems or deluge spray systems shall meet the following criteria:

(1) Water spray density should be 0.25 gpm/sq ft (10.2 L/min/m²) over the entire filter area or 1 gpm per 500 cfm air flow (1 L/min per 3.75 m³/min air flow), whichever is greater.

(2) The spray pattern of the deluge sprinkler head should be in the form of a downward vertical water curtain approximately 6 inches (150 mm) in front of the prefilter or demister. In addition, deluge sprinkler heads should be spaced so that each sprinkler head does not exceed 4 lineal feet of curtain coverage (1.2 lineal meter of curtain coverage).

(3) Deluge spray sprinkler system should operate upon activation of fire alarm system heat detectors or pilot sprinkler heads located in either the final ducting or filter plenum housing. Manual activation should be provided as well.

(4) If the system is only manually activated, the minimum water spray density should be 0.25 gpm/sq ft (10.2 L/min/m²) over the entire filter area. Activation should be by manually activating deluge valve or opening a normally closed Outside Screw & Yoke gate valve. Control devices to activate the spray nozzle deluge valve should be provided in the process operators control room or other locations accessible to fire fighters.

Statement of Problem and Substantiation for Public Input

Provide protection for sensitive equipment

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Committee: ECG-AAA



Public Input No. 5-NFPA 850-2020 [New Section after 9.13]

9.17 Overhead cranes

9.17.1 Overhead cranes shall not be positioned above critical equipment (turbine...) when not in operation.

9.17.2* Smoke detection systems shall be provided, as well as provision of portable fire extinguishers, for the electric cabinets of the main overhead cranes (turbine hall, spent fuel pool and reactor building as a minimum).

Smoke detection shall be provided in the battery room, machinery room, elevator shaft, elevator machine room, transformer room, transformer blower room, near main electrical disconnect and group cable trays, and in any similar areas not having fixed protection.

* 9.17.2 The needs to provide an automatic fixed gas protection system should be considered if the access is deemed too difficult (or delayed) in case of fire for manual firefighting means.

In that case, an automatic gaseous fire protection system should be provided in the control room, cable room and cabinets, switchgear cabinets and other similar areas where combustibles are present.

If a time-delay interlock needs to be provided on the system set it to the minimum required for safe evacuation of personnel.

Note that situations where electrical cabinets are located inside of the beam of the crane (bridge beam) is more problematic than when the electrical cabinets are located outside (in terms of fire damages)

When electrical cabinets are located inside the following disadvantages are present:

- Smoke is not easily detected by operators (remains inside the beam)
- Even with a limited amount combustible material involved in a fire inside the beam, the heat released can have serious adverse effects on the steel structure of the crane (phenomenon similar to a “baker stove” effect).

9.17.3 The alarm must sound in the control cab and at the base of the crane. The alarm should also be transmitted to the Main Control Room.

Statement of Problem and Substantiation for Public Input

Cranes are not considered as a critical equipment as they are not used on a continuous basis for the process.

But should a crane be impaired (due to a fire) just prior or during an outage and the associated downtime to replace or repair it could be very important.

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**Public Input No. 10-NFPA 850-2022 [Sections 10.3.1.4.2, 10.3.1.4.3, 10.3.1.4.4]****Sections 10.3.1.4.2, 10.3.1.4.3, 10.3.1.4.4****10.3.1.4.2***

All areas beneath the turbine-generator operating floor that are subject to oil flow, oil spray, or oil accumulation ~~should~~ spill or pool fires should be protected by an automatic sprinkler or foam-water sprinkler system. This coverage normally includes all areas beneath the operating floor in the turbine building. The sprinkler system beneath the turbine-generator should take into consideration obstructions from structural members and piping and should be designed to a density of 0.30 gpm/ft² (12.2 mm/min) over a minimum application of 5000 ft² (464 m²) for ceilings up to 40 ft (12 m).

10.3.1.4.3 All areas that are subject to oil spray fires due to pressurized releases should be protected by one of the following methods:

- (1) A room or enclosure around the equipment and spray source protected with an automatic sprinkler system, a listed inert gas or carbon dioxide system, a total flooding water mist system listed for protection of machinery in enclosures, or a hybrid (water and inert gas) system listed for protection of machinery in enclosures.
- (2) A combination of barriers and sprinklers, including a spray hood or barrier above the spray source, with automatic sprinklers having K-factor of at least 8.0 (115) under the barrier designed to provide a minimum end pressure of 50 psig (3.4 bar-g).
- (3) A deluge sprinkler system having K-factor of at least 8.0 (115) approximately 6 ft vertically over each spray source on 5 ft x 5 ft (1.5 m x 1.5 m) spacing. Activate the deluge system using either a listed flame detection system or line-type heat detection.
- (4) A water mist system listed for spray fire point protection and installed in accordance with its listing.

10.3.1.4.4

Lubricating oil lines above the turbine operating floor should be protected with an automatic sprinkler system covering those areas subject to oil accumulation, including the area within the turbine lagging (skirt). The automatic sprinkler system should be designed to a density of 0.30 gpm/ft² (12.2 mm/min).

10.3.1.4.4 5 *

Protection for pedestal-mounted turbine generators with no operating floor can be provided by recommendations in 10.3.1.4 and by containing and drainage of oil spills and providing local automatic protection systems for the containment areas. In this type of layout, spray fires from lube oil and hydrogen seal oil conditioning equipment and from control oil systems using mineral oil, if released, could expose building steel or critical generating equipment. Additional protection such as enclosing the hazard, installing a noncombustible barrier between the hazard and critical equipment, or use of a water spray system over the hazard should be considered.

Statement of Problem and Substantiation for Public Input

FM Global testing has demonstrated that ceiling-level sprinklers are not adequate for control or extinguishment of oil spray fires. The new section covers several approaches that have been shown to provide control of spray fires until safe turbine shutdown is accomplished.

Related Public Inputs for This Document**Related Input****Relationship**

Public Input No. 11-NFPA 850-2022 [Section No. A.10.3.1.4.4]

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Public Input No. 3-NFPA 850-2020 [New Section after 10.3.5.2.3]

10.3.2.5.4

When seal oil systems are automatically fed by the main lubricating oil system (by gravity or via the lube oil pumps), a specific study shall be performed to ensure that in case of fire involving the hydrogen seal oil pump system, there is a specific procedure to close the oil supply coming from the lubricating oil system (to avoid a continuous flow of oil, far beyond the expected quantity of oil present at the seal oil pump area), once the turbine has been adequately stopped.

Statement of Problem and Substantiation for Public Input

This configuration is not found on all Power Plants, but many seal oil systems, which are provided with limited retention means, are fed directly from the main lube oil tank to avoid a loss of oil in the system and loose the proper oil sealing on the generator, which would release hydrogen in the building. When the connection exists, there is a sectional valve on the feed main, but in many cases, this is not identified for firefighting purposes and could lead to a severe oil spill exposure as, if it is fed by gravity, the quantity of oil is not the one inside the seal oil system, the total quantity of the seal oil system and the main lubricating oil tank.

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Committee: ECG-AAA



Public Input No. 1-NFPA 850-2020 [Section No. 10.3.5.9.1]

10.3.5.9.1 Exciter.

The area inside a directly connected exciter housing should be protected with a total flooding automatic carbon dioxide ~~system~~ system designed to deliver a minimum concentration of 34% during at least 20 min (or during the total coast down period of the machine if longer than 20 min) .

Statement of Problem and Substantiation for Public Input

This will give indication on the design of the system, in particular for rotating equipment where the design concentration should be provided for longer than 10 minutes.

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Public Input No. 9-NFPA 850-2022 [Section No. 17.5.2]

17.5.2 Generator Pit and Windings.

17.5.2.1*

Protection of generator windings consisting of materials that will not extinguish when de-energized should be provided by automatically actuated gaseous extinguishing systems, hybrid fire-extinguishing systems, water mist systems, water spray rings, or a combination thereof.

17.5.2.2

Fire detection in generator winding should be provided.

17.5.2.3

Protection of generator pits containing air distribution guides made of combustible materials or auxiliary circuits such as protection current transformers (CTs), neutral transformers, and grounding resistors that are associated with generator protection ~~should~~ and made of thermoplastic insulation ~~should~~ be provided by an automatically actuated gaseous extinguishing system, hybrid fire-extinguishing system, water mist system, or water spray system.

17.5.2.4

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

17.5.2.5

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 (i.e., electrically isolated and without excitation) for at least 24 hours to avoid creating stator ground faults on both types of winding materials.

Statement of Problem and Substantiation for Public Input

I have one client in Brazil that had a fire inside the generator, which spread through plastic air distribution guides (everything else was Class F). There was no automatic fire protection system. The fire caused a property damage of approximately 20% of generator replacement value and 8 months of downtime. Fire did not spread to any part with Class F insulation. There is no requirement in NFPA 850 section 17.5.2 to protect generators with combustible air distribution guides.

There is also no mention on NFPA 850 section 17.5.2.3 about how to deal with auxiliary circuits with Class F insulation inside the generators. I believe automatic fire protection system can be omitted in this case, similarly to NFPA 850 section 17.5.2.1.

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Committee: ECG-AAA



Public Input No. 36-NFPA 850-2024 [New Section after A.3.2.1]

A.1.3.2

. A1.3.2 Changes that might introduce a different or increased hazard include, but are not limited to: fuel conversions, new technologies, new site buildings and structures, fuel handling system modifications, dissimilar major equipment replacements

Statement of Problem and Substantiation for Public Input

Clarifies changes proposed in separate PI to section 1.3.2 (TG 1 Submittal)

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
<u>Public Input No. 35-NFPA 850-2024 [Section No. 1.3.2]</u>	Annex Material

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Public Input No. 27-NFPA 850-2023 [Section No. A.6.1.4.2(9)]

A.6.1.4.2(9)

Oil-filled transformer explosions 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. An example is provided in D.2.14. This fast depressurization can be achieved by a quick oil evacuation triggered by the transient 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, because 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. The systems can include outflow devices that are located directly on the high-risk areas of the bushing turrets and oil-bushing cable boxes. [The Fast Depressurization System should have been type tested on a sealed transformer tank full of oil by a STL Member laboratory with an electrical arc generated of actual arc energy greater than 4 MJ corresponding to an Applied Arc Energy over 50 MJ.](#)

Statement of Problem and Substantiation for Public Input

As it is not easy for users to understand all phenomena surrounding the generation of the dynamic pressure, the resulting increase in the static pressure and the fast depressurization systems without a large investment of time, some companies are falsely claiming to sell technologies that avoid transformer explosions.

Due to large uncertainties associated with the physics associated with arcing in oil-filled transformers, simulations are not sufficient to validate a Fast Depressurization System. Therefore, it is recommended compliance testing or type testing. This criterion for Fast Depressurization Systems live tests involves generating electrical arcs in sealed oil-filled transformers. The test campaign should include arc energies large enough to rupture transformer tanks in the absence of Fast Depressurization Systems, including tests with arc energies higher than several megajoule (MJ). Tests should be performed by a certified laboratory such as STL member.

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Committee: ECG-AAA



Public Input No. 29-NFPA 850-2023 [Section No. A.6.1.4.2(9)]

A.6.1.4.2(9)

Oil-filled transformer explosions 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. An example is provided in D.2.14. This fast depressurization can be achieved by a quick oil evacuation triggered by the transient 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, because 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. The systems can include outflow devices that are located directly on the high-risk areas of the bushing turrets and oil-bushing cable boxes.

While it is ideal to test these fast depressurization systems on a live transformer in a laboratory, this is not always a feasible option for most companies. The reasons being:

- (1) *Prohibitively expensive to test this equipment.*
- (2) *Most laboratories are not equipped to conduct these tests. In fact, personnel working in these facilities do not possess enough knowledge to design and specify test parameters for these systems.*

These reasons make it very hard, if not impossible, for smaller, more innovative companies to bring better and affordable solutions to the market.

Another approach could be to test technologies or systems against each other in an environment that is like a live transformer. A pressure test, for example, is a good place to start. If technology A has been tested on a live transformer and it operates like it should and protects the transformer from explosions, technology B from another company can be compared with it to see how it performs against pressure rise. These simpler tests can be performed everywhere and does not require extensive planning. Regardless of how pressure behaves within the transformer during an electrical short circuit, the result is rapid pressure increase within the tank. Performance against pressure rise of technology A can be compared with technology B to determine if they are both at par and what the differences are.

This approach will pave way for broader choices for the customers looking to protect their power plants and grids.

-

Statement of Problem and Substantiation for Public Input

Providing better choices, method of shortlisting potential solutions for the power industry to choose the right fast depressurization equipment for their plants.

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Submittal Date: Fri Nov 03 14:04:37 EDT 2023

Committee: ECG-AAA

**Public Input No. 12-NFPA 850-2022 [Section No. A.10.3.1.4.2]****A.10.3.1.4.2**

To avoid water application to hot parts or other water sensitive areas and to provide adequate coverage, designs that incorporate items such as fusible element operated directional spray nozzles can be necessary.

A sprinkler design of 0.3 gpm/ft² (12 mm/min) is adequate for spill or pool fire control only where adequate containment and drainage are provided to limit the fire area. For other scenarios, the fire protection system should be designed for fire extinguishment based on Table A.10.3.1.4.2.

Maximum Roof Height, ft (m)	Sprinkler K factor, gpm/psi ^{0.5} (L/min /bar ^{0.5})	Density, gpm/ft ² (mm/min)	Demand Area, ft ² (m ²)
15 (4.6)	≥ 11.2 (161)	0.30 (12)	For pool areas < 200 ft ² (18 m ²), use design area of 200 ft ² (186 m ²). For pool areas ≥ 200 ft ² (18 m ²) and < 625 ft ² (56 m ²), use design area of 625 ft ² (56 m ²). For pool areas ≥ 625 ft ² (56 m ²), use design area of 8000 ft ² (743 m ²).
30 (9.1)	≥ 11.2 (161)	0.40 (15)	
40 (12)	≥ 11.2 (161)	0.70 (29)	
45 (14)	≥ 11.2 (161)	0.80 (33)	

Statement of Problem and Substantiation for Public Input

FM Global testing has demonstrated that increasing density is needed to achieve control of pool fires as the clearance of the sprinklers above the pool increases. This information should be provided to support more robust protection under high ceilings.

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Submittal Date: Thu Dec 22 15:34:35 EST 2022

Committee: ECG-AAA



Public Input No. 11-NFPA 850-2022 [Section No. A.10.3.1.4.4]

A.10.3.1.4.4

Above the operating floor, ceiling level sprinkler systems might not be effective to protect floor level equipment and components from oil fires because of the high ceilings [typically in excess of 40 ft (12 m)].

~~A spray fire can blow past conventional automatic sprinkler protection without operating the system and can expose structural steel or critical components of the turbine generator. The concern is that fire exposure to the roof for the rundown time of the turbine could bring down building steel and result in damage to long lead time equipment critical to operation of the turbine or that the fire could directly expose critical equipment such as the generator. Where possible, one of the following protection measures should be used:~~

- ~~(1) *Enclosure of the hazard.* An example would be location within a room of noncombustible construction protected with automatic sprinkler protection.~~
- ~~(2) *Use of a barrier.* A metal barrier could be installed between the hazard and critical equipment or the roof of the building with automatic sprinklers installed under the barrier.~~
- ~~(3) *Water spray protection.* Tests have shown that deluge sprinklers over the hazard can reduce the size of an oil spray fire. The tests were conducted with pendant sprinklers spaced 5 ft x 5 ft (1.5 m x 1.5 m) apart, with an orifice coefficient of K-8.0 (115) and an end head pressure of 50 psi (3.9 bar) located 6 ft (1.8 m) over the hazard. The system should be automatically activated by a listed line type heat detection or flame detection system.~~

Statement of Problem and Substantiation for Public Input

This material has been expanded and proposed for inclusion in the body of the standard.

Related Public Inputs for This Document

<u>Related Input</u>	<u>Relationship</u>
Public Input No. 10-NFPA 850-2022 [Sections 10.3.1.4.2, 10.3.1.4.3, 10.3.1.4.4]	

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Public Input No. 20-NFPA 850-2023 [Section No. F.1.2.4]

F.1.2.4 ASTM Publications.

ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM D448, *Standard Classification for Sizes of Aggregate for Road and Bridge Construction*, 2003 _ 2012 (reapproved 2022) .

Statement of Problem and Substantiation for Public Input

date update

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