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NUCLEAR MANAGEMENT AND RESOURCES COUNCIL

1776 Eye Street, N.W. • Suite 300 • Washington, DC 20006-3706
(202) 872-1280

January 25, 1994

Mr. Conrad E. McCracken
Chief, Plant Systems Branch
Division of Systems Safety & Analysis
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. McCracken:

The purpose of this letter is to provide you supplemental errata sheets for the *Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide*. This guideline was transmitted to you as an enclosure to our October 12, 1993 letter. Errata sheets and text revisions were forwarded to you via our December 27, 1993. Subsequent to this issuance, several of our members have notified us that errata sheets A4-18 through A4-26 were missing from their packages. Therefore, we are providing the enclosed supplemental errata sheets to all recipients of the guideline. We apologize for any inconvenience resulting from this inadvertent omission.

Again, as indicated in our last letter, the entire *Thermo-Lag 330-1 Combustibility Evaluation Methodology Plant Screening Guide* will be issued as an integral part of a NUMARC document addressing the comprehensive Thermo-Lag test program.

If you have any questions regarding this issue, please contact me or Morris Schreim of the NUMARC staff.

Sincerely,

Alex Marion

Alex Marion
Manager, Technical Division

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MS/cma
Enclosures

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WORKSHEET 2A

Flame Propagation Scenarios (IP Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
1	Target Extinguishment Temperature (Representative value for Thermo-Lag is (1000°F))		°F
2	Critical Flux for Safe Shutdown Equipment (Representative value for cables = 0.88 Btu/s ft^2 Use Table 1E for Guidance)		Btu/s ft^2
3	Peak Fire Intensity (Thermo-Lag) (See Section 5.2.5 to determine value)		Btu/s
4	Radiant Fraction of Heat Release (Typically 0.4)		N/A
5	Radiant Heat Release Rate (Box 3 times Box 4)		Btu/s
6	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (17))		ft
7	Height of Target above Fire Source (Based on scenario geometry)		ft
8	Height from Fire Source to Ceiling (Based of scenario geometry)		ft
9	Ratio of Target Height to Ceiling Height (Box 7 divided by Box 8)		N/A
If the value in Box 9 is > 0.85, Complete Boxes 10 through 18; Else enter a value of zero (0) in Box 19			
10	Longitudinal Distance From Source to Target (Based on Scenario Geometry)		ft
11	Longitudinal Distance to Height Ratio (L/H) (Box 10 divided by Box 8)		N/A
12	Enclosure Width (W) (Based on Scenario Geometry)		ft
13	Height to Width Ratio (H/W) (Box 8 divided by Box 12)		N/A

WORKSHEET 2A

Flame Propagation Scenarios (IP Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
14	Peak Fire Intensity (Q) (Use Tables 1E-2 & Figures 4-5 for guidance) (Use Box 9 from section 5.4 or Box 4 from section 5.3)		Btu/s
15	Fire Location Factor (1 for center, 2 for wall, 4 for corner)		N/A
16	Effective Heat Release Rate (Box 14 times Box 15)		Btu/s
17	Plume Temperature Rise at Target (Use Table 5 or calculate using equation (19))		°F
18	Ceiling Jet Temperature Factor at Target (Use either Table 6a or 6b or calculate using equation (20) or (21) use the higher value)		N/A
19	Calc. Ceiling Jet Temp. Rise at Target (Multiply Box 17 times Box 18)		°F
20	Critical Temperature Rise at Target (Box 1 minus max. ambient space temp.)		°F
21	Critical Temp. Rise - Ceiling Jet Temp. Rise (Box 20 minus Box 19)		°F
If the entry in Box 21 has a value of < 0, then stop here and enter a "YES" in step 4.5 of the worksheet (Figure 1); Else continue with Boxes 22 through 27.			
22	Net Energy Addition per Unit Volume (Use Table 7 or eq.(21b) based on Box 21)		Btu/ft^3
23	Calculated Enclosure Volume (V) (Box 8 times floor area of space)		ft^3
24	Calculated Critical Q_{net} (Q) (Box 22 times Box 23)		Btu
25	Estimated Heat Loss Fraction (representative value = 0.7)		N/A
26	Estimate of Critical Total Energy Release (Box 24 / [1- Box 25])		Btu

WORKSHEET 2A

Flame Propagation Scenarios (IP Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
27	Estimate of Actual Total Energy Release (Qtot) (Use Worksheet 1A)		Btu
If the entry in Box 27 is less than the entry in Box 26, the critical conditions are not met and a "NO" is entered in step 4.5 of Worksheet (Figure 1), and Boxes 31 through 35 should be performed to ensure that the radiant energy from the fire will not impact the results. If the entry in Box 27 is equal to or greater than Box 26 then continue with Boxes 28 through 30.			
28	Time To Consume Fire Source (Box 27 divided by Box 14)		s
29	Target Temperature (Use Table 13 or equation (22))		°F
30	Ignition Temperature-Surface Temperature (Box 1 minus Box 29)		°F
If the entry in Box 30 is greater than zero, then the fire will burn itself out before the critical point, therfore continue with Boxes 31 - 35. If entry in Box 30 is less than or equal to zero then the critical conditions are met and a "YES" is entered in step 4.5 of Worksheet (Figure 1)			
31	Critical Radiant Flux at Target (Look up value in Table A, for Thermo-lag use a value of 2.2 Btu/s ft^2)		Btu/s ft^2
32	Radiant Fraction of Heat Release (Typically 0.4)		N/A
33	Radiant Heat Release Rate (Box 14 times Box 32)		Btu/s
34	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (23))		ft
35	Radial Dist.to Target-Crit. Rad. Flux Dist. (Box 10 minus Box 34)		ft
If the entry in Box 35 is greater than zero, then the critical point is outside of the Thermo-Lag burn distance and the screening criteria is met. Enter a "NO" in Step 4.5 of Worksheet (Figure 1); Else continue with Boxes 36 through 38.			
36	Radiant Flux At Target (Lookup value in Table 11 or use equation (24))		Btu/s ft^2

WORKSHEET 2A

Flame Propagation Scenarios (IP Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
37	Target Surface Temperature (Lookup value in Table 14 or use equation (25))		°F
38	Ignition Temperature-Surface Temperature (Box 1 minus Box 36)		°F
If the entry in Box 38 is greater than zero, then critical conditions are not met and a "NO" is entered in step 4.5 of Worksheet (Figure 1). If the entry in Box 38 is equal to or less than zero, then a "Yes" is entered in Step 4.5 of Worksheet (Figure 1.)			

WORKSHEET 2A

Flame Propagation Scenarios (SI Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
1	Target Extinguishment Temperature (Representative value for Thermo-Lag is (538°C, 811°K))		°K
2	Critical Flux for Safe Shutdown Equipment (Representative value for cables = 10 Kw/m^2 Use Table 1E for Guidance)		Kw/m^2
3	Peak Fire Intensity (Thermo-Lag) (See Section 5.2.5 to determine value)		Kw
4	Radiant Fraction of Heat Release (Typically 0.4)		N/A
5	Radiant Heat Release Rate (Box 3 times Box 4)		Kw
6	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (17))		m
7	Height of Target above Fire Source (Based on scenario geometry)		m
8	Height from Fire Source to Ceiling (Based of scenario geometry)		m
9	Ratio of Target Height to Ceiling Height (Box 7 divided by Box 8)		N/A
If the value in Box 9 is > 0.85, Complete Boxes 10 through 18; Else enter a value of zero (0) in Box 19			
10	Longitudinal Distance From Source to Target (Based on Scenario Geometry)		m
11	Longitudinal Distance to Height Ratio (L/H) (Box 10 divided by Box 8)		N/A
12	Enclosure Width (W) (Based on Scenario Geometry)		m
13	Height to Width Ratio (H/W) (Box 8 divided by Box 12)		N/A

WORKSHEET 2A

Flame Propagation Scenarios (SI Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
14	Peak Fire Intensity (Q) (Use Tables 1E-2 & Figures 4-5 for guidance) (Use Box 9 from section 5.4 or Box 4 from section 5.3)		Kw
15	Fire Location Factor (1 for center, 2 for wall, 4 for corner)		N/A
16	Effective Heat Release Rate (Box 14 times Box 15)		Kw
17	Plume Temperature Rise at Target (Use Table 5 or calculate using equation(18))		°C
18	Ceiling Jet Temperature Factor at Target (Use either Table 6a or 6b or calculate using equation (20) or (21) use the higher value)		N/A
19	Calc. Ceiling Jet Temp. Rise at Target (Multiply Box 17 times Box 18)		°C
20	Critical Temperature Rise at Target (Box 1 minus max. ambient space temp.)		°C
21	Critical Temp. Rise - Ceiling Jet Temp. Rise (Box 20 minus Box 19)		°C
If the entry in Box 21 has a value of < 0, then stop here and enter a "YES" in step 4.5 of the worksheet (Figure 1). Else continue with Boxes 22 through 27.			
22	Net Energy Addition per Unit Volume (Use Table 7 or eq.(21a) based on Box 21)		KJ/m^3
23	Calculated Enclosure Volume (V) (Box 8 times floor area of space)		m^3
24	Calculated Critical Q_{net} (Q) (Box 22 times Box 23)		KJ
25	Estimated Heat Loss Fraction (representative value = 0.7)		N/A
26	Estimate of Critical Total Energy Release (Box 24 / [1- Box 25])		KJ
27	Estimate of Actual Total Energy Release (Qtot) (Use Worksheet 1A)		KJ

WORKSHEET 2A

Flame Propagation Scenarios (SI Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
If the entry in Box 27 is less than the entry in Box 26, the critical conditions are not met and a "NO" is entered in step 4.5 of Worksheet (Figure 1), and Boxes 31 through 35 should be performed to ensure that the radiant energy from the fire will not impact the results.. If the entry in Box 27 is equal to or greater than Box 26, then continue with Boxes 28 through 30.			
28	Time To Consume Fire Source (Box 27 divided by Box 14)		s
29	Target Temperature (Use Table 13 or equation (22))		°C
30	Ignition Temperature-Surface Temperature (Box 1 minus Box 29)		°C
If the entry in Box 30 is greater than zero, then the fire will burn itself out before the critical point. Therefore, continue with Boxes 31 - 35. If entry in Box 30 is less than or equal to zero, then the critical conditions are met and a "YES" is entered in step 4.5 of Worksheet (Figure 1)			
31	Critical Radiant Flux at Target (Look up value in Table A, for Thermo-lag use a value of 25 Kw/m^2)		Kw/m^2
32	Radiant Fraction of Heat Release (Typically 0.4)		N/A
33	Radiant Heat Release Rate (Box 14 times Box 32)		Kw
34	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (23))		m
35	Radial Dist.to Target-Crit. Rad. Flux Dist. (Box 10 minus Box 34)		m
If the entry in Box 35 is greater than zero, then the critical point is outside of the Thermo-Lag burn distance and the screening criteria is met. Enter a "NO" in Step 4.5 of Worksheet (Figure 1): Else continue with Boxes 36 through 38.			
36	Radiant Flux At Target (Lookup value in Table 11 or use equation (24))		Kw/m^2

WORKSHEET 2A

Flame Propagation Scenarios (SI Units)

WORKSHEET 2A: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
37	Target Surface Temperature (Lookup value in Table 14 or use equation (25))		°C
38	Ignition Temperature-Surface Temperature (Box 1 minus Box 37)		°C
If the entry in Box 38 is greater than zero, then critical condition are not met and a "No" is entered in step 4.5 of Worksheet (Figure 1). If the entry in Box 38 is equal to or less than zero then, a "Yes" is entered in Step 4.5 of Worksheet (Figure 1.)			

WORKSHEET 3

Critical Radiant Flux (IP Units)(ref 6.20)

WORKSHEET 3: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
1	Critical Radiant Flux of Target (Look up value in Table A, for Thermo-Lag use a value of 2.2 Btu/s ft^2		Btu/s ft^2
2	Radial Distance From Source To Target (Based on Scenario Geometry)		ft
3	Peak Fire Intensity (Use Tables 1E-2 for guidance)		Btu/s
4	Radiant Fraction of Heat Release (Typically 0.4)		N/A
5	Radiant Heat Release Rate (Box 3 times Box 4)		Btu/s
6	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (14))		ft
7	Source Distance - Flux Distance (Box 2 - Box 6)		ft
If the value entered in Box 7 is greater then zero stop here and enter a "No" in 4.4 of Worksheet Figure 1. If the value in Box 7 is less than or equal to zero then critical conditions can occur, therefore continue.			
8	Total Energy in Fire Source (the total Btu loading (Worksheet 1A) of the peak fire intensity in Box 3)		Btu
9	Time To Consume Fire Source (Box 8 divided by Box 3)		s
10	Radiant Flux at Target Look up value in Table 11 or use equation (15))		Btu/s ft^2
11	Calculate Surface Temperature of Target (Look up Value in Table 14 or use equation (16)		°F
12	Ignition Temperature of Target (For Thermo-Lag the Value is 1000°F)		°F
13	Ignition Temp. - Surface Temp. (Box 12 minus Box 11)		°F
If the value entered in Box 13 is greater than zero then the Thermo-Lag will not ignite and enter a "No" in step 4.4 of Worksheet (Figure 1)			

WORKSHEET 3

Critical Radiant Flux (SI Units)(ref 6.20)

WORKSHEET 3: FIRE AREA _____ SCENARIO:_____			
BOX NO	DESCRIPTION	ENTRY	UNITS
1	Critical Radiant Flux of Target (Look up value in Table A, for Thermo-Lag use a value of 2.2 Btu/s ft^2		kW/m^2
2	Radial Distance From Source To Target (Based on Scenario Geometry)		m
3	Peak Fire Intensity (Use Tables 1E-2 for guidance)		kW
4	Radiant Fraction of Heat Release (Typically 0.4)		N/A
5	Radiant Heat Release Rate (Box 3 times Box 4)		Kw
6	Critical Radiant Flux Distance (Look up value in Table 10 or use equation (14))		m
7	Source Distance - Flux Distance (Box 2 - Box 6)		m
If the value entered in Box 7 is greater then zero stop here and enter a "No" in 4.4 of Worksheet Figure 1. If the value in Box 7 is less than or equal to zero then critical conditions can occur, therefore continue.			
8	Total Energy in Fire Source (the total Btu loading (Worksheet 1A) of the peak fire intensity in Box 3)		kJ
9	Time To Consume Fire Source (Box 8 divided by Box 3)		s
10	Radiant Flux at Target Look up value in Table 11 or use equation (15))		kW/m^2
11	Calculate Surface Temperature of Target (Look up Value in Table 14 or use equation (16)		°C
12	Ignition Temperature of Target (For Thermo-Lag the Value is 1000°F)		°C
13	Ignition Temp. - Surface Temp. (Box 12 minus Box 11)		°C
If the value entered in Box 13 is greater than zero then the Thermo-Lag will not ignite and enter a "No" in step 4.4 of Worksheet (Figure 1)			