MINUTES OF MEETING

Technical Committee on Fundamentals of Combustion Systems Hazards

May 22-23, 2012
Southern Company
Birmingham, AL

I. Attendance:

Principal Members/Staff:
Dale Evely, Technical Committee Chair, Southern Company Services, AL
Denise Beach, NFPA, MA
Barry, Basile, Babcock Power, Inc., MA
John Eley, GN Electronics Inc., IL
Richard Gallagher, Zurich Services Inc., DE
Ted Jablkowski, Fives North American Combustion, CT
Randy Kleen, General Electric Co., TX
Gail Lance, Babcock & Wilcox Company, OH
James Lemanski, XL Insurance, IL
Dennis Mason, AEGIS Insurance Services, MI
Roy Reeves, Emerson Process Management, PA
Bill Smith, Exothermic Engineering LLC, MO
William A. Smith, Global Risk Consultants Corp., GA
Franklin Switzer, S-afe, Inc., IN
Mike Walz, Burns & McDonnell Engineering Co., MO
Harold (Skip) Yates, HRY, Inc. Boiler Systems Consulting, MI

Alternates:
Steven Graf, Emerson Process Management, PA
Daniel May, Burns & McDonnell Engineering Company, MO

Guests:
Paul Cannon, Hurst Technologies
Mark Fecke, Exponent
Joseph E. Fehr, Sega, Inc.
James Franks, XL GAPS
Sinming Kwong, Emerson Process Management
II. Minutes of Meeting:

1. Call to order. The meeting was called to order at 8:05 a.m. on May 22, 2012.

2. Introduction. The Committee members and guests introduced themselves and identified their affiliation.

3. Minutes Approval. The minutes from the March 2010 meeting were approved as written.

4. NFPA Staff Report. The NFPA Staff Liaison reviewed the new document revision process and tools, including the new terminology, the revision cycle timeline, and the online public input submittal process.

5. Old Business.
   A. Held Items from Last Revision. The preliminary committee actions can be found in Attachment A. Actions taken in the Pre-First Draft meeting have not been balloted. Any committee member can request reconsideration of a preliminary action in the First Draft meeting in January 2013. PLEASE NOTE: As discussed in the meeting, the next revision of NFPA 85 is regulated by the new NFPA process. In the new process, the committee does not accept or reject public input (PI). The committee creates First Revisions (FRs) which may be based on one or more PIs. The attached report reflects only the FRs created by the committee in the meeting. The unresolved PIs will be addressed in the First Draft (FD) meeting. Don’t be alarmed if you don’t see your public input in the attachment. In addition, there is a glitch in the software used to process the FR actions that prevents me from modifying the committee field. Therefore all FRs list the responsible committee as the Pulverized Fuel Committee. This will be corrected before the FD meeting.
   B. Gas Line Purging Task Group. Members of the task group are: B. Baesel; R. Gallagher; T. Jablkowski; R. Kleen; D. Mason; and F. Switzer. Mr. Jablkowski brought forward draft text that is also being reviewed by the NFPA 86 technical committee. The draft text will be forwarded to the task group members for additional work. The task group will report to the committee in the First Draft meeting.
   C. BCS-MBB Aluminum Valves Task Group. At the chairman’s request, Mr. Switzer briefly updated the committee on the work of the BCS-MBB task group on aluminum body valves. Mr. Switzer reported that the phrase “including valves, strainers and fittings” had been struck from paragraph 5.6.8.4 of NFPA 54, National Fuel Gas Code.
D. Requests from R. Kleen. The committee referred the items from Mr. Kleen to the BCS-HRS committee for discussion. However, Mr. Kleen’s request to review the vent valve sizing led to a broader discussion on the origin of the data in chapter 4. The committee requested that NFPA Staff develop a National Fire Protection Research Foundation project request to research vent valve sizing and the possible impact of length. The committee intends this to be a literature search with the possibility of developing recommendations for further study or testing.

6. New Business PLEASE NOTE: As discussed in the meeting, the next revision of NFPA 85 is regulated by the new NFPA process. In the new process, the committee does not accept or reject public input (PI). The committee creates First Revisions (FRs) which may be based on one or more PIs. The attached report reflects only the FRs created by the committee in the meeting. The unresolved PIs will be addressed in the First Draft (FD) meeting. Don’t be alarmed if you don’t see your public input in the attachment. In addition, there is a glitch in the software used to process the FR actions that prevents me from modifying the committee field.

A. Review of Public Input Received to Date. The preliminary committee actions can be found in Attachment A. Actions taken in the Pre-First Draft meeting have not been balloted. Any committee member can request reconsideration of a preliminary action in the First Draft meeting in January 2013. Therefore all FRs list the responsible committee as the Pulverized Fuel Committee. This will be corrected before the FD meeting.
  i. Low Water Cutout – Mr. Gallagher and Mr. Switzer will study this issue and recommend specific code text to address the public input.
  ii. Flue Gas Path Auxiliary Systems (4.10.3 and A.4.10.3) – Mr. Lance, Mr. Graf and Mr. Basile will study this issue and recommend specific code text to address the public input.

B. NFPA Editorial Requests. The preliminary committee actions can be found in Attachment A. Actions taken in the Pre-First Draft meeting have not been balloted. Any committee member can request reconsideration of a preliminary action in the First Draft meeting in January 2013.

C. Referenced Documents in Fundamentals Chapters. Mr. Switzer will work with Mr. Mason to review the documents referenced in mandatory text in the Fundamentals chapters. The documents referenced in chapter 4 are: NFPA 31, NFPA 54, ASME B31.1, ASME B31.3 (section 4.10) and CGA G-2.1 (subsection 4.16.3).

D. Requirement for burner management system to be limited to a single boiler or HRSG. The committee discussed the issue and a subsequent email from Mr. Polagye regarding a draft API document. NFPA staff will seek permission from API to distribute the draft document to the BCS-FUN and BCS-MBB members. Committee members are encouraged to submit public input on this subject after reviewing the relevant materials.
E. Definitions 3.3.159.11 and 3.3.159.12. The committee requested that NFPA undertake a full review of chapter 3 to identify defined terms that are not used in the mandatory text. The committee will revisit this item after the review is complete.

F. Annex Material on Flue Gas Analyzers. The committee briefly discussed the annex material and the general topic of in situ oxygen analyzers. Committee members should direct any public input on this subject to the BCS-FBB, BCS-MBB, and BCS-SBB technical committees.

7. Other Items. There were no other items to discuss.

8. Next Meeting. The First Draft meeting is tentatively scheduled for the week of Jan. 28, 2013 at GE Headquarters in Houston, TX. Details will be forwarded as they become available.

9. Adjournment. The meeting adjourned at 12:00 noon on May 23, 2012.
Attachment A: Preliminary Committee Actions
85- Log #FR3  BCS-PFS
(3.3) Final Action:

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 3.3.x Competent Person. One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. [29 CFR 1926. 32(f)]
Statement: To support the use of the term "competent person" in new paragraph 4.5.5(A).

85- Log #FR9  BCS-PFS
(3.3.2) Final Action:

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 3.3.2 Agglomeration. Alkali compounds can attach to bed material particles. These compounds can have low melting points and cause the bed particles to stick to each other to form agglomerates.
Statement: The committee deleted the definition because it is information specific to the use of the term "agglomeration" in chapter 7; not a general definition. The BCS-FUN committee encourages the BCS-FBB committee to consider using the definition as a basis for annex material to 7.3.3.9(6), as it is the only usage in the document.

85- Log #FR6  BCS-PFS
(3.3.60.4) Final Action:

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 3.3.60.4 Induced Draft (ID) Fan. A device downstream of the combustion process used to remove the products of combustion from the boiler, or HRSG, or flue gas ductwork, by introducing a negative pressure differential.
Statement: The committee revised the definition based partially on PI 1. However, the committee determined that any reference to pressure differential is non-descriptive. Therefore the definition is revised to the purpose of the fan rather than how it is accomplished.

85- Log #FR10  BCS-PFS
(3.3.78) Final Action:

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 3.3.78 Gate (for Raw Fuel) (Silo Gate; Bunker Gate). A shutoff gate between the raw-fuel bunker and the raw-fuel feeder.
Statement: The usage in context is clear, therefore no definition is needed. In addition, the definition is circular and not very descriptive.
Final Action:  

85- Log #FR29 BCS-PFS  
(3.3.141.1)  
_____  
Submitter: Technical Committee Pulverized Fuel Systems  
Recommendation: 3.3.141.1 Combustion Turbine Normal Shutdown. The normal sequence of events that automatically provides successful shutdown of the combustion turbine with no abnormal conditions in the combustion system.  
Statement: There are a number of situations not related to the combustion system for which the turbine controller will reduce the power to full speed no load, force the line breaker open, then perform a full unit shutdown using the "normal" shutdown sequence. It is the intent of the committee that abnormal conditions in auxiliary systems and other systems unrelated to combustion do not impact the eligibility for combustion turbine purge credit.

85- Log #FR11 BCS-PFS  
(3.3.148)  
_____  
Submitter: Technical Committee Pulverized Fuel Systems  
Recommendation: 3.3.148 Steam Generator. A pressure vessel in which water is converted to steam or steam is superheated, or in which any combination thereof takes place.  
Statement: The term steam generator, excluding as part of a HRSG, is used only in section 4.12. Section 4.12 is revised in FR-12 to remove this usage, therefore the definition is no longer needed.

85- Log #FR1 BCS-PFS  
(4.1.5)  
_____  
Submitter: Technical Committee Pulverized Fuel Systems  
Recommendation: 4.1.5 The burner or fuel feed piping and equipment shall be designed, and constructed and located to prevent the formation of hazardous concentrations of combustibles gases that exist under normal operating conditions.  
A.4.1.6 The installation of a boiler or HRSG, including the burner(s) or fuel feed piping and equipment, in accordance with the requirements of this Code shall not in and of itself require a change to determine the electrical classification of the boiler or HRSG location.  
A.4.1.6 The area surrounding boilers or HRSGs that meet the requirements of 4.1.5 are not classified as a hazardous (classified) location due solely to the presence of their associated burners and fuel feed piping. However, users are cautioned that valves, flanges, fittings, ventilation, or other pieces of equipment can impact the electrical classification of the area around a boiler or HRSG. Therefore, users should be familiar with the guidance in NFPA 497 and NFPA 499.  
Statement: NFPA 497 section 5.4.3 states "Open flames and hot surfaces associated with the operation of certain equipment, such as boilers and fired heaters, provide inherent thermal ignition sources. Electrical classification is not appropriate in the immediate vicinity of these facilities. However, it is prudent to avoid installing electrical equipment that could be a primary ignition source for potential leak sources in pumps, valves, and so forth, or in waste product and fuel feed lines."

Therefore, NFPA 85 incorporates requirements for safe design and maintenance of equipment in its scope to maintain system integrity and minimize hazards related to fuel systems. However, there are many factors that should be considered in identifying electrically classified areas around such equipment. Users must use caution when identifying electrically classified areas and use appropriate recommended practices and good engineering judgment.
**Recommendation:**

4.5.4 The design shall not require any deliberate defeating of an interlock to start or operate equipment.

4.5.5 Interlock devices shall be permitted to be temporarily removed from service in accordance with the following:

(A) Removal of the interlock shall be authorized by a competent person and documented in accordance with operating procedures.

(B) Alternate means shall be substituted to supervise this interlock function in accordance with operating procedures.

No interlocks shall be bypassed during start-up or operation of the unit unless the bypass is tagged and is governed by operating procedures.

**Statement:**

This language was extracted from 6.4.2.2.13 at the suggestion of the BCS-AAC Technical Correlating Committee. The BCS-FUN TC recognizes that interlocks may need to be bypassed to complete maintenance and testing. While the existing 4.5.4 addresses this need, the language from the existing 6.4.2.2.13 provides a more thorough treatment of the procedure for doing so. The BCS-MBB language was modified because "annunciation" requires both visual and audible notification. The BCS-FUN committee determined that the company's operating procedures should be used to determine how operators document the override. The requirements were broken out into a subsection and paragraphs to comply with the Manual of Style.

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**Recommendation:**

4.7.8.5 Boilers or HRSGs that share a common component between the furnace outlet and the stack shall be in accordance with the following:

(A) There shall be provisions to bypass the common component for unit purge when the common component contains a possible ignition source.

(B) A common component shall not interrupt the open-flow air path of a boiler or HRSG during operation or purge.

(C) A common component shall not permit the flow of combustion products into an idle boiler or HRSG.

A.4.7.8.4 4.7.8.5(C) The designer is cautioned that, when boilers or HRSGs share a common component between the furnace outlet and the stack, a positive pressure at the tie-in point could create a reverse flow into a nonoperating unit when at least one unit is in operation.

**Statement:**

When two or more boiler outlets are tied together, it is possible to pressurize the connection point either by design or excursion. Positive pressure at the common component eliminates an open flow path (3.3.105), permits products of combustion from a running unit to enter an idle unit, and also prevents the unburned fuel and products of combustion from exiting the combustion chamber and gas paths via passive means when fans are lost. This comment does not pertain to a specific type of equipment; it pertains to the requirements of any combustion products removal subsystem.
Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 4.11.3 The burner management system interlock and alarm functions shall be initiated by one or more of the following:

1. One or more switches or transmitters that are dedicated to the burner management system
2. One or both signals from two transmitters exceeding a preset value
3. The median signal from three transmitters exceeding a preset value
4. Voting logic derived from two or more switches or transmitters

4.11.3.1 Where multiple transmitters are used in the burner management system, such signals shall be permitted to be shared with other control systems for control purposes.

Statement: The BCS-FUN TC revised the language to recognize the use of voting systems. The median value is a sub-set of voting logic, therefore (2) and (3) are redundant to the new voting logic allowance. When only one switch or transmitter is utilized, it should be dedicated to the burner management system so that protection and control functions are not operating off of a single signal. When multiple transmitters are utilized, those signals can be shared for process control purposes. The committee does not find it realistic that switches would be shared with control systems for process control purposes.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 4.11.3.1

Statement: Existing section 4.11.3.1 requires that multiple switches or transmitters be monitored for disagreement with each other but does not explicitly state what is to be done if a disagreement is detected. The proposed annex text clarifies the intent of the requirement and recommends that action be taken.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 4.12 Flame Monitoring and Tripping Systems. Additional requirements concerning flame detection associated with each type of steam generator covered by this code are given in the respective chapters.

Statement: The text was originally intended to provide a reminder to users of the combined code format that requirements in chapter 4 must be combined with requirements on the same topic in the equipment-specific chapters. The committee deleted the text because it does not provide a clear requirement, and users of the code should be familiar with the merged format.
85- Log #FR15 BCS-PFS  
(6.4.2.3.4.3)  

**Submitter:** Technical Committee Pulverized Fuel Systems  
**Recommendation:** 6.4.2.3.4.3 A boiler enclosure purge shall be required after the occurrence of a master fuel trip or if any purge permissive, as defined in 6.4.2.3.4.5, is lost prior to the introduction of any fuel or ignition source to the boiler enclosure.  

(D) After completion of the boiler enclosure purge, the unit shall be permitted to either:  
(1) Shut down, closing the burner air registers and shutting down the FD and ID fans; however, maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak by.  
(2) Relight in accordance with 6.6.5, 6.7.5, or 6.8.5, as applicable, depending on the fuels being fired.  

**Statement:** The committee deleted sub-paragraph (D) because shutting down or relighting are the only options. There is no reason to state them in the code.

85- Log #FR18 BCS-PFS  
(6.4.3.2.27)  

**Submitter:** Technical Committee Pulverized Fuel Systems  
**Recommendation:** 6.4.3.2.27 Axial Flow Fan Nearing Stall Line. This condition shall be sensed and alarmed in accordance with the fan manufacturer’s recommendations.  

**Statement:** The committee clarified the statement by adding a requirement.

85- Log #FR19 BCS-PFS  
(6.4.3.2.30)  

**Submitter:** Technical Committee Pulverized Fuel Systems  
**Recommendation:** 6.4.3.2.30 Reburn Fuel Oil Supply Pressure Low. This alarm shall apply to units with a reburn system.  

**Statement:** The committee added a requirement for consistency with other subparagraphs in this section.
Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down. After completion of the unit purge, closing the burner air registers and shutting down the forced draft fans and induced draft fans shall be permitted to be optional; however, maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak-by.
6.6.5.2.3.9 After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down.
A.6.6.5.2.3.9 Maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak-by.
[Renumber subsequent]
Recommendation: After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down.
A.6.6.5.2.3.9 Maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak-by.
[Renumber subsequent]
Statement: The committee separated the requirements into new paragraphs, revised the language for clarity, and moved the unenforceable language to the annex.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Leakage of main or igniter fuel into the furnace or windbox shall be prevented.
Statement: The committee deleted the subparagraph because it contains unenforceable language. In addition, there are already several steps in the normal shutdown procedure that should prevent leakage of fuel.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down. After completion of the unit purge, closing the burner air registers and shutting down the forced draft fans and induced draft fans shall be permitted to be optional; however, maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak-by.
6.7.5.2.3.10 After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down.
A.6.7.5.2.3.10 Maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak-by.
[Renumber subsequent]
Statement: The committee separated the requirements into new paragraphs, revised the language for clarity, and moved the unenforceable language to the annex.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Leakage of main or igniter fuel into the furnace or windbox shall be prevented.
Statement: The committee deleted the subparagraph because it contains unenforceable language. In addition, there are already several steps in the normal shutdown procedure that should prevent leakage of fuel.
Final Action:

85- Log #FR22  BCS-PFS
(6.8.5.2.3.6)

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: After completion of the unit purge, forced and induced draft fans shall be permitted to be shut down. After completion of the unit purge, closing the burner air registers and shutting down the forced draft fans and induced draft fans shall be permitted to be optional; however, maintaining airflow through the unit to prevent accumulation of combustible gases is a prudent procedural step due to the potential of fuel leak by.

Statement: The committee separated the requirements into new paragraphs, revised the language for clarity, and moved the unenforceable language to the annex.

85- Log #FR24  BCS-PFS
(6.8.5.2.3.7)

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: Leakage of main or igniter fuels into the unit shall be prevented.

Statement: The committee deleted the subparagraph because it contains unenforceable language. In addition, there are already several steps in the normal shutdown procedure that should prevent leakage of fuel.

85- Log #FR34  BCS-PFS
(Chapter 8)

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: Chapter 8 change - replace "stop valve or equivalent valve" with "safety shutoff valve" everywhere it appears.

Statement: The committee replaced the term "stop valve" with "safety shutoff valve" for consistency with the rest of the document and NFPA 37. The committee removed the reference to "equivalent valves" because, for a duct burner system, only safety shutoff valves are used to stop fuel flow. It is the intent of the committee to enable designers and/or operators to use the individual burner safety shutoff valve, where provided in accordance with 8.4.3.2.1.11, as the most downstream safety shutoff valve when it is not practical to install the third shutoff valve in the main fuel supply line. The previous text was worded to require the individual burner safety shutoff valves to be used as the "third valve".
Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.4.2.2.1 The HRSG system’s required interlocks shall prevent starting of the combustion turbine unless the HRSG starting conditions are satisfied, which shall include but not be limited to the following:

1. The water levels in drum(s), if provided, are within the defined start-up range.
2. The feedwater supply system is available to respond to demand.
3. The pressure in steam or water spaces is not high.
4. The exit temperature of duct burner(s), if provided, is not high.
5. The position of stack closure, if provided, is correct.
6. The pressure in the HRSG enclosure is not high.
7. The augmented air supply, if provided, is in operation.
8. Where a combustion turbine purge credit is being used, all fuel systems connected to the HRSG are satisfactorily isolated.

Statement: The committee deleted subparagraph (7) because the starting sequence requires flow to be established through the combustion turbine prior to starting augmented air systems.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.4.2.2.4 Where a HRSG is not provided, an interlock shall prohibit starting the combustion turbine if the combustion turbine exhaust system pressure is high.

The combustion turbine exhaust system’s required interlocks shall prevent starting the combustion turbine unless the following starting conditions are satisfied:

1. The pressure in the combustion turbine exhaust ductwork is not high.
2. The tempering air supply, if provided, is in operation.

Statement: The committee modified paragraph 8.4.2.2.4 because the starting sequence requires flow to be established through the combustion turbine prior to starting tempering air systems.
Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.4.3.2.2.3* Triple Block and Double Vent Valve Arrangement. Three stop safety shutoff valves or equivalent valves in series, with proof of closure, shall be provided in each fuel line to the duct burner for units with combustion turbine purge credit provisions in accordance with 8.8.4.6. An automatic vent valve shall be provided between each of these valves. The most downstream valve for a duct burner installation shall be located in each burner line (runner) in accordance with 8.4.3.2.1.11.

8.4.3.2.2.4* Where individual burner safety shutoff valves are installed in accordance with 8.4.3.2.1.11, the individual burner safety shutoff valve shall be permitted to be the most downstream safety shutoff valve required in 8.4.3.2.2.3.

A.8.4.3.2.2.4 In general, three safety shutoff valves on the main header is the preferred practice, but in some situations, this may not be practical.

Statement: The committee replaced the term "stop valve" with "safety shutoff valve" for consistency with the rest of the document and NFPA 37. The committee removed the reference to "equivalent valves" because, for a duct burner system, only safety shutoff valves are used to stop fuel flow. It is the intent of the committee to enable designers and/or operators to use the individual burner safety shutoff valve, where provided in accordance with 8.4.3.2.1.11, as the most downstream safety shutoff valve when it is not practical to install the third shutoff valve in the main fuel supply line. The previous text was worded to require the individual burner safety shutoff valves to be used as the "third valve".

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: Revise text to read as follows:

8.7.4.1.6 Interlock functions, including those functions outside the burner management system, shall meet the functional requirements of 4.11.3. Interlock functions shall be initiated by one or more of the following:

(1) A switch or transmitter independent of control functions and signals
(2) Two analog signals with a divergence alarm
(3) Three analog signals employing an auctioneering system and a divergence alarm or other fault diagnostic alarm

Statement: The committee deleted the requirement and referenced the chapter 4 material to eliminate redundancy in the code.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.8.4.1* Combustion Turbine Purge Process. The purge of the combustion turbine shall be in accordance with the manufacturer’s instructions and with the requirements of 8.8.4.2 or 8.8.4.6 and 8.8.4.7, as applicable.

8.8.4.1.1 Where a combustion turbine or HRSG is provided with fuel systems for multiple fuels, the purge requirements for each type of fuel shall be met.

Statement: The paragraph is revised to be consistent with changes made in FR37 to separate purge credit requirements for liquid fuel systems.
Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.8.4.2.4* Where augmented air firing or tempering air is provided, a means shall be supplied for interlocking and purging the augmented or tempering air system shall be purged prior to initiating and during the combustion turbine purge in accordance with the combustion turbine and HRSG manufacturers’ operating instructions. A.8.8.4.2.4 It is not good practice to have air flowing in the reverse direction into the combustion turbine and this reverse flow can come from the augmented or tempering air system. The plant control system could have an interlock to ensure augmented or tempering fans are not started until flow is established through the combustion turbine. Designers and operators should consult the equipment manufacturer’s instructions for further information.

Statement: The committee recognized that 8.8.4.2.4 did not clearly prevent operators from running the augmenting or tempering air fans while the combustion turbine is not in operation or purge. It is not good practice to have air flowing in the reverse direction into the combustion turbine and this reverse flow can come from the augmenting or tempering air system. Tempering air was added to the section because it was reported to the committee that there are tempering air systems other than those associated with SCRs.
Recommendation:

Technical Committee Pulverized Fuel Systems

Submitter: Technical Committee Pulverized Fuel Systems

Revise text to read as follows:

8.8.4.6* Combustion Turbine Purge Credit for Gaseous Fuel Systems. Following a combustion turbine normal shutdown, combustion turbine purge credit shall be permitted to be established for the next start-up event if the following requirements are met:

1. The intent is to ensure that the integrity of the combustion turbine fuel systems and safety controls are maintained. This is particularly important for any retrofit installed to meet the combustion turbine purge credit requirements. This should be accomplished by reviewing existing operating instructions and consulting the OEM of the combustion turbine and ancillary equipment before finalizing a design. On units with a duct burner system, similar considerations should be applied.

2. A positive means to prevent leakage of ammonia into the idle HRSG or other combustion turbine exhaust system shall be provided in accordance with 4.10.3.

3. A triple block and double vent valve arrangement is installed on the combustion turbine in accordance with 8.4.2.1.2.2 and is installed on the HRSG fuel burning system (if provided) in accordance with 8.4.3.2.2.3.

4. Pressures in the two double block and vent pipe sections shall be continuously monitored. If continuous monitoring is lost or any valve deviates from its assigned position, purge credit is lost, and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.

5. The combustion turbine purge credit period shall not exceed 8 days (192 hours). If a combustion turbine purge in accordance with 8.8.4.2 is performed during the 8-day period, the combustion turbine purge credit is reinitiated for an 8-day period.

6. System 2 Gaseous Fuels. Where a triple block and double vent valve arrangement is installed on the combustion turbine in accordance with 8.4.2.1.2.2 and is installed on the HRSG fuel burning system (if provided) in accordance with 8.4.3.2.2.3.

(A)* Valve-proving Method (Note: Renumber A.8.8.4.6.1 here.)

(A.8.8.4.6.1*) Combustion turbine and duct burner manufacturer's valve-proving requirements, fuel supply system requirements, and safety control system requirements shall be met.

(A.8.8.4.6.1*) The intent is to ensure that the integrity of the combustion turbine fuel systems and safety controls are maintained. This is particularly important for any retrofit installed to meet the combustion turbine purge credit requirements. This should be accomplished by reviewing existing operating instructions and consulting the OEM of the combustion turbine and ancillary equipment before finalizing a design. On units with a duct burner system, similar considerations should be applied.

(A.8.8.4.6.2*) Valve-proving method.

(A.8.8.4.6.2*) Prior to each start-up and following each normal shutdown, block valves shall be validated for gas leak tightness via a valve-proving system. As a minimum, the most downstream block valve shall be valve proved during the start-up sequence, and the middle block valve shall be valve proved during the shutdown sequence. The most downstream block valve shall be tested only when airflow is passing through the combustion turbine.

8.8.4.6.2* System 2 Gaseous Fuels with Pressurized Pipe Section. Where a triple block and double vent valve arrangement is installed on the combustion turbine in accordance with 8.4.2.1.2.2 and is installed on the HRSG fuel burning system (if provided) in accordance with 8.4.3.2.2.3.

1. Combustion turbine normal shutdown and duct burner normal shutdown, where provided, shall be accomplished.

2. Air or inert gas shall be introduced to create and maintain a pressurized pipe section between the middle and most downstream block valves.

3. Fuel gas block and vent valve positions shall be continuously monitored. If continuous monitoring is lost or any valve deviates from its assigned position, purge credit is lost and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.

4. Pressures in the two double block and vent pipe sections shall be continuously monitored. If the continuous monitoring is lost or the pressure downstream of the middle block valve decreases to less than 20.7 kPa (3 psid) above the upstream pressure, purge credit is lost and subsequent start-up of the combustion turbine requires a combustion
turbine purge prior to light-off, in accordance with 8.8.4.2.

(5) Combustion turbine purge credit period shall be considered to be maintained as long as the conditions in 8.8.4.6.2(2), (3), and (4) are met.

(6) Provisions shall be made to ensure that fuel cannot enter the air or inert gas supply line at any time.

**Statement:** The committee restructured the paragraphs to be consistent with the NFPA Manual of Style. The introductory paragraph referred to systems being installed, but the subsequent subparagraphs described operational sequences. The committee separated the requirements from the sequences and renumbered accordingly.

The committee added the requirement for a normal duct burner shutdown to make it clear that all systems must be in a "normal" condition in order for the combustion turbine purge credit to be established.

The committee added the requirement for meeting the requirements of OEM of the combustion turbine to ensure that the integrity of the combustion turbine fuel systems and safety controls are maintained. This is particularly important for any retrofit installed to meet the combustion turbine purge credit requirements.
8.8.4.6.3 Combustion Turbine Purge Credit for Liquid Fuel Systems. Following a normal shutdown, combustion turbine purge credit shall be permitted to be established for the next start-up event provided that the following requirements are met for each combustion turbine and duct burner fuel system:

1. Liquid fuel block and drain valve arrangement filled with an inert gas or air and maintained at a pressure that prevents liquid fuel from entering the combustion turbine or duct burner in accordance with the following requirements:
   - The block and drain valve arrangement shall be monitored continuously for any deviation from its assigned position.
   - Pressures in the two double block and drain pipe sections shall be continuously monitored. If the continuous monitoring is lost or either pressure indicates leakage, purge credit is lost, and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.
   - The combustion turbine purge credit period is maintained as long as the conditions in 8.8.4.6.3(2), (3), and (4) are met.

2. Provisions shall be made to ensure that fuel cannot enter the air or inert gas supply line at any time.

8.8.4.7.1 Combustion turbine and duct burner manufacturer's fuel supply valve monitoring system requirements and safety control system requirements shall be met.

A.8.8.4.7.1 See A.8.8.4.6.1.

A.8.8.4.7.2 A positive means to prevent leakage of ammonia into the idle HRSG or other combustion turbine exhaust system shall be provided in accordance with 4.10.3.

A.8.8.4.7.3 A triple block and double drain valve arrangement is installed on the combustion turbine in accordance with 8.4.2.1.1.2 and is installed on the HRSG fuel burning system (if provided) in accordance with 8.4.3.2.2.4.

A.8.8.4.7.4 One of the following shall be used to establish the purge credit:

A. (A) Proof-of-Closure Method
   1. Combustion turbine normal shutdown and duct burner normal shutdown, where provided, shall be accomplished.
   2. Liquid fuel block and drain valve positions shall be continuously monitored. If continuous monitoring is lost or any valve deviates from its assigned position, purge credit is lost, and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.
   3. Pressures in the two double block and drain pipe sections shall be continuously monitored. If the continuous monitoring is lost or either pressure indicates leakage, purge credit is lost, and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.
   4. The combustion turbine purge credit period shall not exceed 8 days (192 hours). If a combustion turbine purge in accordance with 8.8.4.2 is performed during the 8-day period, the combustion turbine purge credit is reinitiated for an 8-day period.

B. (B) Pressurized Pipe Section Method (Renumber A.8.8.4.6.3 here)
   1. Combustion turbine normal shutdown and duct burner normal shutdown, where provided, shall be accomplished.
   2. Air or inert gas shall be introduced to create and maintain a pressurized pipe section between the middle and most downstream block valves.
   3. The liquid fuel block and drain valve positions shall be continuously monitored. If continuous monitoring is lost or any valve deviates from its assigned position, purge credit is lost, and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.
   4. Pressures in the two double block and drain pipe sections shall be continuously monitored. If the continuous monitoring is lost or the pressure downstream of the middle block valve decreases to less than 20.7 kPa (3 psid) above the upstream pressure, purge credit is lost and subsequent start of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.
start-up of the combustion turbine requires a combustion turbine purge prior to light-off, in accordance with 8.8.4.2.

(5) The combustion turbine purge credit period is maintained as long as the conditions in 8.8.4.7.4(B)(2), (3), and (4) are met.

(6) Provisions shall be made to ensure that fuel cannot enter the air or inert gas supply line at any time.

8.8.4.7.4 An inert liquid shall be permitted to be used in lieu of inert gas if acceptable to the original equipment manufacturer.

Statement: The committee separated the purge credit requirements for liquid fuels from the requirements for gaseous fuels. The introductory paragraphs are repeated for completeness.

The committee added the proof-of-closure method to enable operators of liquid-fuel fired units to establish purge credit without the use of an inert gas or air plug. Realizing that the plug provides an infinite time for purge credit, the proof-of-closure method only provides an 8 day limit. With multiple drains in the system between the safety shutoff valves that are gravity-fed to safe areas, and no pressure on the middle or downstream safety shutoff valves, there is minimal opportunity for fuel to leak into the combustion turbine or duct burner.

The committee added the requirement for a normal duct burner shutdown to make it clear that all systems must be in a "normal" condition in order for the combustion turbine purge credit to be established.

The committee added the requirement for meeting the requirements of OEM of the combustion turbine to ensure that the integrity of the combustion turbine fuel systems and safety controls are maintained. This is particularly important for any retrofit installed to meet the combustion turbine purge credit requirements.

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85- Log #FR41 BCS-PFS Final Action:
(8.8.7.3)

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Add new text to read as follows:
8.8.7.3 The automated vent or drain valve associated with the main safety shutoff valves shall be opened.
8.8.7.4* The duct burners shall be taken out of service in a manner that relieves fuel pressure in the pipe section between the two most downstream safety shutoff valves.
A.8.8.7.4 Where individual burner safety shutoff valves are installed, the pressure should be relieved between the most downstream main safety shutoff valve and the individual burner safety shutoff valves.

[Renumber subsequent]
Statement: The committee recognizes that there is no specific requirement to open the vent or drain valves on a normal duct burner shutdown. Pressure should be relieved in the pipe section immediately upstream of the safety shutoff valve(s) closest to the duct burner during a shutdown to prevent the possibility of leakage into the HRSG.

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85- Log #FR40 BCS-PFS Final Action:
(8.8.7.4)

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 8.8.7.4 When establishing a combustion turbine purge credit in accordance with 8.8.4.6.24(B), the following procedure shall be implemented prior to combustion turbine shutdown for duct burners utilizing gaseous fuels (Pressurized Pipe Section Method) (System 2):
(1) Open both vent valves of the duct burner fuel supply.
(2) Admit the blocking medium to purge any remaining fuel until the fuel level is less than 25 percent of the LEL.
(3) Close the downstream (header) vent valve.
(4) Establish and maintain the required blocking pressure

Statement: The paragraph is revised to be consistent with changes made in FR39.
Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: 8.8.7.5 When establishing a combustion turbine purge credit in accordance with 8.8.4.7, the following procedure shall be implemented prior to combustion turbine shutdown for duct burners utilizing liquid fuels (System 3) after scavenging in accordance with 8.8.2.6:
Statement: The paragraph was revised to be consistent with changes made in FR37.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Revise text to read as follows:
8.8.9.2.2 All automated vent valves associated with the main safety shutoff valves shall be opened.
Statement: The committee modified the requirement to make it clear that manual vent valves or any optional vent valves are not required to open on a duct burner master fuel trip.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Revise text to read as follows:
8.9.2.3* Returning HRSG to Service. Where combustion turbine exhaust flow is to be reintroduced to the HRSG through operation of the stack diverter damper, the combustion turbine load and damper sequence of operation shall be in accordance with the HRSG manufacturer's operating instructions considered by the HRSG manufacturer.
Statement: The committee recognizes that there is no specific requirement to open the vent or drain valves on a normal duct burner shutdown. Pressure should be relieved in the pipe section immediately upstream of the safety shutoff valve(s) closest to the duct burner during a shutdown to prevent the possibility of leakage into the HRSG.
Report on First Revision – November 2014

85-     Log #FR26  BCS-PFS

(8.11)

Final Action:

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: 8.11 Combustion Turbine Exhaust System.

8.11.1 The requirements of Section 8.11 shall apply to combustion turbine exhaust systems, either with or without emissions control systems.

8.11.2 The purge requirements of 8.8.4 shall be met.

8.11.3 Selective Catalytic Reduction (SCR) Systems.

8.11.3.1 When an SCR system is provided, the requirements of Section 4.16 shall be met.

8.11.3.2 A tempering air system shall be provided if required to meet catalyst temperature limitations.

8.11.3.2.1* A means shall be supplied for interlocking and purging. The tempering air system shall be purged prior to initiating and during the combustion turbine purge in accordance with the combustion turbine manufacturer’s operating instructions.

8.11.3.2.2* Combustion turbine exhaust flow shall be established prior to initiating tempering air flow. Following a combustion turbine failure to start, the tempering air system shall be repurged.

A.8.11.3.2.1 Where an isolation damper is closed to isolate the tempering air system from the combustion turbine, it is not critical to purge the tempering air system concurrently with the combustion turbine. Manufacturer’s operating instructions should be followed.

A.8.11.3.2.2 It is not good practice to have air flowing in the reverse direction into the combustion turbine and this reverse flow can come from the tempering air system. The plant control system could have an interlock to ensure tempering fans are not started until flow is established through the combustion turbine. Designers and operators should consult the equipment manufacturer’s instructions for further information.

Statement: The committee recognized that 8.11 did not clearly prevent operators from running the tempering fans while the combustion turbine is not in operation or purge. It is not good practice to have air flowing in the reverse direction into the combustion turbine and this reverse flow can come from the tempering air system. The plant control system should be designed to have an interlock to ensure tempering fans are not running until combustion turbine purge is in progress. Existing 8.11.3.2.2 was deleted because it is redundant to 8.8.4. In addition, annex material was added to include an isolation damper with stack to allow tempering fans to operate when the combustion turbine is isolated.
**Submitter:** Technical Committee Pulverized Fuel Systems

**Recommendation:** A.4.1 Safety in any plant is directly influenced by an extensive upfront effort in the engineering, design, and selection of equipment for each individual application.

**Project inception phase:** In the project inception phase, the following should be accomplished to ensure a plant design that meets expected operating modes and reliability needs:

1. Establishment of plant operating parameters.
2. Identification of site-related constraints.
3. Review of steam cycle, including generating a family of heat balance diagrams for the expected operating ranges and modes.
4. Conceptualization of plant layout to provide for personnel safety, operability, and maintenance needs.
5. Definition and verification of requirements of worst-case operating transients, including start-ups.
6. Definition of required test program.
7. Definition of start-up criteria and goals.
8. Identification of the authority having jurisdiction. If multiple authorities having jurisdiction are identified, the scope of each authority having jurisdiction should be determined.
9. Establishment of electrical area classifications by the owner or the owner’s designated representative in conjunction with the boiler or HRSG system designer.

**Equipment planning:** The project should consider the use of dynamic simulation, prior operating experience, or both before equipment is selected. Dynamic simulation, where utilized, should include development of the following:

1. Configuration and data initialization
2. Plant behavior knowledge
3. Preliminary control system design and tuning
4. Validation of operating requirements (system performance)
5. Transients and ramps for intended and unintended operation

**Statement:** The committee deleted the run-in headings to comply with the NFPA Manual of Style.

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**Submitter:** Technical Committee Pulverized Fuel Systems

**Recommendation:** A.4.3.1 **Human error.** As part of the coordination of design, construction, and operation, consideration should be given to the impact of human error and unfavorable function design. Statistics indicate that human error is a contributing factor in the majority of explosions. It is important to consider whether the error was a result of any of the following:

1. Lack of understanding of, or failure to use, proper operating procedures, safeguards, and equipment
2. Unfavorable operating characteristics of the equipment or its control
3. Lack of functional coordination of the various components of the steam-generating system and its controls

Explosions also can occur as a result of unfavorable functional design. Investigations frequently reveal human error but completely overlook the chain of causes that triggered the operating error. Therefore, the design, installation, and functional objectives of the overall system of components and their controls should be integrated. Consideration should be given to the existing ergonomics that can affect system operation.

**Statement:** The committee added lead-in text and deleted the run-in headings to comply with the NFPA Manual of Style.
Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: A.4.13(1)(b) For protective actions, the system should be able to convert a changed input sensor value to a completed output control action in 250 milliseconds or less less than 25 milliseconds.

Statement: Section A.8.7.1 includes text that is essentially the same as A.4.13 with the difference being that section requires less than 250 milliseconds. This difference has existed since the 2001 edition and prior to that NFPA 8506-1998 appears to have been the only document in the 8500 series that had this requirement at all. It is believed that the 25 millisecond requirement is extreme and probably a typographical error in the 2001 edition that has cascaded through each successive edition. Also, it makes sense to change the requirement to “or less” since a 1 millisecond difference (249 versus 250) is insignificant and would provide for the use of an even fraction of 1 second.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: A.6.8.2.2.3 When the boiler is operating with pulverized coal for an extended time at reduced loads, incomplete combustion can cause large quantities of unburned combustible dust to settle in hoppers and on horizontal surfaces. If this dust is disturbed by a rapid increase in airflow or by sootblowing, an explosive mixture can result. This condition has been the cause of several explosions.

Statement: The committee deleted the annex material because it is redundant to the CAUTION statement in the mandatory text.

Submitter: Technical Committee Pulverized Fuel Systems

Recommendation: A.8.8.4.6.1(1) The philosophy for combustion turbine purge credit is that a combustion turbine normal shutdown does not result in a hazardous atmosphere being introduced. Therefore, a combustion turbine purge should not be required for subsequent startup provided that a combustion turbine purge credit is maintained. The combustion turbine normal shutdown includes sufficient postpurge airflow to satisfy the requirements of the combustion turbine purge.

Statement: The existing language was being interpreted to mean that a complete combustion turbine purge was required regardless of combustion turbine purge credit status, which was not the committee’s intent. The committee modified the note to specify the intent that combustion turbine purge credit overrides the requirement for combustion turbine purge as long as the purge credit conditions are maintained.
Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: A.8.8.4.6.2(1) The philosophy for combustion turbine purge credit is that a combustion turbine normal shutdown does not result in a hazardous atmosphere being introduced. Therefore, a combustion turbine purge should not be required for subsequent startup provided that a combustion turbine purge credit is maintained. The combustion turbine normal shutdown includes sufficient postpurge airflow to satisfy the requirements of the combustion turbine purge.
Statement: The existing language was being interpreted to mean that a complete combustion turbine purge was required regardless of combustion turbine purge credit status, which was not the committee's intent. The committee modified the note to specify the intent that combustion turbine purge credit overrules the requirement for combustion turbine purge as long as the purge credit conditions are maintained.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: A.8.8.4.6.3(1) The philosophy for combustion turbine purge credit is that a combustion turbine normal shutdown does not result in a hazardous atmosphere being introduced. Therefore, a combustion turbine purge should not be required for subsequent startup provided that a combustion turbine purge credit is maintained. The combustion turbine normal shutdown includes sufficient postpurge airflow to satisfy the requirements of the combustion turbine purge.
Statement: The existing language was being interpreted to mean that a complete combustion turbine purge was required regardless of combustion turbine purge credit status, which was not the committee's intent. The committee modified the note to specify the intent that combustion turbine purge credit overrules the requirement for combustion turbine purge as long as the purge credit conditions are maintained.

Submitter: Technical Committee Pulverized Fuel Systems
Recommendation: Figure A.8.8.5.8(d) - Delete caution statement on the legend. Delete asterisk between the two A valves in the upper right of the diagram.
Statement: The cross reference has been incorrect for two editions. It does not appear to be used, therefore there is no reason to keep it.