IMC 0609 Appendix F Attachment 1

Part 1: Fire Protection SDP Phase 1 Worksheet

Facility: _____

Step 1.1 - Provide Statement of Fire Inspection Finding

Provide a clear statement of fire inspection finding and the specific non-compliance:

Step 1.2 - Assign a Fire Inspection finding Category

A fire finding can only be in one category. Please indicate finding category by checking one of the circles in Table 1:

Table 1, **Category of Fire Inspection Finding**		
Finding Category		Elements Covered by Each Category
O	**1.4.1 Fire Prevention and administrative Controls**	• The plant combustible material controls program • Other administrative controls such as work permit programs • Hot work fire watches • Roving or periodic fire watches (other than in category 1.4.2, below) • Training programs
O	**1.4.2 Fixed Fire Protection Systems**	• Fixed fire detection systems • Fixed fire suppression systems (automatic or manual) • Fire watches posted as a compensatory measure for a fixed fire protection system outage or degradation
O	**1.4.3 Fire Confinement**	• Fire barrier elements that separate one fire area from another • Penetration seals • Water curtains • Fire and/or smoke dampers • Fire doors
O	**1.4.4 Localized Cable or Component Protection**	• Passive physical features installed for the thermal/fire protection of cables, cable raceways, or individual components • Raceways or component fire barriers (e.g., cable wraps) • Radiant heat shields protecting a component or cable • Spatial separation (e.g., per App. R Section III.G.2)
O	**1.4.5 Post-fire Safe Shutdown (SSD)**	• Systems or functions identified in the post-fire SSD analysis • Systems or functions relied upon for post-fire SSD • Post-fire SSD component list (e.g., completeness) • Post-fire SSD analysis (e.g., completeness) • Post-fire plant response procedures • Operator manual actions • Alternate shutdown (e.g., control room abandonment) • Circuit failure modes and effects (e.g., spurious operation issues)
O	**1.4.6 Manual Firefighting**	• Hose Station • Fire Extinguishers • Fire pre-plans
O	**1.4.7 Fire Water Supply**	• Fire pumps • Yard loop piping • Water Sources

Step 1.3 - Ability to Achieve Safe Shutdown

Task 1.3.1: Screen Fire Finding for Ability to Achieve Safe Shutdown

1.3.1 A Question: Is the reactor able to reach and maintain safe shutdown (either hot or cold) condition?

O Yes – Screens to Green, no further analysis required.
O No – Continue to next question.

Provide supporting information that may be needed for documentation:

1.3. B Question: Based on the criteria in Appendix F, Attachment 2, is the finding assigned a "Low" degradation rating?

O Yes – Screens to Green, no further analysis required.
O No – Continue to question below.

Provide Explanation of "Low" Degradation Rating:

Step 1.4 - Qualitative Screening Question Set for Seven Individual Categories

Proceed to applicable category below to further screen the finding.

Task 1.4.1: Fire Prevention and Administrative Controls

1.4.1. A Question: Would the impact of the fire finding be limited to equipment which is not important to safety?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.1. B Question: Would the impact of the fire finding be limited to no more than one train/division of equipment important to safety?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.1. C Question: If the fire finding is associated with the presence of transient combustibles, were there sufficient transient combustibles such that they could challenge either a fire barrier or a safe shutdown analysis boundary?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.1. D Question: If the fire finding is associated with the presence of transient combustibles, did the transient combustibles involve self-igniting materials (e.g., oily rags)?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.1. E Question: If the fire finding is associated with the presence of transient combustibles, did the transient combustibles involve a gallon or more of low flashpoint (having a flashpoint less than 200°F) flammable or combustible liquids in a non-approved container?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.1. F Question: If the fire finding is associated with the presence of transient combustibles, did the transient combustibles involve in excess of 1 lb of a flammable gas?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.1. G Question: Is the fire finding associated with the presence of an ignition source (e.g., evidence of portable heater)?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.1. H Question: Is the fire finding associated with the presence of an ignition source (e.g., evidence of recent cigarette smoking)?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.

O No – Continue to next question.

1.4.1. I Question: Is the fire finding associated with a failure to implement a hot work fire watch capable of suppressing a fire from hot work which could impact equipment important to safety?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.

O No – Continue to Step 1.5.

Task 1.4.2: Fixed Fire Protection Systems

1.4.2. A Question: If the fire finding involves a slightly code-deviant fire suppression system (e.g., automatic sprinkler coverage or fire water supply system), could the suppression system still protect the targets (such as cable raceways that contain cables critical for safe shutdown) in this fire area?

O Yes – Screen to Green, no further analysis required.

O No – Continue to next question.

1.4.2. B Question: Would the impact of the fire finding be limited to equipment which is not important to safety?

O Yes – Screen to Green, no further analysis required.

O No – Continue to next question.

1.4.2. C Question: Would the impact of the fire finding be limited to no more than one train/division of equipment important to safety?

O Yes – Screen to Green, no further analysis required.

O No – Continue to next question.

1.4.2. D Question: For a fire finding involving fixed detection systems which provide an alarm only function (i.e., not used to activate a fire suppression system), would the fire finding result in more than a 5 minute delay in the detection of a fire large enough to damage equipment important to safety?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.

O No – Continue to next question.

1.4.2. E Question: Does the finding affect only a manually actuated suppression system for an area which is accessible by the fire brigade?

O Yes – Screen to Green, no further analysis required.

O No – Continue to next question.

1.4.2. F Question: If the finding affects a Fixed Fire Protection System, are there non-transient ignition sources in the area protected by this system?

O Yes – Continue to next question, no further analysis required.
O No – Screen to Green, no further analysis required.

1.4.2. G Question: Would the affected fixed fire suppression system still be able to suppress a fire such that no additional equipment important to safety would be affected by a fire?

O Yes – Screen to Green, no further analysis required.
O No – Continue to Step 1.5.

Task 1.4.3: Fire Confinement

1.4.3. A Question: For findings involving fire doors, is the combustible loading on both sides of the wall representative of a fire duration less than 1.5 hours (i.e., less than 120,000 Btu/ft2)?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question..

1.4.3. B Question: Will the barrier in its degraded condition provide a 1-hour or greater fire endurance rating?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.3. C Question: Is a fully functional automatic suppression system on either side of the fire barrier?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.3. D Question: The exposed fire area contains no potential damage targets that are unique from those in the exposing fire area (damage targets may include post-fire safe shutdown components or other plant components whose loss might lead to a demand for safe shutdown (e.g., a plant trip))?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.3. E Question: For a wall fire barrier finding, involving equipment (such as a pipe) penetrating the barrier, is the equipment neither combustible nor capable of propagating a fire (such as cables in conduit)?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.3. F Question: For a fire inspection finding pertaining to a wall fire barrier deficiency, is there equipment important to safety (i.e. from a different safe shutdown train) within 10 feet horizontally on the other side, or vertically above, in the adjoining compartment, that can be affected by cable fire spreading through an opening in the wall fire barrier (e.g., a cable that pass through multiple fire areas)?

O Yes – Continue to Step 1.5.
O No – Screen to Green, no further analysis required.

Task 1.4.4: Localized Cable or Component Protection

1.4.4. A Question: Does an automatic suppression system protect the area where the cable or component protection is affected by the fire finding?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.4. B Question: Is a fully functional detection system in the area, and would the fire barrier provide at least 20 minutes of fire endurance?

O Yes – Screen to Green, no further analysis required.
O No – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.

Task 1.4.5: Post-fire Safe-shutdown (SSD)

1.4.5. A Question: Could the fire cause secondary fires outside of the originating fire area due to circuit issues?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.5. B Question: Does the fire finding affect the ability to reach and maintain a stable plant condition within the first 24 hours of a fire event?

O Yes – Continue to next question.
O No – Screen to Green, no further analysis required.

1.4.5. C Question: Could the fire result in a piece of equipment required for safe shutdown not being available?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.5. D Question: Could the finding result in a failure to reach a stable condition (such as due to a substantial flow diversion)?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to next question.

1.4.5. E Question: Would the finding result in a delay in excess of 10 minutes for performing required actions necessary within 1 hour?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to Step 1.5.

Task 1.4.6: Manual fire fighting

1.4.6. A Question: Is the fire finding associated with portable fire extinguishers not used for hot work fire watches?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.6. B Question: Is the fire finding associated with pre-fire plans?

O Yes – Screen to Green, no further analysis required.
O No – Continue to next question.

1.4.6. C Question: Is the fire finding associated with an observed fire drill deficiency or equipment deficiency which could have delayed suppression of a fire by more than 5 minutes?

O Yes – Continue to SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.
O No – Continue to Step 1.5.

Task 1.4.7: Fire Water Supply

1.4.7. A Question: Would at least 50% of required fire water capacity (flow at required pressure) still be available?

O Yes – Screen to Green, no further analysis required.
O No – Continue to Step 1.5.

Step 1.5 - Initial Quantitative Screening

Task 1.5.1: Assign a Duration Factor (DF)

The duration factor is the length of time (days divided by 365) that the noted performance degradation was, or will be, in existence (i.e., the duration of the degradation) rounded up as shown in Table 1.5.1. If the exposure time is greater than 30 days, the duration factor, DF, is always treated as 1.

Please document duration of fire finding by checking one of the applicable circles in left column of Table 1.5.1.

Table 1.5.1, Duration Factor		
	Duration of Degradation	Duration Factor Value(DF)
O	Less than 3 Days	0.01
O	3 to 30 Days	0.1
O	Greater than 30 Days	1.0

Task 1.5.2: Estimate the Fire Frequency for the Fire Area

Estimation of fire frequency (F) for ignition source in the fire areas can be found in Table 1.5.2. These values are from NUREG/CR 6850. Please document the finding by checking applicable circle in the left column of Table 1.5.2.

	Table 1.5.2 - Generic Fire Area Fire Frequencies, F (NUREG/CR 6850)		
	Room Identifier/Limited Specific Fire Findings	**Ignition Source**	**F, Generic Fire Frequency (per rx yr)**
O	Battery Room	Batteries	7.5E-04
O	Containment (PWR)	Reactor Coolant Pump	6.1E-03
O	Containment (PWR)	Transients and Hotwork	2.0E-03
O	Control Room	Main Control Board	2.5E-03
O	Control/Aux/Reactor Building	Cable fires caused by welding and cutting	1.6E-03
O	Control/Aux/Reactor Building	Transient fires caused by welding and cutting	9.7E-03
O	Control/Aux/Reactor Building	Transient	3.9E-03
O	Diesel Generator Room	Diesel Generators	2.1E-02
O	Plant-Wide Components	Air compressors	2.4E-03
O	Plant-Wide Components	Battery chargers	1.8E-03
O	Plant-Wide Components	Cable fires caused by welding and cutting	2.0E-03
O	Plant-Wide Components	Cable-Run (Self-ignited cable fires)	4.4E-03
O	Plant-Wide Components	Dryers	2.6E-03
O	Plant-Wide Components	Electric Motors	4.6E-03
O	Plant-Wide Components	Electrical Cabinets	4.5E-02
O	Plant-Wide Components	High Energy Arcing Faults	1.5E-03
O	Plant-Wide Components	Hydrogen Tanks	1.7E-03
O	Plant-Wide Components	Junction Boxes	1.9E-03
O	Plant-Wide Components	Misc. Hydrogen Fires	2.5E-03
O	Plant-Wide Components	Off-gas/H2 Recombiner (BWR)	4.4E-02
O	Plant-Wide Components	Pumps	2.1E-02
O	Plant-Wide Components	RPS MG Sets	1.6E-03
O	Plant-Wide Components	Transformers (Oil filled)	9.9E-03
O	Plant-Wide Components	Transformers (Dry)	9.9E-03
O	Plant-Wide Components	Transient fires caused by welding and cutting	4.9E-03
O	Plant-Wide Components	Transients	9.9E-03
O	Plant-Wide Components	Ventilation Subsystems	7.4E-03
O	Transformer Yard	Transformer - Catastrophic	6.0E-03
O	Transformer Yard	Transformer – Non Catastrophic	1.2E-02
O	Transformer Yard	Yard transformers (Others)	2.2E-03
O	Turbine Building	Boiler	1.1E-03
O	Turbine Building	Cable fires caused by welding and cutting	1.6E-03

	Table 1.5.2 - Generic Fire Area Fire Frequencies, F (NUREG/CR 6850)		
O	Turbine Building	Main Feedwater Pumps	1.3E-02
O	Turbine Building	Turbine Generator Excitor	3.9E-03
O	Turbine Building	Turbine Generator Hydrogen	6.5E-03
O	Turbine Building	Turbine Generator Oil	9.5E-03
O	Turbine Building	Transient fires caused by welding and cutting	8.2E-03
O	Turbine Building	Transients	8.5E-03

Task 1.5.3: Fire Non-Suppression Probability (S)

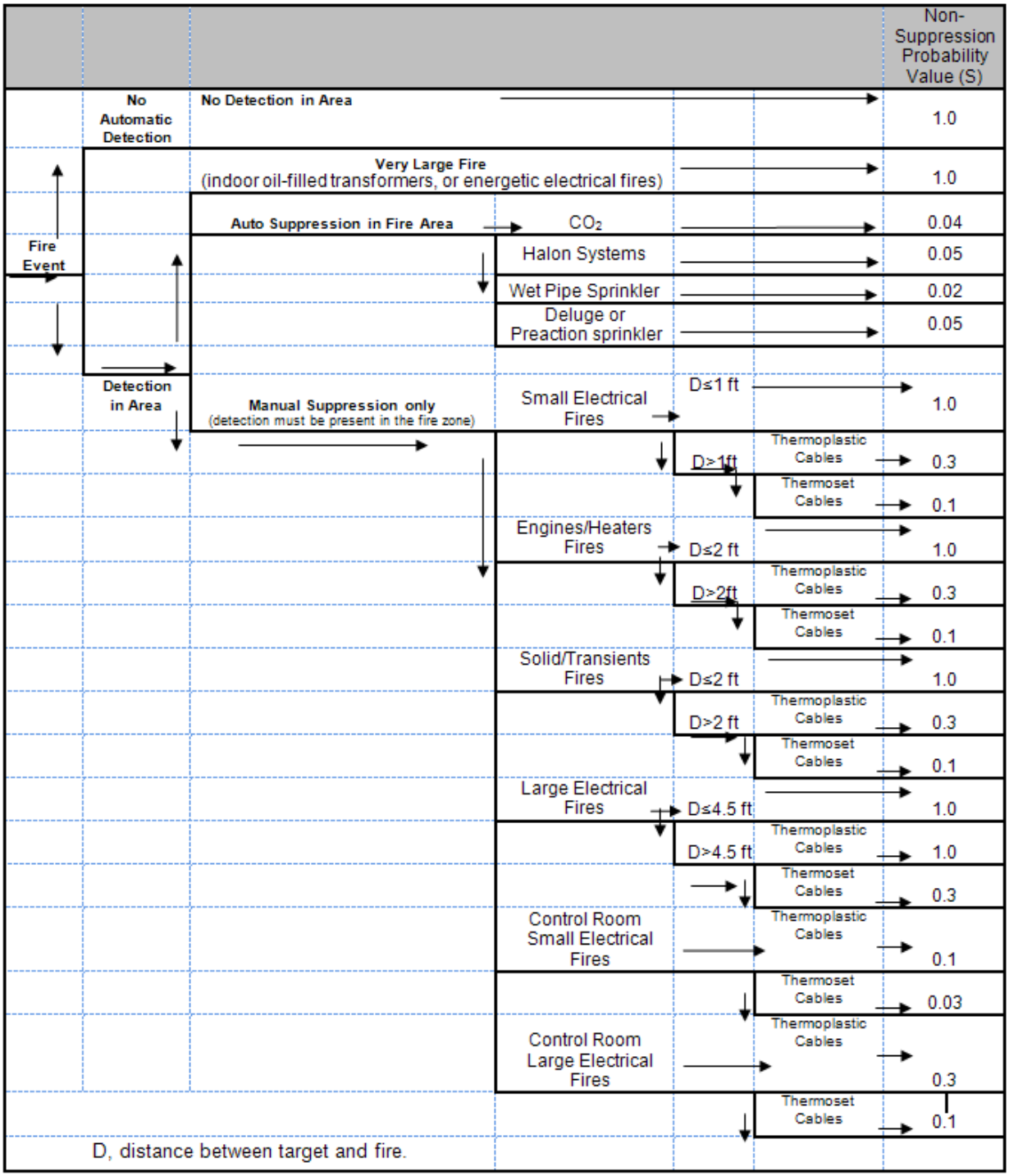
Fire Non-Suppression Probability is the likelihood that a fire would not be suppressed before potential damage is done to safe shutdown cables, safety-related cables, or safety-related equipment located in the fire area. The selection of a value for S is based on the Non-Suppression decision tree and engineering judgment. The S value for a fire finding is determined by following the decision path in Figure F.3 that best describes the fire finding.

For example, if the fire is judged to be a very large fire, such as, an indoor oil-filled transformer or energetic electrical fire, then the S value would be assumed to be 1. This value indicates that in 100% of the time there would be damage to target equipment before fire could be suppressed.

If the fire is in a fire area protected by a wet-pipe auto suppression system, then following the branch from left to right would indicate an S value of 0.02. This value indicates that 98% of the time a fire would be suppressed before damage to target cables occurs. Please document characteristics of the fire finding by checking applicable circles in left column of Table 1.5.3.

Table 1.5.3, Characteristics of Fire Finding	
Available Detection	
O	No Detection in Area
O	Detection in Area
Suppression Capability	
O	Auto Suppression in Fire Area: CO_2 Gaseous Suppression
O	Auto Suppression in Fire Area: Halon Suppression
O	Auto Suppression in Fire Area: Wet Pipe Sprinkler Suppression
O	Auto Suppression in Fire Area: Deluge or Preaction Sprinkler Suppression
O	Only Manual Suppression available
Fire Type	
O	Very Large Fire (e.g., indoor oil-filled transformer, or energetic electrical fires)
O	Small Electrical Fire (e.g., Vertical cabinets with qualified cable, fire limited to 1 cable bundle)
O	Engines/Heaters Fire (e.g., Diesel generators and auxiliary subsystems fire)
O	Solid/Transients Fire (e.g., cloth, paper, wood, plastics, any flammable material fire)
O	Large Electrical fire (e.g., Vertical cabinets with unqualified cable, fire in more than one cable bundle)
O	Control Room Small Electrical Fire (e.g., fire in localized areas extinguishable by hand-held extinguishers)
O	Control Room Large Electrical Fire (e.g., fire affecting a large number of items inside the main control board)
Cable Type	
O	Thermoplastic Cables or combination or unknown cable type
O	Thermoset Cables
Distance Between Fire and Target	
O	≤ 1 ft
O	>1 ft and ≤ 2 ft
O	> 2 ft and ≤ 4.5 ft
O	> 4.5 ft

Figure F.3 - Non-Suppression Probability Decision Tree



The quantitative screening is based on a threshold value of 1E-6 for change in core damage frequency (ΔCDF). This value is derived by multiplying the fire area duration factor (DF) by the fire frequency (F), the non-suppression probability (S), and the conditional core damage probability (CCDP). Since CCDP has not been considered yet, it is unwritten, and assumes a value of 1.0. This assumption provides a margin of conservatism.

$$\Delta CDF \approx DF \times F \times S$$

If the finding impacts multiple fire areas, then the initial Phase 1 screening ΔCDF value is based on the sum of the fire frequencies for all impacted fire areas as follows:

$$\Delta CDF \approx DF \times \sum(F_{AREA} \times S_{AREA})$$

Record the DF, F, S and ΔCDF values in Table 1.5.4.

Table 1.5.4, Change in Core Damage Frequency

	Duration of Degradation (DF)	Area Fire Frequency (F)	Non-Suppression Probability (S)	ΔCDF
1				
2				
3				
			ΔCDF Total =	

- If ΔCDF is less than 1E-06, the fire finding screens to Green and the analysis is complete, and no further analysis is required.

- If ΔCDF is greater than or equal to 1E-06, then the fire finding does not screen to Green. The finding then has to be evaluated by the SDP Phase 2 Quantitative Screening Approach in IMC 0609, Appendix F.

Step 1.6 - Screen by Licensee Fire PRA Results

Task 1.6.1: Screen by Licensee PRA-based Safety Evaluation

Results from licensee's PRA evaluation can also serve as the basis for determining if a fire finding is of very low risk significance.

1.6.1. A Question: If there is an approved fire PRA for this plant, does the licensee's risk-based evaluation for this fire finding indicate a ΔCDF of less than 1 E-6, and is the evaluation result accepted by a US NRC Senior Risk Analyst?

O Yes – Screen to Green, no further analysis required

O No – Continue to Phase 3 evaluation

Comments:

Part 2: Fire Protection SDP Phase 2 Worksheet

Facility: _____

Results from FP SDP Phase 1 Review: $\Delta CDF \approx DF \times \sum(F_{AREA} \times S_{AREA})$= _____

Request and review the following licensee documents:

- ○ The fire hazards analysis for the fire areas to be evaluated
- ○ The post-fire safe shutdown analysis for the fire areas to be evaluated
- ○ The licensee's lists of required and associated circuits
- ○ Post-fire operating procedures applicable to the fire areas to be assessed
- ○ Documentation for any USNRC approved deviations or exemptions relevant to the fire areas to be assessed.

Step 2.1 - Independent SSD Path First Screening Assessment

2.1.1: Identify the Designated Post-fire SSD Path

The identified SSD path must meet the following criteria in order to be considered at this stage of the Phase 2 analysis:

- ○ The SSD path must be identified as the designated post-fire SSD path in the plant's fire protection program.
- ○ The SSD path must be supported by a documented post-fire SSD analysis consistent with regulatory requirements.
- ○ Use of the SSD path must be documented and included in the plant operating procedures.

SSD Path:

2.1.2: Assess the Unavailability Factor for the Identified SSD Path

$CCDP_{2.1.2}$ = (SSD Unavailability Factor) = _____ (Credited as either 1.0, 0.1, or 0.01)

Basis for selection/comments:

_____

_____

_____

If $CCDP_{2.1.2}$ = 1.0, proceed to Step 2.2.

2.1.3: Assess Independence of the Identified SSD Path

Criteria satisfied:$CCDP_{2.1.3}$ = $CCDP_{2.1.2}$ = (SSD Unavailability Factor)
Criteria not satisfied:$CCDP_{2.1.3}$ = 1.0. Proceed to Step 2.2

Basis for criteria not met/comments:

_____

_____

_____

Task 2.1.4.: Screening Check

$$\Delta CDF_{2.1} = DF \times \left(\sum F_{AREA}\right) \times CCDP_{2.12} = \_\_\_\_\_$$

Table A1.2 - Phase 2 Screening Step 1 Quantitative Screening Criteria		
Assigned Finding Category (from Step 1.1):	**Δ $CDF_{2.1}$ Screening Value**	
	Moderate Degradation	**High Degradation**
Fire Prevention and Administrative Controls	N/A	1E-6
Fixed Fire Protection Systems	1E-5	
Fire Confinement	1E-5	
Localized Cable or Component Protection	1E-5	
Post-fire SSD	1E-6	

- ○ Δ $CDF_{2.1}$ is lower than the corresponding value in Table A1.2 - the finding screens to Green and the analysis is complete.
- ○ Δ $CDF_{2.1}$ is greater than or equal to the corresponding value in Table A1.2. The analysis continues to Step 2.2

Step 2.2 - Fire Damage State Determination

2.2.1: Initial FDS Assignment

(Check all that apply from Appendix F, Table 2.2.1)

O FDS1
O FDS2
O FDS2

Basis for selection (s)/FDS3 assessment/comments: _____

_____

_____

_____

2.2.2: Screening Assessment for FDS3 Scenarios

If the finding category assigned in Step 1.1 is "Fire Confinement," retain the FDS3 scenarios and continue the analysis with Step 2.3. For all other finding categories, conduct a screening check for the FDS3 scenarios based on the following questions:

Question 1: Does the fire barrier separating the exposed and the exposing fire areas have a non-degraded 2-hour or greater fire endurance rating?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 2: Is there a non-degraded automatic gaseous room-flooding fire suppression system either in the exposed or in the exposing fire area?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 3: Is there a non-degraded or no more than moderately degraded automatic full area water-based fire suppression system either in the exposed or in the exposing fire area?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 4: Can it be determined that the exposed fire area contain no potential damage targets that are unique from those in the exposing fire area (damage targets may include post-fire safe shutdown components or other plant components whose loss might lead to a demand for safe shutdown (e.g., a plant trip))?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 5: If the exposed fire area does contain post-fire safe shutdown components or components whose fire-induced failure might lead to a demand for safe shutdown, are all such components located at least 20 feet from the intervening fire barrier, and/or provided with passive fire protection with a minimum one-hour fire endurance rating?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 6: Is a partial-coverage automatic water based fire suppression system installed in the exposing fire area and are all the fixed or *in-situ* fire ignition sources included within the zone of coverage for this system?

- O Yes – FDS3 scenarios screen out, continue to Step 2.3.
- O No – Continue to next question

Question 7: Does the fire barrier provide a minimum of 20 minutes fire endurance protection and are the fixed or *in situ* fire ignition sources and combustible or flammable materials in the exposing fire area positioned such that, even considering fire spread to secondary combustibles, the barrier will not be subject to direct flame impingement?

O Yes – FDS3 scenarios screen out, continue to Step 2.3.

O No – Retain the FDS3 scenarios and continue the analysis with Step 2.3.

Step 2.3 - Fire Scenario Identification and Ignition Source Screening

2.3.1: Identify and Count Fire Ignition Sources

(Use the worksheet on the following pages)

Table A1.3 - Fire Frequency Evaluation Worksheet						
Nuclear Power Plant:						
Description of the Plant Area of Interest:						
Identifier/Designator of the Plant Area:						
Ignition Source Bin		**# of Items or Level**	**Individual Base Fire Frequency**	**Associated Frequency**	**Comments**	**Associated HHRs**
Cables - Non-Qualified (Low/Medium/High) (See Attachment 4)			1.6E-05/4.8E-04/ 1.4E-03			Initial 70kW See Attachments 3 and 5
Electrical Cabinets:						
Switchgear Cabinets	Thermal		5.5E-05			70kW, 200kW
	High Energy		4.7E-06			See Attachment 5
General Electrical Cabinets			6.0E-05			70kW, 200kW
General Control Cabinets			6.0E-05			200kW, 650kW
MCR and MCR Service Cabinets			4.8E-03			200kW, 650kW
Electric Motors:						
Electric Motors (<100HP)			6.5E-04			70kW, 200kW
Electric Motors (≥100HP)			6.5E-04			200kW, 650kW
Generators - General:						
Diesel Generators			5.6E-03			70kW, 200kW
Gas Turbine Generators			3.2E-04			70kW, 200kW
Reactor Protection System MG Sets			6.7E-04			70kW, 200kW

Ignition Source Bin		# of items or	Individual Base Fire	Associated Frequency	Comments	Associated HHRs
Hydrogen Sources:						
Hydrogen Recombiner (BWR)			5.5E-03			See Attachment 5
Hydrogen Storage Tanks (Yes / No)			6.5E-04			See Attachment 5
Hydrogen Piping - Charged (Yes / No)			9.7E-04			See Attachment 5
Hot Work (Low/Medium/High) (See Attachment 4)			2.3E-05/6.9E-05/ 6.9E-04			See Attachment 5
Main Turbine- Generator Set:						
T/G Exciter Fire (Yes / No)			1.4E-03			70kW, 200kW
T/G Oil Fires (Yes / No)			1.7E-03			See Attachment 5
T/G Hydrogen Fire (Yes / No)			1.4E-03			See Attachment 5
Miscellaneous Components:						
Air Compressors (<100HP)	Motor Fire		1.5E-04			70kW, 200kW
	Oil Fire		1.0E-04			See Attachment 5
Air Compressors (≥100HP)	Motor Fire		1.5E-04			200kW, 650kW
	Oil Fire		1.0E-04			See Attachment 5
Battery Banks			1.9E-04			70kW, 200kW
Boiler Heating Units			9.7E-04			See Attachment 5
Electric Dryers			5.4E-04			70kW, 200kW
Ventilation Subsystems			6.0E-05			70kW, 200kW

Ignition Source Bin		# of Items or	Individual Base Fire	Associated Frequency	Comments	Associated HHRs
Pumps:						
Reactor Coolant Pump (PWR)	Motor Fire		6.2E-04			200kW, 600kW
	Oil Fire		3.1E-04			See Attachment 5
Reactor Feed Pump (BWR)	Motor Fire		8.4E-05			200kW, 650kW
	Oil Fire		8.4E-04			See Attachment 5
Main Feedwater Pumps	Motor Fire		2.7E-04			200kW, 650kW
	Oil Fire		2.7E-03			See Attachment 5
Other Pumps (<100HP)	Motor Fire		5.0E-05			70kW, 200kW
	Oil Fire		5.0E-05			See Attachment 5
Other Pumps (≥100HP)	Motor Fire		5.0E-05			200kW, 650kW
	Oil Fire		5.0E-05			See Attachment 5
Transformers:						
Transformers - Outdoor/Yard			4.2E-03			650kW, 10MW
Transformers - Indoor Dry			1.1E-04			70kW, 200kW
Transformers - Indoor Oil-Filled			1.1E-04			650kW, 2MW
Transients (Low/Medium/High) (See Attachment 4)			5.5E-05/1.7E-04/ 1.7E-03			70kW, 200kW or See Attachment 5

2.3.2: Characterize Fire Ignition Sources and
2.3.3: Identify Nearest and Most Vulnerable Ignition or Damage Targets
2.3.4: Fire Ignition Source Screening (Using NUREG-1805 or Zone of Influence Chart)

Table A1.4

Source#	Source - Description/Location	Number of Sources	From Table A1.3 Expected HRR / High Confidence HRR	Severity Factor (SF_i)	Identify Nearest Target	Target Distance (ft) H	Target Distance (ft) R	Critical Distance (ft) (from Tables 2.3.2 thru 2.3.4) H	Critical Distance (ft) (from Tables 2.3.2 thru 2.3.4) R	Number of Sources Retained (i.e., Did not screen out)

Fire Area Dimensions: Width(ft) _____ Highest HRR for sources not retained: _____kW
Depth (ft) _____ Does this HRR result in damaging hot gas layer?
Height (ft) _____ ○ Yes ○ No If yes, retain scenario.
(Attach printouts of any spreadsheet calculations utilized from NUREG-1805.)

2.3.5: Finding Screening Check

- All identified fire ignition sources screened out in Task 2.3.4. The Phase 2 analysis is complete and the finding should be assigned a Green significance determination rating. Subsequent analysis tasks and steps need not be completed.

- One or more of the fire ignition sources is retained, even if only at the higher severity value. The analysis continues to Step 2.4.

Step 2.4 - Fire Frequency for Unscreened Fire Sources

2.4.1: Nominal Fire Frequency Estimation
2.4.2: Findings Quantified Based on Increase in Fire Frequency and
2.4.3: Credit for Compensatory Measures that Reduce Fire Frequency

(Use the worksheet on the following page)

Table A1.5 - Step 2.4: Fire Frequency for Unscreened Fire Sources							
Source #	Unscreened Fire Source at Specified HRR Value	Number of Sources Retained (Table A1.4)	Individual Base Fire Frequency (Table A1.3)	Severity Factor (SF_i) (Table A1.4)	Adjustment Factor for Fire Frequency Increase or Compensatory Measures* ($AF_{i\ 2.4}$)	Base Frequency Increase **	Revised Fire Frequency for Unscreened Source
Total $\left(\sum F_{source\ i} \times SF \times \Pi AF_{i\ 2.4}\right)$							

* Adjustment Factor for Fire Frequency Increase applies only to "Fire Prevention and Administrative Controls" findings (see discussion under Task 2.4.2). Credit for Compensatory Measures applies only to transient or hot work sources (see discussion under Task 2.4.3).

** Base frequency increases apply only to "Fire Prevention and Administrative Controls" findings within the combustible controls programs (see discussion under Task 2.4.2).

Assumptions/Comments/Remarks:_____

_____

_____

$\Delta CDF_{2.4} \approx \left(\sum F_{source\ i} \times SF_i \times \Pi AF_{i\ 2.4}\right) \times DF \times CCDP_{2.1.2}$ or $CCDP_{2.1.3} \approx$ _____

2.4.4: Finding Screening Check

Compare the updated change in CDF value, given the newly calculated fire frequency reflecting only the unscreened fire sources, with the values in the table below.

Table A1.6 - Phase 2, Screening Step 4 Quantitative Screening Criteria		
Assigned Finding Category (from Step 1.1):	**$\Delta CDF_{2.4}$ screening value**	
	Moderate Degradation	**High Degradation**
Fire Prevention and Administrative Controls	N/A	1E-6
Fixed Fire Protection Systems	1E-5	
Fire Confinement	1E-5[1]	
Localized Cable or Component Protection	1E-5[1]	
Post-fire SSD	1E-6	

[1] This entry applies to both 'Moderate A' and 'Moderate B' findings against a fire barrier.

- O Δ $CDF_{2.4}$ is lower than the corresponding value in Table A1.6 - the finding screens to Green and the analysis is complete.
- O Δ $CDF_{2.4}$ is greater than or equal to the corresponding value in Table A1.6. The analysis continues to Step 2.5

Step 2.5 - Definition of Specific Fire Scenarios and Independent SSD Path Second Screening Assessment:

Task 2.5.1: Identify Specific Fire Growth and Damage Scenarios (Fixed Ignition Sources)
Task 2.5.2: Identify Specific Fire Growth and Damage Scenarios (Self-ignited Cable Fire, Transients. Hot Work)
Task 2.5.3: Identify Specific Plant Damage State Scenarios and
Task 2.5.4: Assess Fire Scenario-Specific SSD Path Independence

(Use the worksheet on the following page)

Table A1.7

Source#	Unscreened Fire Source at Specified HRR Value	FDS State (carried forward unscreened from Table 2.2.1)	Plant Damage State Scenarios	Scenario-Specific SSD Path Independence (Yes / No)	Worst Case FDS (√)	Revised Fire Frequency for Unscreened Fire Sources (from Table A1.5)	Weighting Factor* (Attachment 5)	CCDPi (from task 2.1.2 or 2.1.3)	Revised Fire Frequency x $CCDP_i$
$\Delta CDF_{2.5} \approx \left(\sum F_{Source\ i} \times SF_i \times \Pi AF_i \times CCDP_{i\ 2.1.2\ \mathbf{or}\ 2.1.3}\right) \times DF$									

* Weighting factors apply only to transient and hot work sources (see Attachment 5).

Attach printouts of any spreadsheet calculations utilized from NUREG-1805.

Assumptions/Comments/Remarks:_____

_____

_____

$\Delta CDF_{2.5} \approx \left(\sum F_{Source\ i} \times SF_i \times \Pi AF_i \times CCDP_{i\ 2.1.2\ \mathbf{or}\ 2.1.3}\right) \times DF \approx$ _____

2.5.5: Screening Check

If the SSD path cannot be credited for any of the identified fire ignition sources given its worst-case damage state, then Step 2.5.5 is complete, and the analysis continues with Step 2.6.

If the SSD path can be credited for at least one fire ignition source, then the screening check is performed based on the values and criteria provided in the table below:

Table A1.8 - Phase 2, Screening Step 5 Quantitative Screening Criteria		
Assigned Finding Category (from Step 1.1):	**$\Delta CDF_{2.5}$ screening value**	
	Moderate Degradation	**High Degradation**
Fire Prevention and Administrative Controls	N/A	1E-6
Fixed Fire Protection Systems	1E-5	
Fire Confinement	1E-5[1]	
Localized Cable or Component Protection	1E-5[1]	
Post-fire SSD	1E-6	

[1] This entry applies to both 'Moderate A' and 'Moderate B' findings against a fire barrier.

- The value of $\Delta CDF_{2.5}$ is lower than the corresponding value in Table A1.8. The finding Screens to Green, and the analysis is complete.
- The value of $\Delta CDF_{2.5}$ exceeds the corresponding value in Table A1.8. The analysis continues to Step 2.6.

Step 2.6 -
Fire Growth and Damage Time Analysis

and

Step 2.7 -
Non-Suppression Probability Analysis

Attach printouts of any spreadsheet calculations utilized from NUREG-1805.

Table A1.9
(All times in nearest whole minute - damage times rounded down, detection/suppression and manual response times up)

Source #	Unscreened Fire Damage State Scenarios	Time to Damage (Attachment 7)	Detection Time (Attachment 8)	(T_{Damage} - $T_{Detection}$)	Fixed Suppression Actuation Time (Attachment 8 and NUREG-1805)	(T_{Damage} - $T_{Suppression}$)

Assumptions/Comments/Remarks:_____

_____

_____

2.7.4: Probability of Non-Suppression

Table A1.10

Source#	Unscreened Fire Damage State Scenarios	PNS_{fixed} (Table A8.2)	PNS_{manual} (Table 2.7.1)	$PNS_{scenario\ i}$ (Attachment 8)

Assumptions/Comments/Remarks:_____

_____

_____

2.7.5: Screening Check

The estimated risk contribution or screening CDF, for each fire scenario is based on the product of the following factors:

Table A1.11

Source#	Unscreened Fire Damage State Scenarios	Revised Fire Frequency x $CCDP_i$ ($F_{Source\ i}$ X SF_i X $\Pi AF_{i\ 2.4}$ X $CCDP_{i\ 2.1.2\ or\ 2.1.3}$) (from Table A1.7)	PNS_i (from Table A1.10)	Revised Fire Frequency
Total $\left(\sum F_{Source i} \times SF_i \times \Pi AF_{i2.4} \times CCDP_{i2.1.2\ or\ 2.1.3} \times PNS_{scenario\ i}\right)$				

$$\Delta CDF_{2.7} \approx DF \times \left(\sum F_{Source\ i} \times SF_i \times \Pi AF_{i\ 2.4} \times CCDP_{i\ 2.1.2\ or\ 2.1.3} \times PNS_{scenario\ i}\right)$$

$$\Delta CDF_{2.7} \approx \_\_\_\_\_$$

If $\Delta CDF_{2.7}$ is less than or equal to 1E-6, then the finding screens to Green, and the analysis is complete. If $\Delta CDF_{2.7}$ is greater than 1E-6, then the analysis continues to Step 2.8.

Step 2.8 - Plant Safe Shutdown Response Analysis

Using the appropriate plant initiating event worksheet(s) from the plant risk-informed inspection notebook, carry out the guidance provided under Step 2.8 of Appendix F, to account for the plant SSD response and required human recovery actions in order to quantify the factor "$CCDP_i$" for each fire growth and damage scenario of interest.

Attach any internal event worksheets and manual action evaluation table determinations used to quantify each $CCDP_i$.

(Use the worksheet on the following page)

Table A1.12 - Step 2.8: Plant Safe Shutdown Response Analysis							
Source #	**Unscreened Fire Damage State Scenarios**	**HEP_i (from Table 2.8.1 or 2.8.2)**	**P_{SPi} (from Table 2.8.3)**	**CCDP (given successful manual action)**	**CCDP (given manual action fails and spurious actuation)**	**CCDP (given manual action fails and no spurious actuation)**	**$CCDP_i$**

$CCDP_i$ = [(1-HEP_i) x CCDP(given successful manual action)] +
[HEP_i x P_{SPi} x CCDP(given manual action fails and spurious actuation)] +
[HEP_i x (1 - P_{SPi}) x CCDP(given manual action fails and no spurious actuation)]

where: HEP_i is the true value of the human error probability for scenario i (not the exponent value derived from the HEP tables), and
P_{SPi} is the probability of a spurious actuation for scenario I.

Step 2.9 - Quantification and Preliminary Significance Determination

Calculate a final quantification of the FDS scenarios of interest and assign a preliminary determination of a findings significance.

Source #	Unscreened Fire Damage State Scenarios	Revised Fire Frequency for Unscreened Source (from Step 2.4) ($F_{Source\ i}$ x SF_i x $\Pi AF_{i\ 2.4}$) (from Table A1.5)	Probability of Non-Suppression (PNS_i) (Table A1.10)	$CCDP_i$ (Table A1.12)	Revised Fire Frequency for Unscreened Source
$\text{Total}\left(\sum F_{Source\,i} \times SF_i \Pi AF_{i2.4} \times PNS_i \times CCDP_i\right)$					

Assumptions/Comments/Remarks:_____ _____

_____ _____

_____

The estimated risk contribution or screening CDF, for each fire scenario is based on the product of the following factors:

$$\Delta CDF_{2.8} = DF \times \sum_{i=1}^{n} \left[F_i \times SF_i \times \prod AF_{i2.4} \times PNS_i \times CCDP_i \right]_{\text{All Scenarios}}$$

$$\Delta CDF_{2.8} = \_\_\_\_\_$$

Where:

n	=	number of fire scenarios evaluated for a given finding (covering all relevant FDSs)
DF	=	Duration factor from Step 1.4
F_i	=	Fire frequency for the fire ignition source i from Task 2.4.1
SF_i	=	Severity factor for scenario i from Task 2.4.1
$AF_{i\ 2.4}$	=	Ignition source specific frequency adjustment factors from Step 2.4
PNS_i	=	Probability of non-suppression for scenario i from Step 2.7
$CCDP_i$	=	Conditional core damage probability for scenario i from Step 2.8

If $\Delta CDF_{2.8}$ is less than or equal to 1E-6, then the finding screens to Green, and the analysis is complete. If $\Delta CDF_{2.8}$ is greater than 1E-6, then the finding is potential safety significant.

Attachment 1

Revision History for IMC 0609 Appendix F, Attachment 1

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number
N/A	02/27/2001	IMC 0609, App F, Att 1 (Application of Fire Protection Risk-Significant Screening Methodology to Hypothetical Cases) has been revised to update the examples to reflect the change made to Appendix F defining fire scenarios.	None	N/A
N/A	05/28/2004	IMC 0609, App F, Att 1 (Part 1: Fire Protection SDP Phase 1 Worksheet) is revised to provide the qualitative screening approach and guidance and worksheets for the inspectors to complete a phase 1 screening process of fire protection related findings.	None	N/A
N/A	02/28/2005	IMC 0609, App F, Att 1 (Attachment 1, part 1: Application of Fire Protection SDP Phase 1 Worksheet) is revised to correct the base fire frequency for non-qualified cables, medium loading in Table A1.3 on page F1-9.	None	N/A

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number
N/A	ML13193A044 09/20/13 CN 13-022	This update incorporates an expanded Phase 1. This was created in response to a large number of comments we received from the regional senior reactor analysts (SRAs) via the ROP feedback and the Risk Network initiative. Specific key improvements include: (a) inclusion of additional screening questions for each of the fire finding categories based on review of archived fire SDP items, fire data, and expertise that were not available at the previous release of Appendix F, (b) expansion of initial quantitative screening to include a non-suppression probability term, and (c) addition of an option to rely on licensees' fire PRA assessment of fire findings under appropriate oversight. Incorporated recommendations from ROPFF 0609F1-1796.	None	ML 12249A185 ML 13039A091