Appendix A

Material Properties for COBRA-SFS Model of TN-68 Package

Table A.1. Internal Fill Gas—Helium at Atmospheric Pressure

Temperature (°F)	Enthalpy (Btu/lbm)	Thermal Conductivity (Btu/hr-ft-°F)	Specific Heat (Btu/lbm-°F)	Specific Volume (ft^3/lbm)	Viscosity (lbm/hr-ft)
0	100	0.078	1.24	83.33	0.0410
200	348	0.097	1.24	119.76	0.0533
400	596	0.115	1.24	156.25	0.0641
600	844	0.129	1.24	192.31	0.0727
800	1092	0.138	1.24	229.36	0.0823
1000	1340	0.138	1.24	265.25	0.0907
2552	3264	0.138	1.24	549.00	0.1138

Table A.2. External Ambient Air at Atmospheric Pressure

Temperature (°F)	Enthalpy (Btu/lbm)	Thermal Conductivity (Btu/hr-ft-°F)	Specific Heat (Btu/lbm-°F)	Specific Volume (ft^3/lbm)	Viscosity (lbm/hr-ft)
60	124.5	0.0146	0.24	13.5669	0.0434
300	182.1	0.0193	0.243	19.8325	0.058
400	206.5	0.0212	0.245	22.4432	0.063
500	231.1	0.0231	0.247	25.0539	0.068
600	256	0.025	0.25	27.6645	0.072
700	281.1	0.0268	0.253	30.2752	0.077
800	306.7	0.0286	0.256	32.8859	0.081
900	332.5	0.0303	0.259	35.4966	0.085
1000	358.6	0.0319	0.262	38.1072	0.0889
2000	617.2	0.0471	0.2586	64.214	0.1242
4000	1522	0.0671	0.4524	116.428	0.1242

Table A.3. Summary of All Solid Material Properties Pre-Fire

Specific Heat (Btu/lbm-°F)	Density (lbm/ft^3)	Thermal Conductivity (Btu/hr-ft-°F)	Emissivity	Description
0.129	483.8	22.92	0.3	gamma shielding (SA-517 grade 70 carbon steel)
0.13	499.4	10.44	0.3	fuel tubes (SA-240 stainless steel)
0.214	165.9	41.72	0.3	borated aluminum poison plates
0.311	98.5	4.34	N/A	neutron shield (borated polyester)
0.228	165.9	99.84	0.3	Aluminum alloy basket rails
0.118	483.8	22.92	0.3	cask outer shell[a]
0.228	165.9	84.00	N/A	aluminum in neutron shield and thermal shield between cask and bottom impact limiter
0.420	23.1	0.064	N/A	wooden impact limiters (covered with sheet steel)
0.420	11.0	0.053	N/A	thin top layer of wood on impact limiter ends (covered with sheet steel)

[a] Based on nominal emissivity for carbon steel. SAR analyses use emissivity of 0.9 for painted cask surface, but cask specifications allow option for unpainted outer surface.

Table A.4. Summary of All Solid Material Properties Post-Fire

Specific Heat (Btu/lbm-°F)	Density (lbm/ft^3)	Thermal Conductivity (Btu/hr-ft-°F)	Emissivity	Description
0.129	483.8	22.92	0.3	gamma shielding (SA-517 grade 70 carbon steel)
0.13	499.4	10.44	0.3	fuel tubes (SA-240 stainless steel)
0.214	165.9	41.72	0.3	borated aluminum poison plates
0.26	0.027	0.03	N/A	hot air (replaces polyresin neutron shield vaporized in fire)
0.228	165.9	99.84	0.3	aluminum alloy basket rails
0.118	483.8	22.92	0.8	steel shell (SAR value post-fire is 0.95 for charred cask surface emissivity)
0.228	165.9	84.00	0.9	aluminum in neutron shield; inner and outer ring after polyresin evaporates
1020.0	134.8	0.00735	0.8	charcoal (impact limiters after the fire)
			0.9	tunnel wall

COBRA-SFS Material Properties Compared with Published SAR Values

Table A.5. BWR Spent Fuel Assemblies

<table>
<tr><td colspan="5">SAR values determined using k-effective model for homogeneous representation of fuel rods and helium gas within fuel tube.</td></tr>
<tr><th>Temperature (°F)</th><th>Transverse Thermal Conductivity (Btu/hr-ft-°F)</th><th>Axial Thermal Conductivity (Btu/hr-ft-°F)</th><th>Specific Heat (Btu/lbm-°F)</th><th>Density (lbm/ft^3)</th></tr>
<tr><td>195.8</td><td>0.0157</td><td></td><td>0.055</td><td>257.5</td></tr>
<tr><td>200.0</td><td></td><td>0.058</td><td></td><td></td></tr>
<tr><td>268.4</td><td>0.0178</td><td></td><td></td><td></td></tr>
<tr><td>365.9</td><td>0.0206</td><td></td><td></td><td></td></tr>
<tr><td>400.0</td><td></td><td>0.0646</td><td></td><td></td></tr>
<tr><td>463.7</td><td>0.0239</td><td></td><td></td><td></td></tr>
<tr><td>561.8</td><td>0.0277</td><td></td><td></td><td></td></tr>
<tr><td>600.0</td><td></td><td>0.0709</td><td></td><td></td></tr>
<tr><td>660.3</td><td>0.0319</td><td></td><td></td><td></td></tr>
<tr><td>758.9</td><td>0.0367</td><td></td><td></td><td></td></tr>
<tr><td>800.0</td><td></td><td>0.0769</td><td>0.055</td><td>257.5</td></tr>
<tr><td colspan="5">COBRA-SFS input— BWR fuel rods; conservative values at nominal operating temperature and above.</td></tr>
<tr><th>Component</th><th colspan="2">Thermal Conductivity (Btu/hr-ft-°F)</th><th>Specific Heat (Btu/lbm-°F)</th><th>Density (lbm/ft^3)</th></tr>
<tr><td>fuel pellet:</td><td colspan="2">3.0</td><td>0.059</td><td>655.0</td></tr>
<tr><td>cladding:</td><td colspan="2">10.0</td><td>0.1</td><td>409.0</td></tr>
</table>

Table A.6. Stainless Steel Type 304/304L (for fuel tubes)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
70	7.56	0.111	499.4
100	8.76		
200	9.36	0.124	
400	10.44	0.130	
600	11.28	0.134	
800	12.24	0.140	
1000	13.2		499.4
COBRA-SFS input—selected conservative representative values at nominal operating temperature and above			
all	10.44	0.13	499.4

Table A.7. Poison Plates (borated aluminum or boron carbide/aluminum matrix)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
68	69.36	0.214	169.3
212	83.76		
482	86.64		
571	86.64	0.214	169.3
COBRA-SFS input—selected conservative values based on range of allowable fabrication variations, as described for cask specifications in SAR.			
all	41.72	0.214	165.9

Table A.8. Aluminum Type 6060 (for basket support rails and shims)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
70	96.12	0.218	165.9
100	96.96	0.219	
150	98.04	0.223	
200	99	0.225	
250	99.84	0.228	
300	100.56	0.23	
350	101.28	0.233	
400	101.88	0.234	165.9
COBRA-SFS input—selected conservative representative values at nominal operating temperature and above.			
all	99.84	0.228	165.9

Table A.9. Carbon Steel SA-516 Grade 70 (for inner and outer gamma shield and lid)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
70	22.92	0.109	483.8
200	23.76	0.118	
400	23.88	0.129	
600	22.92	0.139	
800	21.6	0.152	
1000	20.16	0.169	
1200	18.24	0.206	
1400	15.48	0.184	483.8
COBRA-SFS input—selected conservative representative values at nominal operating temperature and above.			
all	22.92	0.129	483.8

Table A.10. Neutron Shield (polyester resin with aluminum boxes)

SAR values—properties are composite values for polyester resin and aluminum boxes modeled as single homogeneous material.			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
all	0.0996	0.311	98.5
COBRA-SFS input—selected conservative representative values at nominal operating temperature and above.			
borated polyester	4.34	0.311	98.5
aluminum	84.00	0.228	165.9

Table A.11. Carbon Steel SA-350 grade LF3 (for cask outer shell)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
70	23.64	0.106	489.0
100	23.88	0.11	
200	24.36	0.118	
400	24.24	0.128	
600	23.16	0.137	
800	21.72	0.149	
1000	20.04	0.165	
1200	18.24	0.189	
1400	15.36	0.406	489.0
COBRA-SFS input—typical values for carbon steel at nominal operating temperature and above, based on range of allowable fabrication variations described for cask specifications in SAR.			
all	22.92	0.118	483.8

Table A.12. Impact Limiters (wood covered with sheet steel)

SAR values—none provided; SAR analyses assume impact limiters act as perfect insulators on cask ends for normal, off-normal, and fire accident conditions.			
COBRA-SFS input—selected conservative representative values at nominal operating temperature and above.			
Material	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
redwood	0.064	0.311	98.5
balsa	0.053	0.228	165.9
carbon steel	22.92	0.118	483.8
charcoal	0.00735	1020.0	134.8

Table A.13. Air (replacing neutron shield polyethylene after fire)

SAR values			
Temperature (°F)	**Thermal Conductivity (Btu/hr-ft-°F)**	**Specific Heat (Btu/lbm-°F)**	**Density (lbm/ft^3)**
81	0.0156	0.231	0.0734
261	0.0192	0.237	0.0551
441	0.0228	0.239	0.0440
621	0.0264	0.246	0.0367
981	0.0336	0.264	0.0275
COBRA-SFS input—selected representative values at immediate post-fire temperature and above.			
all	0.03	0.26	0.0270

Appendix B

Material Properties for ANSYS Model of HI-STAR 100 Package

Table B.1. Homogeneous Fuel Region for Westinghouse 17x17 OFA

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
0	0.04412	0.04412	0.06256	0.14353	0.05869	Fuel Region (2.25 multiplier against helium contribution to account for limited convection and pressurization enhancement)
100	0.04412	0.04412	0.06256	0.14353	0.05869	
200	0.04412	0.04412	0.06256	0.14352	0.05869	
300	0.05078	0.05078	0.06509	0.14352	0.05869	
400	0.05895	0.05895	0.06797	0.14352	0.05869	
500	0.06837	0.06837	0.07082	0.14352	0.05869	
600	0.07834	0.07834	0.07391	0.14352	0.05869	
700	0.08920	0.08920	0.07756	0.14352	0.05869	
800	0.09508	0.09508	0.08121	0.15352	0.05869	
900	0.09508	0.09508	0.08484	0.15352	0.05869	
1000	0.09508	0.09508	0.08600	0.15352	0.05869	

Table B.2. Alloy-X

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	0.70000	*	*	0.28993	0.12000	Basket Plates, Basket Supports, Boral Plate Sheathing, MPC shell, impact limiter skin shell
450	0.81667	*	*			
700	0.91667	*	*			
1400	1.19670	*	*			

Table B.3. Helium

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
0	0.00650	*	*	6.90E-06	1.24000	gas conduction between MPC and cask
200	0.00808	*	*	4.81E-06		
400	0.00958	*	*	3.69E-06		
600	0.01075	*	*	2.99E-06		
800	0.01150	*	*	2.52E-06		
1400	0.01370	*	*	1.71E-06		

Table B.4. Helium
(with 2.25 multiplier to account for limited convection and pressurization enhancement)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
0	0.01400	*	*	6.90E-06	1.24000	Conduction in: central core region, between guide tubes and basket plates, between fuel and compartments, and between basket and MPC Shell
200	0.01740	*	*	4.81E-06		
400	0.02063	*	*	3.69E-06		
600	0.02315	*	*	2.99E-06		
800	0.02476	*	*	2.52E-06		
1400	0.02950	*	*	1.71E-06		

Table B.5. Boral Plates
(includes 0.004” helium gap and gap radiation on both sides of Boral)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
0	0.30836	4.62020	4.62020	0.08390	0.24762	parallel to thickness (switch x & y to define cross-width)
100	0.34331	4.62550	4.62550	0.08390		
200	0.37738	4.64850	4.64850	0.08390		
300	0.40969	4.69040	4.69040	0.08390		
400	0.44166	4.73250	4.73250	0.08390		
500	0.46611	4.74620	4.74620	0.08390		
600	0.49024	4.75200	4.75200	0.08390		
700	0.50544	4.73700	4.73700	0.08390		
800	0.52053	4.72210	4.72210	0.08390		
900	0.53517	4.70710	4.70710	0.08390		
1000	0.54970	4.69220	4.69220	0.08390		
1100	0.56438	4.68350	4.68350	0.08390		

Table B.6. Carbon Steel (SA-516, Gr. 70)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (radial)	Thermal Conductivity (Btu/hr-in-°F) (circumferential)	Thermal Conductivity (Btu/hr-in-°F) (axial)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	0.17409	2.03330	2.03330	0.28299	0.10000	Gamma Shield with 0.01” air gaps between plates
450	0.22634	1.99170	1.99170			
700	0.28273	1.86670	1.86670			
1400	0.44136	1.46670	1.46670			

Table B.7. Carbon Steel (SA-515, Gr. 70)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	2.43330	*	*	0.28299	0.10000	For radial channels of overpack and enclosure of shells of overpack (Fins)
450	2.25830	*	*			
700	2.05000	*	*			
1400	1.46670	*	*			

Table B.8. Holtite-A

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
*	0.03108	*	*	0.06076	0.39000	Neutron Shield/In impact limiter

Table B.9. HT-870

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
*	0.00340	*	*	0.00868	0.39000	Foam on back side of fins

Table B.10. Air Properties Representing Degraded Materials

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	0.00148	*	*	3.48E-05	0.24110	For degraded Holtite-A, HT-870, and Honeycomb after fire
450	0.00188	*	*	2.53E-05	0.24605	
700	0.00227	*	*	1.99E-05	0.25355	
1400	0.00336	*	*	1.31E-05	0.27445	

Table B.11. One-Quarter-Inch Fillet Weld - Carbon Steel (SA-515, Gr. 70)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	1.21670	2.43330	2.43330	0.28299	0.10000	Reduced radial channel conductivity (Fin Fillet Weld Root)
450	1.12920	2.25830	2.25830			
700	1.02500	2.05000	2.05000			
1400	0.73333	1.46670	1.46670			

Table B.12. Carbon Steel (SA-516, Gr. 70)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	2.03330	*	*	0.28299	0.10000	Gamma Shield (intimate contact) and impact limiter base structure
450	1.99170	*	*			
700	1.86670	*	*			
1400	1.46670	*	*			

Table B.13. Aluminum Honeycomb
(700 psi unidirectional w/1700 psi cross-core backing)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
68	1.11710	0.47427	1.11710	0.01406	0.20800 (assumed)	Type 1: Aluminum Honeycomb
212	1.15270	0.48944	1.15270	0.01406		
752	1.42620	0.59537	1.42620	0.01406		
1400	1.75440	0.72248	1.75440	0.01406		

Table B.14. Aluminum Honeycomb
(700 psi unidirectional and 2300 psi cross-core)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
68	0.82721	0.31682	0.82721	0.00579	0.20800 (assumed)	Type 2&5: Aluminum Honeycomb
212	0.85369	0.32693	0.85369	0.00579		
752	1.03810	0.39771	1.03810	0.00579		
1400	1.25940	0.48265	1.25940	0.00579		

Table B.14. Aluminum Honeycomb (2300 psi cross-core)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
68	1.40690	0.63172	1.40690	0.01684	0.20800 (assumed)	Type 3: Aluminum Honeycomb
212	1.45170	0.65194	1.45170	0.01684		
752	1.81430	0.79302	1.81430	0.01684		
1400	2.24930	0.96231	2.24930	0.01684		

Table B.16. Aluminum Honeycomb (1100 psi unidirectional and 2300 psi cross-core)

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F) (x)	Thermal Conductivity (Btu/hr-in-°F) (y)	Thermal Conductivity (Btu/hr-in-°F) (z)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
68	1.40690	0.63172	1.40690	1.40630	0.20800 (assumed)	Type 4: Aluminum Honeycomb
212	1.45170	0.65194	1.45170	1.40630		
752	1.81430	0.79302	1.81430	1.40630		
1400	2.24930	0.96231	2.24930	1.40630		

Table B.17. Emissivity Values for Radiation Heat Transfer

Component	Material	Emissivity
Fuel	Zircaloy	0.80
Basket	Alloy-X	0.36
Support Bracket	Alloy-X	0.36
MPC Wall	Alloy-X	0.36
Borated Aluminum Plate	Boral	0.55
Bare Carbon Steel	Carbon Steel	0.65
Painted Surfaces		0.90
Cask and Impact Limiter Surfaces	Alloy-X	0.36
Tunnel Surface		0.90
Soot Surfaces		0.90

Appendix C

Material Properties for ANSYS Model of Legal Weight Truck Package

Table C.1. 304 Stainless Steel

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
70	0.7143	-	0.1141	Used for cask body, cask lid, spokes
212	0.7800	0.2888	0.1207	
392	0.8592	0.2872	0.1272	
572	0.9333	0.2855	0.1320	
752	1.0042	0.2839	0.1356	
932	1.0717	0.2822	0.1385	
1112	1.1375	0.2805	0.1412	

Table C.2. 6061-T6 Aluminum

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
32	9.7500	0.0984	0.2140	Used for basket, IL 1, 2 skin
212	9.9167			
572	11.0833			
932	12.9167			

Table C.3. 6061-T6 Aluminum Honeycomb

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
32	1.6965	0.017118056	0.214	Used for IL 1 (Honeycomb)
212	1.7255			
572	1.9285			
932	2.2475			

Table C.4. 6061-T6 Aluminum Honeycomb

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
32	1.4235	0.0144	0.214	Used for IL 2 (Honeycomb)
212	1.4478			
572	1.6182			
932	1.8858			

Table C.5. Helium

Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Density (lbm/in^3)	Specific Heat (Btu/lbm-°F)	Description
200	0.00808	4.83E-06	1.24	Used for cask gap and fuel gap
400	0.00942	3.70E-06		
600	0.01075	3.01E-06		
800	0.0115	2.52E-06		

Table C.6. Lead Gamma Shield

Temperature (°F)	Enthalpy(1) (Btu/lbm)	Temperature (°F)	Thermal Conductivity(2) (Btu/hr-in-°F)	Temperature (°F)	Density(3) (lbm/in^3)	Description
80.33	0.0860	80.3	1.698984	53.3	4.11060E-01	Used for lead gamma shield
260.33	5.7610	170.3	1.671552	233.3	4.07470E-01	
440.33	11.608	260.3	1.641888	413.3	4.03670E-01	
611.50	17.756	350.3	1.608588	607.7	3.99450E-01	
629.50	27.730	440.3	1.573092	622.1	3.84440E-01	
800.33	34.007	530.3	1.539792	802.1	3.80740E-01	
980.33	40.241	610.3	1.515924	982.1	3.76330E-01	
1160.33	46.432	630.3	0.746712	1162.1	3.71930E-01	
1340.33	52.580	710.3	0.796428	1342.1	3.67520E-01	
1520.33	58.641	800.3	0.84222	1522.1	3.63120E-01	
		890.3	0.884016			
		980.3	0.921852			
		1070.3	0.955764			
		1160.3	0.985716			
		1250.3	1.01171			
		1340.3	1.03378			

(1) Based on specific heat from B.J. McBride, S. Gordon and M.A. Reno, NASA Technical Paper 3287, (1993). Enthalpy as a function of temperature calculated using definition of specific heat as partial derivative of enthalpy with respect to temperature at constant pressure;

$$c_p = \left(\frac{\partial h}{\partial T} \right)_p$$

(2) C.Y. Ho, R.W. Powell and P.E. Liley, J. **Phys. Chem. Ref. Data**, v1, p279 (1972).

(3) F.C. Nix and D. MacNair, Physical Review, v60, p597 (1941) and R. Feder, A.S. Norwick, Physical Review, v109, p1959 (1958); calculated from the linear expansion.

Table C.7. 56% Ethylene Glycol Solution

Avg. Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Specific Heat (Btu/lbm-°F)	Density (lbm/in^3)
50	0.0188	0.7405	0.0391
70	0.0187	0.7522	0.0389
100	0.0185	0.7696	0.0385
150	0.0182	0.7979	0.0378
200	0.0179	0.8255	0.0370
250	0.0177	0.8522	0.0362
260	0.0176	0.8575	0.0360
270	0.0176	0.8627	0.0358
280	0.0175	0.8679	0.0357
290	0.0175	0.8731	0.0355
300	0.0174	0.8782	0.0353
310	0.0174	0.8833	0.0351
320	0.0173	0.8884	0.0349
330	0.0173	0.8934	0.0347
340	0.0172	0.8984	0.0345
350	0.0172	0.9034	0.0343

Table C.8. Air

Avg. Temperature (°F)	Thermal Conductivity (Btu/hr-in-°F)	Specific Heat (Btu/lbm-°F)	Density (lbm/in^3)
350	0.0017	0.2467	0.0000283
450	0.0018	0.2494	0.0000252
550	0.0020	0.2516	0.0000227
650	0.0022	0.2533	0.0000206
750	0.0023	0.2546	0.0000189
850	0.0025	0.2556	0.0000175
950	0.0026	0.2562	0.0000162
1050	0.0027	0.2566	0.0000152
1150	0.0029	0.2568	0.0000142
1250	0.0030	0.2570	0.0000134
1350	0.0031	0.2571	0.0000126
1450	0.0033	0.2571	0.0000120
1550	0.0034	0.2573	0.0000114
1650	0.0035	0.2576	0.0000108
1750	0.0036	0.2581	0.0000104
1850	0.0038	0.2589	0.0000099
1950	0.0039	0.2599	0.0000095
2050	0.0040	0.2614	0.0000091

Table C.9. Effective Conductivity for Liquid Neutron Shield with 1°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	0.364	0.149	0.003	0.002
260	0.374	0.153	0.003	0.002
270	0.384	0.157	0.003	0.002
280	0.393	0.161	0.003	0.002
290	0.398	0.163	0.003	0.002
300	0.396	0.162	0.003	0.002
310	0.395	0.162	0.003	0.002
320	0.394	0.161	0.003	0.002
330	0.393	0.161	0.003	0.002
340	0.391	0.160	0.003	0.002
350	0.390	0.160	0.003	0.002
351	*	*	0.003	0.002
400	*	*	0.003	0.002
500	*	*	0.003	0.002
600	*	*	0.003	0.002
700	*	*	0.003	0.002
800	*	*	0.003	0.002
1000	*	*	0.003	0.003
1200	*	*	0.003	0.003
1500	*	*	0.003	0.003
2000	*	*	0.004	0.004
2500	*	*	0.004	0.004

Table C.10. Effective Conductivity for Liquid Neutron Shield with 10°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	0.654	0.268	0.006	0.002
260	0.673	0.276	0.006	0.002
270	0.691	0.283	0.006	0.002
280	0.704	0.288	0.006	0.002
290	0.705	0.289	0.006	0.002
300	0.703	0.288	0.006	0.002
310	0.701	0.287	0.006	0.002
320	0.699	0.286	0.006	0.002
330	0.697	0.286	0.006	0.002
340	0.695	0.285	0.006	0.002
350	*	*	0.006	0.002
351	*	*	0.006	0.002
400	*	*	0.006	0.002
500	*	*	0.006	0.002
600	*	*	0.005	0.002
700	*	*	0.005	0.002
800	*	*	0.005	0.002
1000	*	*	0.005	0.003
1200	*	*	0.005	0.003
1500	*	*	0.004	0.003
2000	*	*	0.004	0.004
2500	*	*	0.004	0.004

Table C.11. Effective Conductivity for Liquid Neutron Shield with 25°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	0.840	0.344	0.008	0.003
260	0.863	0.353	0.008	0.003
270	0.882	0.361	0.008	0.003
280	0.888	0.364	0.008	0.003
290	0.885	0.363	0.007	0.003
300	0.883	0.361	0.007	0.003
310	0.880	0.360	0.007	0.003
320	0.877	0.359	0.007	0.003
330	0.875	0.358	0.007	0.003
340	0.872	0.357	0.007	0.003
350	*	*	0.007	0.003
351	*	*	0.007	0.003
400	*	*	0.007	0.003
500	*	*	0.007	0.003
600	*	*	0.007	0.003
700	*	*	0.007	0.003
800	*	*	0.006	0.003
1000	*	*	0.006	0.003
1200	*	*	0.006	0.003
1500	*	*	0.005	0.003
2000	*	*	0.005	0.004
2500	*	*	0.005	0.004

Table C.12. Effective Conductivity for Liquid Neutron Shield with 50°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	1.061	0.434	0.009	0.004
260	1.058	0.433	0.009	0.004
270	1.055	0.432	0.009	0.004
280	1.052	0.431	0.009	0.004
290	1.049	0.430	0.009	0.004
300	1.046	0.428	0.009	0.004
310	1.043	0.427	0.009	0.004
320	1.039	0.426	0.009	0.004
330	*	*	0.009	0.004
340	*	*	0.009	0.004
350	*	*	0.009	0.004
351	*	*	0.009	0.004
400	*	*	0.009	0.003
500	*	*	0.008	0.003
600	*	*	0.008	0.003
700	*	*	0.008	0.003
800	*	*	0.008	0.003
1000	*	*	0.007	0.003
1200	*	*	0.007	0.003
1500	*	*	0.006	0.003
2000	*	*	0.006	0.004
2500	*	*	0.006	0.004

Table C.13. Effective Conductivity for Liquid Neutron Shield with 70°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	1.151	0.471	0.010	0.004
260	1.148	0.470	0.010	0.004
270	1.144	0.469	0.010	0.004
280	1.141	0.467	0.010	0.004
290	1.138	0.466	0.010	0.004
300	1.134	0.464	0.010	0.004
310	1.131	0.463	0.010	0.004
320	*	*	0.010	0.004
330	*	*	0.010	0.004
340	*	*	0.009	0.004
350	*	*	0.009	0.004
351	*	*	0.009	0.004
400	*	*	0.009	0.004
500	*	*	0.009	0.004
600	*	*	0.009	0.004
700	*	*	0.008	0.003
800	*	*	0.008	0.003
1000	*	*	0.008	0.003
1200	*	*	0.007	0.003
1500	*	*	0.007	0.003
2000	*	*	0.006	0.004
2500	*	*	0.006	0.004

Table C.14. Effective Conductivity for Liquid Neutron Shield with 100°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	1.253	0.513	0.011	0.004
260	1.249	0.512	0.011	0.004
270	1.245	0.510	0.011	0.004
280	1.242	0.509	0.011	0.004
290	1.238	0.507	0.011	0.004
300	1.234	0.505	0.011	0.004
310	*	*	0.010	0.004
320	*	*	0.010	0.004
330	*	*	0.010	0.004
340	*	*	0.010	0.004
350	*	*	0.010	0.004
351	*	*	0.010	0.004
400	*	*	0.010	0.004
500	*	*	0.010	0.004
600	*	*	0.009	0.004
700	*	*	0.009	0.004
800	*	*	0.009	0.004
1000	*	*	0.008	0.003
1200	*	*	0.008	0.003
1500	*	*	0.008	0.003
2000	*	*	0.007	0.004
2500	*	*	0.007	0.004

Table C.15. Effective Conductivity for Liquid Neutron Shield with 200°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	1.468	0.601	0.013	0.005
260	*	*	0.013	0.005
270	*	*	0.013	0.005
280	*	*	0.013	0.005
290	*	*	0.013	0.005
300	*	*	0.012	0.005
310	*	*	0.012	0.005
320	*	*	0.012	0.005
330	*	*	0.012	0.005
340	*	*	0.012	0.005
350	*	*	0.012	0.005
351	*	*	0.012	0.005
400	*	*	0.012	0.005
500	*	*	0.012	0.005
600	*	*	0.011	0.004
700	*	*	0.011	0.004
800	*	*	0.011	0.004
1000	*	*	0.010	0.004
1200	*	*	0.010	0.004
1500	*	*	0.009	0.004
2000	*	*	0.008	0.004
2500	*	*	0.008	0.005

Table C.16. Effective Conductivity for Liquid Neutron Shield with 300°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	*	*	0.014	0.005
260	*	*	0.014	0.005
270	*	*	0.014	0.005
280	*	*	0.014	0.005
290	*	*	0.014	0.005
300	*	*	0.014	0.005
310	*	*	0.014	0.005
320	*	*	0.014	0.005
330	*	*	0.014	0.005
340	*	*	0.014	0.005
350	*	*	0.013	0.005
351	*	*	0.013	0.005
400	*	*	0.013	0.005
500	*	*	0.013	0.005
600	*	*	0.012	0.005
700	*	*	0.012	0.005
800	*	*	0.012	0.005
1000	*	*	0.011	0.004
1200	*	*	0.011	0.004
1500	*	*	0.010	0.004
2000	*	*	0.009	0.004
2500	*	*	0.009	0.005

Table C.17. Effective Conductivity for Liquid Neutron Shield with 500°F Temperature Gradient

Avg. Temperature (°F)	56% Ethylene Glycol		Air	
	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)	Effective Conductivity Neutron Shield (Btu/hr-in-°F)	Effective Conductivity Expansion Tank (Btu/hr-in-°F)
250	*	*	0.016	0.006
260	*	*	0.016	0.006
270	*	*	0.016	0.006
280	*	*	0.016	0.006
290	*	*	0.016	0.006
300	*	*	0.015	0.006
310	*	*	0.015	0.006
320	*	*	0.015	0.006
330	*	*	0.015	0.006
340	*	*	0.015	0.006
350	*	*	0.015	0.006
351	*	*	0.015	0.006
400	*	*	0.015	0.006
500	*	*	0.014	0.006
600	*	*	0.014	0.005
700	*	*	0.014	0.005
800	*	*	0.013	0.005
1000	*	*	0.013	0.005
1200	*	*	0.012	0.005
1500	*	*	0.011	0.005
2000	*	*	0.011	0.004
2500	*	*	0.010	0.005

Table C.18. Emissivity Values for Radiation Heat Transfer

Component	Material	Emissivity Before Fire	Emissivity During/After Fire
Canister	stainless steel	0.36	0.36
Cask	stainless steel	0.36	0.36
Outer Neutron Shield		0.34	0.34
Inner Neutron Shield		0.34	0.34
Basket	stainless steel	0.36	0.36
Fuel Clad	zircaloy	0.8	0.8
Boral Plate	aluminum clad	0.55	0.55
Shell Interior	stainless steel	0.36	0.36
Cask Exterior	stainless steel	0.85	0.9
Tunnel/ISO	various		0.9

Appendix D

Boundary Conditions from FDS Simulation of Fully Ventilated Fire Scenario

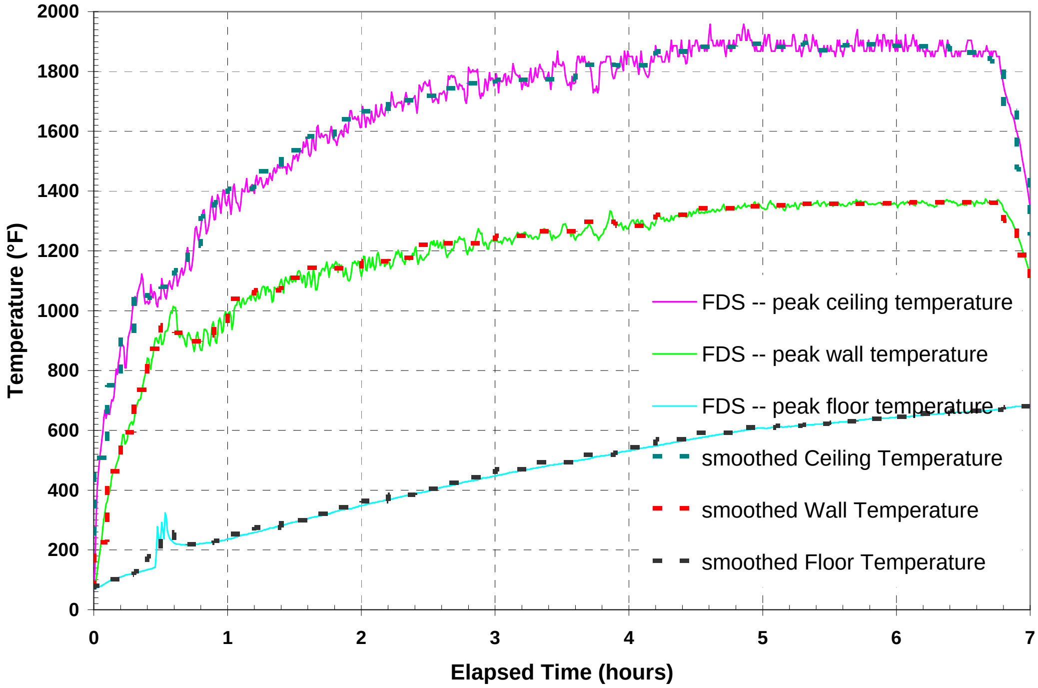

Figure D.1. Peak Surface Temperatures Calculated with FDS for Tunnel Ceiling, Wall, and Floor Regions at 20 meters from Fire Location during 7-hr Fire

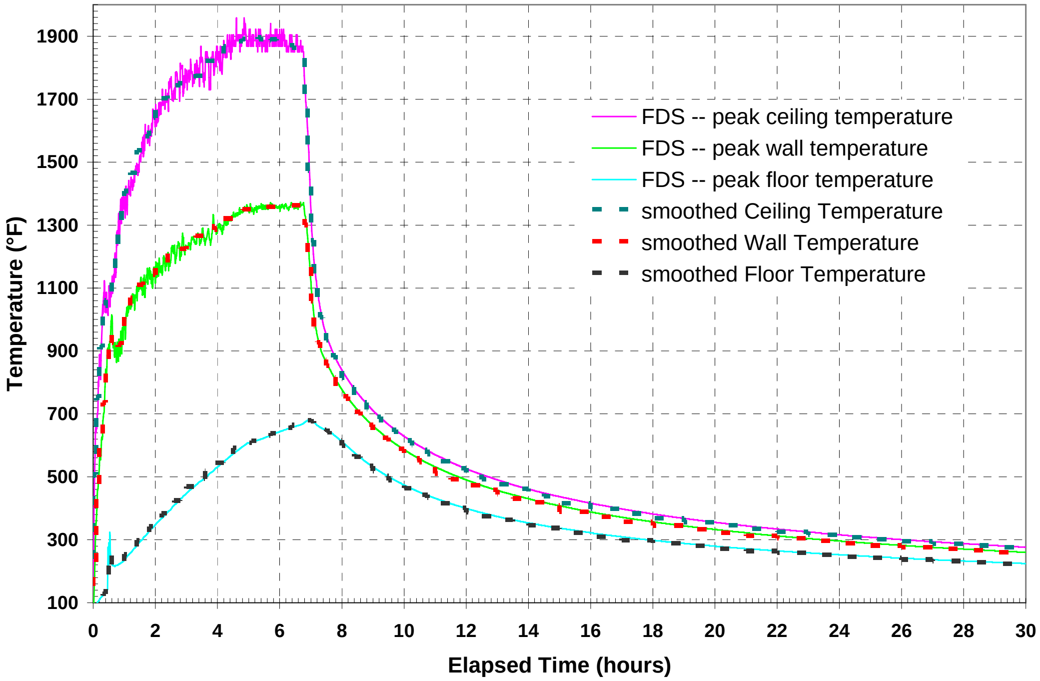

Figure D.2. Peak Surface Temperatures Calculated with FDS for Tunnel Ceiling, Wall, and Floor Regions at 20 meters from Fire Location during 7-hr Fire and 23-hr Cool Down

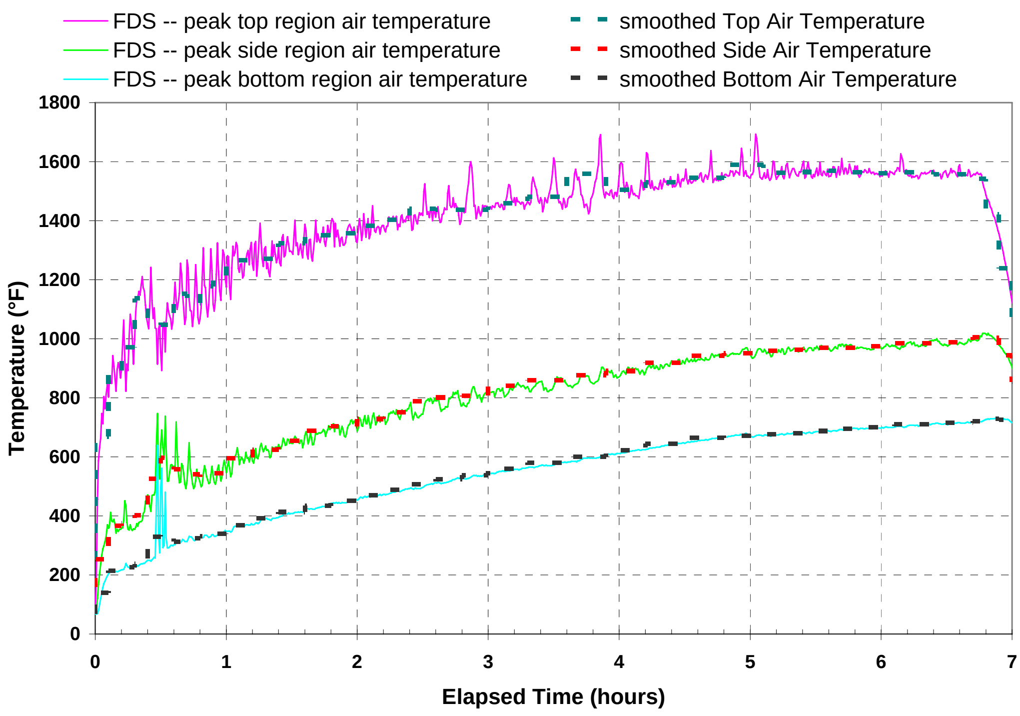

Figure D.3. Peak Air Temperatures Calculated with FDS for Top, Side, and Bottom Regions at 20 meters from Fire Location during 7-hr Fire

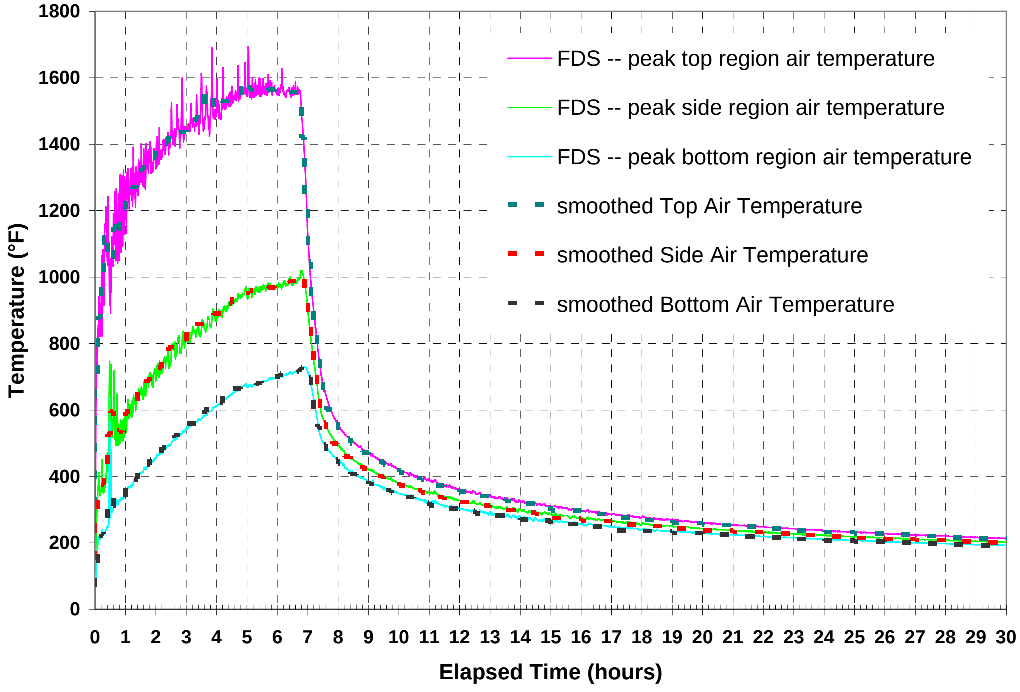

Figure D.4. Peak Air Temperatures Calculated with FDS for Top, Side, and Bottom Regions at 20 meters from Fire Location during 7-hr Fire and 23-hr Cool Down

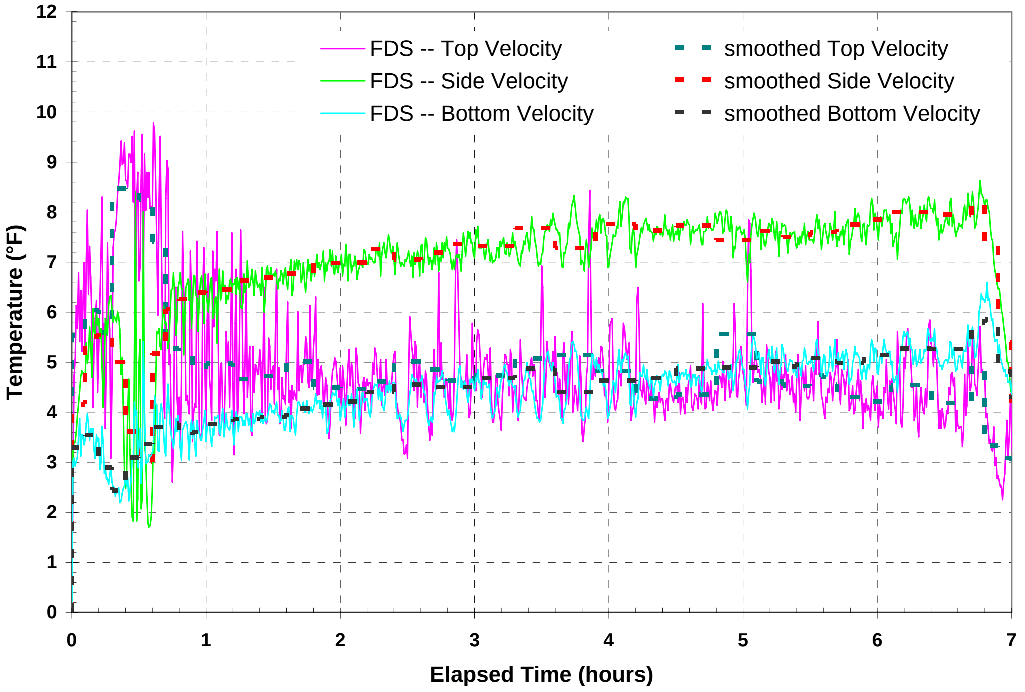

Figure D.5. Velocities at Peak Air Temperature Locations Calculated with FDS for Top, Side, and Bottom Regions at 20 meters from Fire Location during 7-hr Fire

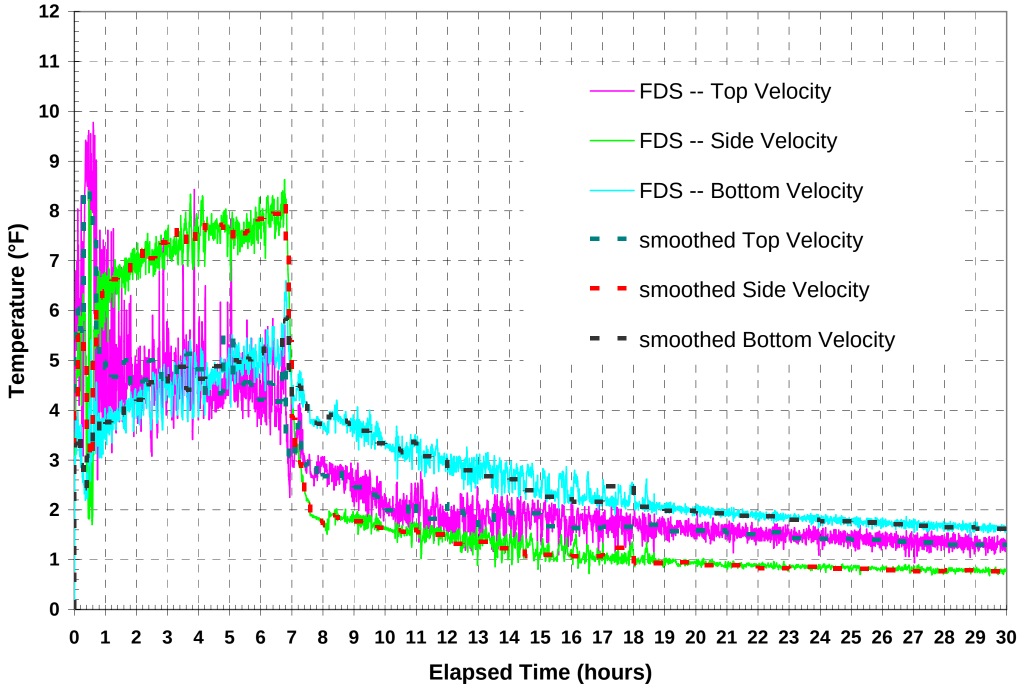

Figure D.6. Velocities at Peak Air Temperature Locations Calculated with FDS for Top, Side, and Bottom Regions at 20 meters from Fire during 7-hr Fire and 23-hr Cool Down

Appendix E

Blackbody Viewfactors for COBRA-SFS Model of TN-68 Package

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C TUNNEL.1=TOP  TUNNEL.2=SIDE  TUNNEL.3=BOTTOM
Cnode_1     node_2     Area*e*Bij  $       Bij      Bji
 CASK.101,  TUNNEL.1,  137.54      $     0.79418,0.00045040
 CASK.101,  TUNNEL.2,  25.477      $     0.14711,7.5761e-005
 CASK.101,  TUNNEL.3,  6.3683      $    0.036772,2.1839e-005
 CASK.102,  TUNNEL.1,  67.819      $     0.39161,0.00022209
 CASK.102,  TUNNEL.2,  87.635      $     0.50603,0.00026060
 CASK.102,  TUNNEL.3,  13.723      $    0.079241,4.7061e-005
 CASK.103,  TUNNEL.1,  12.951      $    0.074781,4.2410e-005
 CASK.103,  TUNNEL.2,  90.996      $     0.52544,0.00027059
 CASK.103,  TUNNEL.3,  65.443      $     0.37789,0.00022443
 CASK.104,  TUNNEL.1,  6.2714      $    0.036213,2.0538e-005
 CASK.104,  TUNNEL.2,  31.022      $     0.17913,9.2251e-005
 CASK.104,  TUNNEL.3,  132.32      $     0.76404,0.00045376
 CASK.201,  TUNNEL.1,  138.22      $     0.79812,0.00045264
 CASK.201,  TUNNEL.2,  24.978      $     0.14423,7.4277e-005
 CASK.201,  TUNNEL.3,  6.3135      $    0.036456,2.1651e-005
 CASK.202,  TUNNEL.1,  68.135      $     0.39343,0.00022313
 CASK.202,  TUNNEL.2,  87.392      $     0.50463,0.00025988
 CASK.202,  TUNNEL.3,  13.599      $    0.078527,4.6637e-005
 CASK.203,  TUNNEL.1,  12.937      $    0.074702,4.2365e-005
 CASK.203,  TUNNEL.2,  90.689      $     0.52367,0.00026968
 CASK.203,  TUNNEL.3,  65.701      $     0.37938,0.00022531
 CASK.204,  TUNNEL.1,  6.1691      $    0.035622,2.0203e-005
 CASK.204,  TUNNEL.2,  31.104      $     0.17961,9.2494e-005
 CASK.204,  TUNNEL.3,  132.31      $     0.76399,0.00045373
 CASK.301,  TUNNEL.1,  137.98      $     0.79676,0.00045187
 CASK.301,  TUNNEL.2,  25.169      $     0.14533,7.4844e-005
 CASK.301,  TUNNEL.3,  6.3354      $    0.036583,2.1726e-005
 CASK.302,  TUNNEL.1,  68.192      $     0.39376,0.00022331
 CASK.302,  TUNNEL.2,  87.312      $     0.50417,0.00025964
 CASK.302,  TUNNEL.3,  13.687      $    0.079031,4.6936e-005
 CASK.303,  TUNNEL.1,  12.880      $    0.074375,4.2180e-005
 CASK.303,  TUNNEL.2,  91.267      $     0.52700,0.00027140
 CASK.303,  TUNNEL.3,  65.225      $     0.37663,0.00022368
 CASK.304,  TUNNEL.1,  6.1435      $    0.035475,2.0119e-005
 CASK.304,  TUNNEL.2,  31.213      $     0.18024,9.2819e-005
 CASK.304,  TUNNEL.3,  132.07      $     0.76261,0.00045291
 CASK.401,  TUNNEL.1,  138.03      $     0.79704,0.00045202
 CASK.401,  TUNNEL.2,  25.096      $     0.14491,7.4627e-005
 CASK.401,  TUNNEL.3,  6.3204      $    0.036496,2.1675e-005
 CASK.402,  TUNNEL.1,  68.295      $     0.39436,0.00022365
 CASK.402,  TUNNEL.2,  87.210      $     0.50358,0.00025934
 CASK.402,  TUNNEL.3,  13.632      $    0.078717,4.6750e-005
 CASK.403,  TUNNEL.1,  13.054      $    0.075376,4.2748e-005
 CASK.403,  TUNNEL.2,  90.720      $     0.52385,0.00026977
 CASK.403,  TUNNEL.3,  65.460      $     0.37799,0.00022448
 CASK.404,  TUNNEL.1,  6.0468      $    0.034916,1.9802e-005
 CASK.404,  TUNNEL.2,  30.945      $     0.17868,9.2020e-005
 CASK.404,  TUNNEL.3,  132.46      $     0.76484,0.00045424
 CASK.501,  TUNNEL.1,  138.12      $     0.79752,0.00045230
 CASK.501,  TUNNEL.2,  25.031      $     0.14454,7.4434e-005
 CASK.501,  TUNNEL.3,  6.3279      $    0.036539,2.1701e-005
 CASK.502,  TUNNEL.1,  68.608      $     0.39616,0.00022468
 CASK.502,  TUNNEL.2,  86.890      $     0.50173,0.00025838
 CASK.502,  TUNNEL.3,  13.693      $    0.079069,4.6959e-005
 CASK.503,  TUNNEL.1,  12.946      $    0.074757,4.2397e-005
 CASK.503,  TUNNEL.2,  91.115      $     0.52613,0.00027095
 CASK.503,  TUNNEL.3,  65.179      $     0.37636,0.00022352
 CASK.504,  TUNNEL.1,  5.9701      $    0.034474,1.9551e-005
 CASK.504,  TUNNEL.2,  30.931      $     0.17860,9.1979e-005
 CASK.504,  TUNNEL.3,  132.45      $     0.76480,0.00045422
 CASK.601,  TUNNEL.1,  138.18      $     0.79788,0.00045250
 CASK.601,  TUNNEL.2,  24.944      $     0.14403,7.4176e-005
 CASK.601,  TUNNEL.3,  6.2188      $    0.035909,2.1326e-005
 CASK.602,  TUNNEL.1,  68.688      $     0.39663,0.00022494
 CASK.602,  TUNNEL.2,  86.987      $     0.50229,0.00025867
 CASK.602,  TUNNEL.3,  13.491      $    0.077899,4.6264e-005
 CASK.603,  TUNNEL.1,  13.037      $    0.075278,4.2692e-005
 CASK.603,  TUNNEL.2,  91.088      $     0.52597,0.00027087
 CASK.603,  TUNNEL.3,  65.088      $     0.37584,0.00022321
 CASK.604,  TUNNEL.1,  5.9256      $    0.034216,1.9405e-005
 CASK.604,  TUNNEL.2,  31.061      $     0.17936,9.2367e-005
 CASK.604,  TUNNEL.3,  132.28      $     0.76385,0.00045365
 CASK.701,  TUNNEL.1,  138.29      $     0.79854,0.00045288
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 CASK.701,  TUNNEL.2,  24.847      $     0.14347,7.3886e-005
 CASK.701,  TUNNEL.3,  6.2483      $    0.036080,2.1428e-005
 CASK.702,  TUNNEL.1,  68.225      $     0.39395,0.00022342
 CASK.702,  TUNNEL.2,  87.042      $     0.50261,0.00025884
 CASK.702,  TUNNEL.3,  13.824      $    0.079826,4.7408e-005
 CASK.703,  TUNNEL.1,  13.006      $    0.075103,4.2593e-005
 CASK.703,  TUNNEL.2,  90.921      $     0.52501,0.00027037
 CASK.703,  TUNNEL.3,  65.304      $     0.37709,0.00022395
 CASK.704,  TUNNEL.1,  5.8582      $    0.033827,1.9184e-005
 CASK.704,  TUNNEL.2,  31.026      $     0.17916,9.2263e-005
 CASK.704,  TUNNEL.3,  132.40      $     0.76454,0.00045406
 CASK.801,  TUNNEL.1,  138.10      $     0.79744,0.00045225
 CASK.801,  TUNNEL.2,  25.102      $     0.14495,7.4647e-005
 CASK.801,  TUNNEL.3,  6.2315      $    0.035983,2.1370e-005
 CASK.802,  TUNNEL.1,  67.889      $     0.39201,0.00022232
 CASK.802,  TUNNEL.2,  87.307      $     0.50414,0.00025963
 CASK.802,  TUNNEL.3,  13.869      $    0.080083,4.7561e-005
 CASK.803,  TUNNEL.1,  12.847      $    0.074182,4.2071e-005
 CASK.803,  TUNNEL.2,  90.805      $     0.52434,0.00027003
 CASK.803,  TUNNEL.3,  65.535      $     0.37842,0.00022474
 CASK.804,  TUNNEL.1,  5.7617      $    0.033270,1.8868e-005
 CASK.804,  TUNNEL.2,  31.064      $     0.17937,9.2374e-005
 CASK.804,  TUNNEL.3,  132.36      $     0.76430,0.00045391
 CASK.901,  TUNNEL.1,  138.13      $     0.79764,0.00045236
 CASK.901,  TUNNEL.2,  25.128      $     0.14510,7.4724e-005
 CASK.901,  TUNNEL.3,  6.2207      $    0.035921,2.1333e-005
 CASK.902,  TUNNEL.1,  68.091      $     0.39318,0.00022298
 CASK.902,  TUNNEL.2,  87.277      $     0.50396,0.00025953
 CASK.902,  TUNNEL.3,  13.700      $    0.079107,4.6981e-005
 CASK.903,  TUNNEL.1,  12.952      $    0.074789,4.2415e-005
 CASK.903,  TUNNEL.2,  90.982      $     0.52536,0.00027055
 CASK.903,  TUNNEL.3,  65.132      $     0.37609,0.00022336
 CASK.904,  TUNNEL.1,  5.7522      $    0.033215,1.8837e-005
 CASK.904,  TUNNEL.2,  31.124      $     0.17972,9.2553e-005
 CASK.904,  TUNNEL.3,  132.31      $     0.76400,0.00045374
CASK.1001,  TUNNEL.1,  137.84      $     0.79593,0.00045139
CASK.1001,  TUNNEL.2,  25.412      $     0.14674,7.5569e-005
CASK.1001,  TUNNEL.3,  6.2311      $    0.035981,2.1369e-005
CASK.1002,  TUNNEL.1,  68.564      $     0.39591,0.00022453
CASK.1002,  TUNNEL.2,  86.856      $     0.50153,0.00025828
CASK.1002,  TUNNEL.3,  13.655      $    0.078849,4.6828e-005
CASK.1003,  TUNNEL.1,  12.716      $    0.073426,4.1642e-005
CASK.1003,  TUNNEL.2,  90.924      $     0.52502,0.00027038
CASK.1003,  TUNNEL.3,  65.500      $     0.37822,0.00022462
CASK.1004,  TUNNEL.1,  5.6573      $    0.032667,1.8526e-005
CASK.1004,  TUNNEL.2,  31.197      $     0.18014,9.2770e-005
CASK.1004,  TUNNEL.3,  132.27      $     0.76378,0.00045361
CASK.1101,  TUNNEL.1,  138.17      $     0.79782,0.00045247
CASK.1101,  TUNNEL.2,  25.006      $     0.14440,7.4362e-005
CASK.1101,  TUNNEL.3,  6.1872      $    0.035727,2.1218e-005
CASK.1102,  TUNNEL.1,  68.446      $     0.39523,0.00022415
CASK.1102,  TUNNEL.2,  87.049      $     0.50265,0.00025886
CASK.1102,  TUNNEL.3,  13.505      $    0.077980,4.6312e-005
CASK.1103,  TUNNEL.1,  12.985      $    0.074982,4.2524e-005
CASK.1103,  TUNNEL.2,  91.145      $     0.52630,0.00027104
CASK.1103,  TUNNEL.3,  65.061      $     0.37568,0.00022312
CASK.1104,  TUNNEL.1,  5.6898      $    0.032855,1.8633e-005
CASK.1104,  TUNNEL.2,  30.943      $     0.17868,9.2016e-005
CASK.1104,  TUNNEL.3,  132.40      $     0.76453,0.00045405
CASK.1201,  TUNNEL.1,  137.88      $     0.79616,0.00045153
CASK.1201,  TUNNEL.2,  25.412      $     0.14674,7.5567e-005
CASK.1201,  TUNNEL.3,  6.1750      $    0.035657,2.1176e-005
CASK.1202,  TUNNEL.1,  67.908      $     0.39212,0.00022238
CASK.1202,  TUNNEL.2,  87.439      $     0.50490,0.00026002
CASK.1202,  TUNNEL.3,  13.717      $    0.079208,4.7041e-005
CASK.1203,  TUNNEL.1,  12.998      $    0.075055,4.2566e-005
CASK.1203,  TUNNEL.2,  90.706      $     0.52377,0.00026973
CASK.1203,  TUNNEL.3,  65.409      $     0.37769,0.00022431
CASK.1204,  TUNNEL.1,  5.5919      $    0.032289,1.8312e-005
CASK.1204,  TUNNEL.2,  31.129      $     0.17975,9.2567e-005
CASK.1204,  TUNNEL.3,  132.27      $     0.76380,0.00045362
CASK.1301,  TUNNEL.1,  138.25      $     0.79830,0.00045274
CASK.1301,  TUNNEL.2,  24.993      $     0.14432,7.4320e-005
CASK.1301,  TUNNEL.3,  6.1782      $    0.035675,2.1187e-005
CASK.1302,  TUNNEL.1,  68.155      $     0.39355,0.00022319
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CASK.1302,  TUNNEL.2,  87.155      $     0.50326,0.00025917
CASK.1302,  TUNNEL.3,  13.671      $    0.078943,4.6884e-005
CASK.1303,  TUNNEL.1,  12.737      $    0.073546,4.1710e-005
CASK.1303,  TUNNEL.2,  91.130      $     0.52622,0.00027099
CASK.1303,  TUNNEL.3,  65.245      $     0.37674,0.00022375
CASK.1304,  TUNNEL.1,  5.6600      $    0.032683,1.8535e-005
CASK.1304,  TUNNEL.2,  31.047      $     0.17928,9.2325e-005
CASK.1304,  TUNNEL.3,  132.30      $     0.76396,0.00045372
CASK.1401,  TUNNEL.1,  138.04      $     0.79707,0.00045204
CASK.1401,  TUNNEL.2,  25.121      $     0.14506,7.4703e-005
CASK.1401,  TUNNEL.3,  6.2019      $    0.035812,2.1269e-005
CASK.1402,  TUNNEL.1,  68.195      $     0.39378,0.00022332
CASK.1402,  TUNNEL.2,  87.073      $     0.50279,0.00025893
CASK.1402,  TUNNEL.3,  13.807      $    0.079729,4.7351e-005
CASK.1403,  TUNNEL.1,  12.669      $    0.073153,4.1487e-005
CASK.1403,  TUNNEL.2,  91.365      $     0.52757,0.00027169
CASK.1403,  TUNNEL.3,  65.069      $     0.37573,0.00022314
CASK.1404,  TUNNEL.1,  5.5888      $    0.032272,1.8302e-005
CASK.1404,  TUNNEL.2,  31.163      $     0.17994,9.2668e-005
CASK.1404,  TUNNEL.3,  132.22      $     0.76345,0.00045341
CASK.1501,  TUNNEL.1,  138.17      $     0.79785,0.00045249
CASK.1501,  TUNNEL.2,  25.075      $     0.14479,7.4565e-005
CASK.1501,  TUNNEL.3,  6.1911      $    0.035749,2.1231e-005
CASK.1502,  TUNNEL.1,  68.139      $     0.39346,0.00022314
CASK.1502,  TUNNEL.2,  87.197      $     0.50350,0.00025930
CASK.1502,  TUNNEL.3,  13.646      $    0.078797,4.6798e-005
CASK.1503,  TUNNEL.1,  12.784      $    0.073818,4.1864e-005
CASK.1503,  TUNNEL.2,  91.009      $     0.52552,0.00027063
CASK.1503,  TUNNEL.3,  65.230      $     0.37666,0.00022370
CASK.1504,  TUNNEL.1,  5.6144      $    0.032419,1.8386e-005
CASK.1504,  TUNNEL.2,  31.011      $     0.17907,9.2217e-005
CASK.1504,  TUNNEL.3,  132.37      $     0.76434,0.00045394
CASK.1601,  TUNNEL.1,  138.38      $     0.79906,0.00045317
CASK.1601,  TUNNEL.2,  24.861      $     0.14355,7.3928e-005
CASK.1601,  TUNNEL.3,  6.1468      $    0.035493,2.1079e-005
CASK.1602,  TUNNEL.1,  68.267      $     0.39420,0.00022356
CASK.1602,  TUNNEL.2,  87.153      $     0.50325,0.00025917
CASK.1602,  TUNNEL.3,  13.587      $    0.078457,4.6595e-005
CASK.1603,  TUNNEL.1,  12.646      $    0.073025,4.1414e-005
CASK.1603,  TUNNEL.2,  90.521      $     0.52270,0.00026918
CASK.1603,  TUNNEL.3,  65.886      $     0.38045,0.00022595
CASK.1604,  TUNNEL.1,  5.5843      $    0.032245,1.8287e-005
CASK.1604,  TUNNEL.2,  30.824      $     0.17799,9.1661e-005
CASK.1604,  TUNNEL.3,  132.56      $     0.76547,0.00045461
CASK.1701,  TUNNEL.1,  137.89      $     0.79623,0.00045156
CASK.1701,  TUNNEL.2,  25.339      $     0.14632,7.5351e-005
CASK.1701,  TUNNEL.3,  6.1499      $    0.035511,2.1090e-005
CASK.1702,  TUNNEL.1,  68.793      $     0.39723,0.00022528
CASK.1702,  TUNNEL.2,  86.707      $     0.50067,0.00025784
CASK.1702,  TUNNEL.3,  13.529      $    0.078123,4.6397e-005
CASK.1703,  TUNNEL.1,  12.704      $    0.073359,4.1604e-005
CASK.1703,  TUNNEL.2,  91.173      $     0.52646,0.00027112
CASK.1703,  TUNNEL.3,  65.193      $     0.37645,0.00022357
CASK.1704,  TUNNEL.1,  5.5697      $    0.032161,1.8240e-005
CASK.1704,  TUNNEL.2,  31.366      $     0.18112,9.3274e-005
CASK.1704,  TUNNEL.3,  132.07      $     0.76260,0.00045290
CASK.1801,  TUNNEL.1,  138.30      $     0.79856,0.00045289
CASK.1801,  TUNNEL.2,  24.981      $     0.14425,7.4286e-005
CASK.1801,  TUNNEL.3,  6.1334      $    0.035416,2.1034e-005
CASK.1802,  TUNNEL.1,  68.068      $     0.39304,0.00022291
CASK.1802,  TUNNEL.2,  87.271      $     0.50393,0.00025952
CASK.1802,  TUNNEL.3,  13.649      $    0.078815,4.6808e-005
CASK.1803,  TUNNEL.1,  12.694      $    0.073297,4.1569e-005
CASK.1803,  TUNNEL.2,  91.352      $     0.52750,0.00027165
CASK.1803,  TUNNEL.3,  65.097      $     0.37589,0.00022324
CASK.1804,  TUNNEL.1,  5.5500      $    0.032047,1.8175e-005
CASK.1804,  TUNNEL.2,  31.344      $     0.18099,9.3208e-005
CASK.1804,  TUNNEL.3,  132.06      $     0.76255,0.00045287
CASK.1901,  TUNNEL.1,  138.28      $     0.79848,0.00045284
CASK.1901,  TUNNEL.2,  24.841      $     0.14344,7.3870e-005
CASK.1901,  TUNNEL.3,  6.1732      $    0.035646,2.1170e-005
CASK.1902,  TUNNEL.1,  68.778      $     0.39714,0.00022523
CASK.1902,  TUNNEL.2,  86.557      $     0.49981,0.00025739
CASK.1902,  TUNNEL.3,  13.637      $    0.078746,4.6767e-005
CASK.1903,  TUNNEL.1,  12.841      $    0.074146,4.2051e-005
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CASK.1903,  TUNNEL.2,  91.151      $     0.52633,0.00027105
CASK.1903,  TUNNEL.3,  65.209      $     0.37654,0.00022362
CASK.1904,  TUNNEL.1,  5.6276      $    0.032496,1.8429e-005
CASK.1904,  TUNNEL.2,  30.798      $     0.17784,9.1584e-005
CASK.1904,  TUNNEL.3,  132.57      $     0.76549,0.00045462
CASK.2001,  TUNNEL.1,  138.26      $     0.79837,0.00045278
CASK.2001,  TUNNEL.2,  24.969      $     0.14418,7.4252e-005
CASK.2001,  TUNNEL.3,  6.1633      $    0.035589,2.1136e-005
CASK.2002,  TUNNEL.1,  67.893      $     0.39204,0.00022234
CASK.2002,  TUNNEL.2,  87.430      $     0.50485,0.00025999
CASK.2002,  TUNNEL.3,  13.778      $    0.079561,4.7251e-005
CASK.2003,  TUNNEL.1,  12.702      $    0.073347,4.1597e-005
CASK.2003,  TUNNEL.2,  90.326      $     0.52157,0.00026860
CASK.2003,  TUNNEL.3,  66.063      $     0.38147,0.00022655
CASK.2004,  TUNNEL.1,  5.6088      $    0.032387,1.8368e-005
CASK.2004,  TUNNEL.2,  30.836      $     0.17806,9.1696e-005
CASK.2004,  TUNNEL.3,  132.54      $     0.76530,0.00045451
CASK.2101,  TUNNEL.1,  137.99      $     0.79682,0.00045190
CASK.2101,  TUNNEL.2,  25.223      $     0.14564,7.5005e-005
CASK.2101,  TUNNEL.3,  6.2208      $    0.035921,2.1333e-005
CASK.2102,  TUNNEL.1,  68.122      $     0.39336,0.00022308
CASK.2102,  TUNNEL.2,  87.248      $     0.50380,0.00025945
CASK.2102,  TUNNEL.3,  13.695      $    0.079082,4.6967e-005
CASK.2103,  TUNNEL.1,  12.623      $    0.072889,4.1338e-005
CASK.2103,  TUNNEL.2,  91.084      $     0.52595,0.00027086
CASK.2103,  TUNNEL.3,  65.444      $     0.37790,0.00022443
CASK.2104,  TUNNEL.1,  5.6251      $    0.032481,1.8421e-005
CASK.2104,  TUNNEL.2,  30.935      $     0.17863,9.1992e-005
CASK.2104,  TUNNEL.3,  132.48      $     0.76497,0.00045431
CASK.2201,  TUNNEL.1,  138.00      $     0.79686,0.00045192
CASK.2201,  TUNNEL.2,  25.240      $     0.14575,7.5057e-005
CASK.2201,  TUNNEL.3,  6.1738      $    0.035650,2.1172e-005
CASK.2202,  TUNNEL.1,  68.741      $     0.39693,0.00022511
CASK.2202,  TUNNEL.2,  86.917      $     0.50189,0.00025847
CASK.2202,  TUNNEL.3,  13.480      $    0.077838,4.6228e-005
CASK.2203,  TUNNEL.1,  12.900      $    0.074490,4.2246e-005
CASK.2203,  TUNNEL.2,  91.269      $     0.52702,0.00027141
CASK.2203,  TUNNEL.3,  64.953      $     0.37506,0.00022275
CASK.2204,  TUNNEL.1,  5.6790      $    0.032793,1.8598e-005
CASK.2204,  TUNNEL.2,  30.883      $     0.17833,9.1837e-005
CASK.2204,  TUNNEL.3,  132.53      $     0.76527,0.00045449
CASK.2301,  TUNNEL.1,  137.99      $     0.79683,0.00045190
CASK.2301,  TUNNEL.2,  25.190      $     0.14546,7.4909e-005
CASK.2301,  TUNNEL.3,  6.2267      $    0.035955,2.1354e-005
CASK.2302,  TUNNEL.1,  68.414      $     0.39504,0.00022404
CASK.2302,  TUNNEL.2,  86.942      $     0.50203,0.00025854
CASK.2302,  TUNNEL.3,  13.674      $    0.078957,4.6892e-005
CASK.2303,  TUNNEL.1,  12.930      $    0.074664,4.2344e-005
CASK.2303,  TUNNEL.2,  90.672      $     0.52357,0.00026963
CASK.2303,  TUNNEL.3,  65.491      $     0.37816,0.00022459
CASK.2304,  TUNNEL.1,  5.6849      $    0.032826,1.8617e-005
CASK.2304,  TUNNEL.2,  31.044      $     0.17926,9.2315e-005
CASK.2304,  TUNNEL.3,  132.32      $     0.76406,0.00045377
CASK.2401,  TUNNEL.1,  137.91      $     0.79636,0.00045164
CASK.2401,  TUNNEL.2,  25.207      $     0.14555,7.4957e-005
CASK.2401,  TUNNEL.3,  6.2003      $    0.035803,2.1263e-005
CASK.2402,  TUNNEL.1,  68.065      $     0.39303,0.00022290
CASK.2402,  TUNNEL.2,  87.281      $     0.50399,0.00025955
CASK.2402,  TUNNEL.3,  13.655      $    0.078847,4.6827e-005
CASK.2403,  TUNNEL.1,  12.813      $    0.073989,4.1961e-005
CASK.2403,  TUNNEL.2,  90.843      $     0.52456,0.00027014
CASK.2403,  TUNNEL.3,  65.521      $     0.37834,0.00022470
CASK.2404,  TUNNEL.1,  5.7547      $    0.033229,1.8845e-005
CASK.2404,  TUNNEL.2,  31.095      $     0.17955,9.2466e-005
CASK.2404,  TUNNEL.3,  132.32      $     0.76405,0.00045377
CASK.2501,  TUNNEL.1,  138.26      $     0.79836,0.00045277
CASK.2501,  TUNNEL.2,  25.000      $     0.14436,7.4342e-005
CASK.2501,  TUNNEL.3,  6.1776      $    0.035672,2.1185e-005
CASK.2502,  TUNNEL.1,  68.473      $     0.39539,0.00022424
CASK.2502,  TUNNEL.2,  87.067      $     0.50275,0.00025891
CASK.2502,  TUNNEL.3,  13.573      $    0.078375,4.6547e-005
CASK.2503,  TUNNEL.1,  12.768      $    0.073729,4.1814e-005
CASK.2503,  TUNNEL.2,  91.066      $     0.52584,0.00027080
CASK.2503,  TUNNEL.3,  65.294      $     0.37703,0.00022391
CASK.2504,  TUNNEL.1,  5.8355      $    0.033696,1.9110e-005
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CASK.2504,  TUNNEL.2,  30.930      $     0.17860,9.1976e-005
CASK.2504,  TUNNEL.3,  132.43      $     0.76468,0.00045414
CASK.2601,  TUNNEL.1,  138.10      $     0.79746,0.00045226
CASK.2601,  TUNNEL.2,  25.102      $     0.14495,7.4647e-005
CASK.2601,  TUNNEL.3,  6.2378      $    0.036019,2.1392e-005
CASK.2602,  TUNNEL.1,  68.554      $     0.39585,0.00022450
CASK.2602,  TUNNEL.2,  86.943      $     0.50203,0.00025854
CASK.2602,  TUNNEL.3,  13.613      $    0.078605,4.6684e-005
CASK.2603,  TUNNEL.1,  12.843      $    0.074160,4.2058e-005
CASK.2603,  TUNNEL.2,  91.332      $     0.52738,0.00027160
CASK.2603,  TUNNEL.3,  64.991      $     0.37528,0.00022288
CASK.2604,  TUNNEL.1,  5.8796      $    0.033951,1.9254e-005
CASK.2604,  TUNNEL.2,  31.149      $     0.17987,9.2628e-005
CASK.2604,  TUNNEL.3,  132.23      $     0.76355,0.00045347
CASK.2701,  TUNNEL.1,  138.10      $     0.79741,0.00045224
CASK.2701,  TUNNEL.2,  25.040      $     0.14459,7.4462e-005
CASK.2701,  TUNNEL.3,  6.3016      $    0.036387,2.1610e-005
CASK.2702,  TUNNEL.1,  68.016      $     0.39275,0.00022274
CASK.2702,  TUNNEL.2,  87.294      $     0.50407,0.00025959
CASK.2702,  TUNNEL.3,  13.821      $    0.079805,4.7396e-005
CASK.2703,  TUNNEL.1,  12.778      $    0.073785,4.1846e-005
CASK.2703,  TUNNEL.2,  90.618      $     0.52326,0.00026947
CASK.2703,  TUNNEL.3,  65.768      $     0.37977,0.00022554
CASK.2704,  TUNNEL.1,  5.8947      $    0.034038,1.9304e-005
CASK.2704,  TUNNEL.2,  31.135      $     0.17978,9.2585e-005
CASK.2704,  TUNNEL.3,  132.22      $     0.76350,0.00045344
CASK.2801,  TUNNEL.1,  137.92      $     0.79641,0.00045167
CASK.2801,  TUNNEL.2,  25.255      $     0.14583,7.5100e-005
CASK.2801,  TUNNEL.3,  6.2785      $    0.036254,2.1531e-005
CASK.2802,  TUNNEL.1,  68.305      $     0.39442,0.00022369
CASK.2802,  TUNNEL.2,  87.253      $     0.50383,0.00025946
CASK.2802,  TUNNEL.3,  13.602      $    0.078545,4.6648e-005
CASK.2803,  TUNNEL.1,  12.785      $    0.073827,4.1869e-005
CASK.2803,  TUNNEL.2,  91.110      $     0.52610,0.00027094
CASK.2803,  TUNNEL.3,  65.358      $     0.37740,0.00022414
CASK.2804,  TUNNEL.1,  6.0104      $    0.034706,1.9683e-005
CASK.2804,  TUNNEL.2,  31.037      $     0.17922,9.2294e-005
CASK.2804,  TUNNEL.3,  132.37      $     0.76435,0.00045394
CASK.2901,  TUNNEL.1,  137.95      $     0.79655,0.00045175
CASK.2901,  TUNNEL.2,  25.208      $     0.14556,7.4961e-005
CASK.2901,  TUNNEL.3,  6.3047      $    0.036405,2.1621e-005
CASK.2902,  TUNNEL.1,  68.094      $     0.39320,0.00022299
CASK.2902,  TUNNEL.2,  87.286      $     0.50402,0.00025956
CASK.2902,  TUNNEL.3,  13.756      $    0.079430,4.7173e-005
CASK.2903,  TUNNEL.1,  12.735      $    0.073535,4.1704e-005
CASK.2903,  TUNNEL.2,  91.049      $     0.52575,0.00027075
CASK.2903,  TUNNEL.3,  65.491      $     0.37817,0.00022459
CASK.2904,  TUNNEL.1,  6.0330      $    0.034837,1.9757e-005
CASK.2904,  TUNNEL.2,  31.507      $     0.18193,9.3691e-005
CASK.2904,  TUNNEL.3,  131.85      $     0.76133,0.00045215
CASK.3001,  TUNNEL.1,  137.97      $     0.79670,0.00045183
CASK.3001,  TUNNEL.2,  25.049      $     0.14464,7.4489e-005
CASK.3001,  TUNNEL.3,  6.3339      $    0.036574,2.1721e-005
CASK.3002,  TUNNEL.1,  68.734      $     0.39689,0.00022509
CASK.3002,  TUNNEL.2,  86.655      $     0.50038,0.00025769
CASK.3002,  TUNNEL.3,  13.815      $    0.079771,4.7376e-005
CASK.3003,  TUNNEL.1,  12.791      $    0.073857,4.1886e-005
CASK.3003,  TUNNEL.2,  91.080      $     0.52592,0.00027084
CASK.3003,  TUNNEL.3,  65.432      $     0.37783,0.00022439
CASK.3004,  TUNNEL.1,  6.1398      $    0.035453,2.0106e-005
CASK.3004,  TUNNEL.2,  31.115      $     0.17967,9.2525e-005
CASK.3004,  TUNNEL.3,  132.27      $     0.76378,0.00045361
CASK.3101,  TUNNEL.1,  137.70      $     0.79510,0.00045093
CASK.3101,  TUNNEL.2,  25.393      $     0.14663,7.5511e-005
CASK.3101,  TUNNEL.3,  6.3698      $    0.036781,2.1844e-005
CASK.3102,  TUNNEL.1,  68.267      $     0.39420,0.00022356
CASK.3102,  TUNNEL.2,  87.177      $     0.50339,0.00025924
CASK.3102,  TUNNEL.3,  13.703      $    0.079126,4.6993e-005
CASK.3103,  TUNNEL.1,  12.902      $    0.074502,4.2252e-005
CASK.3103,  TUNNEL.2,  91.407      $     0.52781,0.00027182
CASK.3103,  TUNNEL.3,  65.078      $     0.37578,0.00022317
CASK.3104,  TUNNEL.1,  6.2118      $    0.035869,2.0342e-005
CASK.3104,  TUNNEL.2,  30.914      $     0.17851,9.1928e-005
CASK.3104,  TUNNEL.3,  132.43      $     0.76470,0.00045415
CASK.3201,  TUNNEL.1,  138.23      $     0.79819,0.00045268
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CASK.3201,  TUNNEL.2,  24.820      $     0.14332,7.3808e-005
CASK.3201,  TUNNEL.3,  6.3863      $    0.036877,2.1901e-005
CASK.3202,  TUNNEL.1,  67.949      $     0.39236,0.00022252
CASK.3202,  TUNNEL.2,  87.413      $     0.50475,0.00025994
CASK.3202,  TUNNEL.3,  13.866      $    0.080068,4.7552e-005
CASK.3203,  TUNNEL.1,  13.070      $    0.075471,4.2802e-005
CASK.3203,  TUNNEL.2,  90.901      $     0.52489,0.00027031
CASK.3203,  TUNNEL.3,  65.388      $     0.37757,0.00022424
CASK.3204,  TUNNEL.1,  6.2751      $    0.036235,2.0550e-005
CASK.3204,  TUNNEL.2,  31.217      $     0.18026,9.2829e-005
CASK.3204,  TUNNEL.3,  132.12      $     0.76292,0.00045309
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