This document was too large to scan as a single document. It has been divided into smaller sections.

Section 2 OF 2

Document Information			
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APPENDIX D

CALCULATION RESULTS OF STEADY-STATE FLAMMABILITY EVALUATIONS IN TANK DOME SPACES FOR 177 HANFORD TANKS

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Table D-1. Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions. (8 Sheets)

Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-AN-101	0.0011	0.0002	0.0011	253	154,328	113.0	0.02%	1.28E-03	1.20E-03	4.20E-04	1.92E-04
241-AN-102	0.0300	0.0003	0.0053	1,054	47,189	119.0	0.46%	3.57E-02	6.31E-03	1.20E-02	3.19E-04
241-AN-103	0.0007	0.0002	0.0007	956	60,290	100.0	0.08%	6.65E-04	6.50E-04	3.04E-03	2.05E-04
241-AN-104	0.0021	0.0002	0.0007	1,052	47,472	100.0	0.14%	2.10E-03	7.09E-04	4.83E-03	1.95E-04
241-AN-105	0.0015	0.0002	0.0013	1,128	37,302	100.0	0.12%	1.51E-03	1.28E-03	4.27E-03	2.20E-04
241-AN-106	0.0000	0.0000	0.0002	38	183,037	117.0	0.01%	0.00E+00	2.32E-04	2.93E-04	1.17E-05
241-AN-107	0.0400	0.0005	0.0053	1,041	48,955	129.0	0.46%	5.16E-02	6.84E-03	9.67E-03	6.29E-04
241-AP-101	0.0125	0.0003	0.0061	1,114	39,209	108.0	0.11%	1.35E-02	6.63E-03	1.00E-03	3.36E-04
241-AP-102	0.0075	0.0002	0.0048	1,089	42,528	135.0	0.08%	1.02E-02	6.50E-03	1.31E-03	3.29E-04
241-AP-103	0.0000	0.0000	0.0008	282	150,408	200.0	0.01%	0.00E+00	1.70E-03	5.46E-04	8.58E-05
241-AP-104	0.0003	0.00001	0.0002	1,109	39,844	71.0	0.06%	2.23E-04	1.43E-04	1.72E-03	7.23E-06
241-AP-105	0.0007	0.0001	0.0026	1,135	36,384	176.0	0.03%	1.29E-03	4.55E-03	1.32E-03	2.30E-04
241-AP-106	0.0005	0.00003	0.0005	623	104,819	111.0	0.03%	5.92E-04	5.53E-04	9.42E-04	2.80E-05
241-AP-107	0.0005	0.0001	0.0017	980	57,148	342.0	0.02%	1.71E-03	5.81E-03	1.61E-03	2.94E-04
241-AP-108	0.0027	0.0000	0.0017	32	183,814	129.0	0.02%	3.43E-03	2.20E-03	2.82E-04	1.11E-05
241-AW-101	0.0005	0.0002	0.0007	1,127	37,443	100.0	0.13%	5.15E-04	7.29E-04	5.06E-03	1.56E-04
241-AW-102	0.0003	0.0000	0.0002	85	176,716	292.0	0.01%	7.44E-04	4.76E-04	4.53E-04	2.41E-05
241-AW-103	0.0138	0.0004	0.0009	1,102	40,833	134.0	0.12%	1.85E-02	1.23E-03	1.02E-03	4.70E-04
241-AW-104	0.0006	0.0007	0.0009	316	145,888	141.0	0.03%	8.46E-04	1.30E-03	4.28E-04	1.03E-03
241-AW-105	0.0043	0.0002	0.0009	427	131,021	194.0	0.04%	8.30E-03	1.78E-03	4.64E-04	3.95E-04
241-AW-106	0.0028	0.0001	0.0018	299	148,148	158.0	0.04%	4.40E-03	2.81E-03	1.15E-03	1.42E-04
241-AY-101	0.0005	0.0001	0.0009	183	163,579	250.0	0.01%	1.25E-03	2.21E-03	8.12E-04	1.42E-04
241-AY-102	0.0004	0.0001	0.0010	635	103,230	250.0	0.32%	1.07E-03	2.50E-03	3.18E-02	3.61E-04
241-AZ-101	0.0001	0.0005	0.0010	944	61,879	150.0	0.13%	1.88E-04	1.50E-03	6.83E-03	7.79E-04

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Table D-1. Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions. (8 Sheets)

Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-AZ-102	0.0006	0.0008	0.0010	997	54,817	112.0	0.26%	6.19E-04	1.12E-03	1.07E-02	8.58E-04
241-SY-101	0.0200	0.0001	0.0005	969	58,595	461.0	0.15%	9.22E-02	2.46E-03	3.62E-03	3.58E-04
241-SY-102	0.0012	0.0004	0.0005	1,034	49,873	363.0	0.03%	4.24E-03	1.95E-03	2.21E-03	1.55E-03
241-SY-103	0.0059	0.0003	0.0016	750	87,869	116.4	0.12%	6.92E-03	1.87E-03	3.31E-03	3.15E-04
241-A-101*	0.0394	0.0006	0.0134	718	80,090	10.0	3.56%	3.94E-03	1.34E-03	1.31E-02	5.51E-05
241-A-102	0.0254	0.0002	0.0224	39	170,900	7.6	0.41%	1.93E-03	1.71E-03	7.22E-04	1.31E-05
241-A-103*	0.0261	0.0004	0.0220	371	126,441	10.0	1.15%	2.61E-03	2.20E-03	3.87E-03	3.92E-05
241-A-104	0.0005	0.0003	0.0040	28	172,312	10.0	1.16%	5.00E-05	4.02E-04	4.61E-03	2.58E-05
241-A-105	na	na	na	na	na	na	na	na	na	na	na
241-A-106	0.0275	0.0012	0.0198	79	165,497	10.0	0.82%	2.75E-03	1.98E-03	2.46E-03	1.15E-04
241-AX-101	0.0041	0.0002	0.0006	713	82,949	28.3	0.62%	1.17E-03	1.81E-04	6.70E-03	5.95E-05
241-AX-102	0.0034	0.0001	0.0050	30	174,302	16.5	0.14%	5.55E-04	8.23E-04	7.85E-04	9.04E-06
241-AX-103	0.0041	0.0002	0.0024	108	163,850	24.7	0.36%	1.02E-03	5.85E-04	3.25E-03	4.94E-05
241-AX-104	0.0007	0.0001	0.0016	7	177,339	7.0	0.24%	5.18E-05	1.15E-04	6.40E-04	7.37E-06
241-B-101	0.0013	0.0004	0.0086	109	99,114	7.8	0.25%	9.81E-05	6.72E-04	7.40E-04	3.40E-05
241-B-102	0.0005	0.0001	0.0063	32	109,354	7.0	0.20%	3.28E-05	4.40E-04	5.47E-04	9.64E-06
241-B-103	0.0008	0.0003	0.0061	56	106,176	7.0	0.21%	5.82E-05	4.26E-04	5.70E-04	1.78E-05
241-B-104	0.0005	0.0049	0.0076	374	63,589	7.0	0.40%	3.50E-05	5.31E-04	8.51E-04	3.41E-04
241-B-105	0.0012	0.0005	0.0092	290	74,854	7.0	0.29%	8.40E-05	6.45E-04	7.65E-04	3.27E-05
241-B-106	0.0005	0.0015	0.0240	123	97,242	7.0	0.26%	3.50E-05	1.68E-03	6.29E-04	1.08E-04
241-B-107	0.0021	0.0007	0.0017	161	92,051	7.0	0.27%	1.47E-04	1.19E-04	6.63E-04	4.95E-05
241-B-108	0.0034	0.0004	0.0087	92	101,303	7.0	0.24%	2.40E-04	6.08E-04	5.98E-04	3.00E-05
241-B-109	0.0042	0.0006	0.0117	125	96,924	7.0	0.28%	2.92E-04	8.21E-04	6.75E-04	4.05E-05
241-B-110	0.0050	0.0032	0.0050	245	80,822	7.0	0.38%	3.50E-04	3.49E-04	7.87E-04	2.24E-04

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Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-B-111	0.0025	0.0058	0.0090	241	81,352	3.5	0.76%	8.79E-05	3.15E-04	8.81E-04	2.02E-04
241-B-112	0.0031	0.0004	0.0068	35	108,966	7.0	0.23%	2.14E-04	4.74E-04	5.51E-04	3.04E-05
241-B-201	0.0005	0.0004	0.0006	30	3,880	7.0	0.06%	3.50E-05	4.16E-05	1.33E-04	2.67E-05
241-B-202	0.0003	0.0003	0.0017	29	4,021	7.2	0.05%	1.92E-05	1.23E-04	1.32E-04	2.49E-05
241-B-203	0.0005	0.0007	0.0105	52	1,055	0.3	1.73%	1.41E-06	2.95E-05	1.93E-04	1.89E-06
241-B-204	0.0005	0.0007	0.0103	51	1,161	0.3	1.80%	1.36E-06	2.79E-05	1.94E-04	1.79E-06
241-BX-101	0.0050	0.0006	0.0088	48	107,137	7.0	0.26%	3.50E-04	6.17E-04	5.98E-04	3.96E-05
241-BX-102	0.0003	0.0013	0.0017	112	98,521	7.0	0.27%	1.79E-05	1.19E-04	6.84E-04	8.85E-05
241-BX-103	0.0090	0.0009	0.0079	73	103,712	7.0	0.31%	6.27E-04	5.52E-04	6.47E-04	6.54E-05
241-BX-104	0.0212	0.0010	0.0130	100	100,110	8.7	0.35%	1.85E-03	1.14E-03	6.62E-04	9.12E-05
241-BX-105	0.0145	0.0006	0.0116	72	103,924	8.5	0.28%	1.23E-03	9.76E-04	5.91E-04	4.70E-05
241-BX-106	0.0047	0.0005	0.0043	38	108,479	7.0	0.24%	3.26E-04	3.02E-04	5.64E-04	3.50E-05
241-BX-107	0.0082	0.0004	0.0012	347	67,128	7.0	0.36%	5.74E-04	8.34E-05	8.45E-04	2.75E-05
241-BX-108	0.0024	0.0003	0.0053	31	109,291	7.0	0.22%	1.68E-04	3.73E-04	5.54E-04	2.40E-05
241-BX-109	0.0020	0.0025	0.0396	193	87,680	7.0	0.33%	1.40E-04	2.77E-03	7.35E-04	1.78E-04
241-BX-110	0.0063	0.0008	0.0017	205	86,091	7.0	0.33%	4.40E-04	1.19E-04	7.50E-04	5.57E-05
241-BX-111	0.0062	0.0002	0.0017	189	88,280	7.0	0.29%	4.35E-04	1.19E-04	6.83E-04	1.15E-05
241-BX-112	0.0122	0.0022	0.0339	164	91,529	7.0	0.36%	8.51E-04	2.37E-03	6.64E-04	1.52E-04
241-BY-101	0.0059	0.0010	0.0056	370	90,792	7.0	0.44%	4.15E-04	3.91E-04	1.08E-03	6.80E-05
241-BY-102	0.0173	0.0004	0.0017	276.8	103,222	7.0	0.40%	1.21E-03	1.22E-04	7.81E-04	2.75E-05
241-BY-103	0.0029	0.0002	0.0017	416	84,612	14.4	0.19%	4.12E-04	2.43E-04	9.57E-04	2.75E-05
241-BY-104	0.0259	0.0007	0.0250	358	92,346	7.6	0.65%	1.98E-03	1.92E-03	1.42E-03	5.41E-05
241-BY-105	0.0083	0.0004	0.0076	503	73,030	15.9	0.28%	1.32E-03	1.21E-03	1.39E-03	6.93E-05
241-BY-106	0.0079	0.0005	0.0132	561	65,226	5.9	0.99%	4.64E-04	7.75E-04	2.19E-03	2.89E-05

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Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-BY-107	0.0962	0.0010	0.0704	272	103,928	5.2	1.29%	5.03E-03	3.68E-03	1.31E-03	5.20E-05
241-BY-108	0.0870	0.0008	0.0553	222	110,531	6.8	0.98%	5.88E-03	3.74E-03	1.03E-03	5.16E-05
241-BY-109	0.0045	0.0002	0.0011	276.6	103,257	14.7	0.17%	6.57E-04	1.57E-04	7.79E-04	3.11E-05
241-BY-110	0.0397	0.0003	0.0102	366	91,357	13.3	0.68%	5.30E-03	1.37E-03	2.19E-03	4.36E-05
241-BY-111	0.0059	0.0003	0.0082	302	99,832	6.0	0.38%	3.51E-04	4.93E-04	7.99E-04	1.65E-05
241-BY-112	0.0063	0.0001	0.0039	286	101,986	13.6	0.19%	8.55E-04	5.34E-04	7.95E-04	1.72E-05
241-C-101	0.0098	0.0012	0.0636	88	101,868	3.6	0.56%	3.52E-04	2.29E-03	6.84E-04	4.30E-05
241-C-102	0.0187	0.0008	0.0141	316	136,094	11.8	0.34%	2.20E-03	1.66E-03	9.25E-04	9.81E-05
241-C-103*	0.0324	0.0016	0.0737	198	151,843	10.0	1.16%	3.24E-03	7.37E-03	3.64E-03	1.58E-04
241-C-104	0.0044	0.0004	0.0063	259	143,722	67.1	0.08%	2.96E-03	4.24E-03	1.23E-03	2.72E-04
241-C-105	0.0002	0.0000	0.0005	132	160,672	535.0	0.01%	1.29E-03	2.81E-03	8.08E-04	1.24E-04
241-C-106	0.0002	0.0001	0.0004	36	173,455	176.1	0.01%	4.38E-04	6.49E-04	8.00E-04	9.86E-05
241-C-107	0.0066	0.0010	0.0096	248	145,134	1.1	4.00%	7.24E-05	1.05E-04	1.73E-03	1.08E-05
241-C-108	0.0003	0.0000	0.0178	66	169,500	7.0	0.22%	1.84E-05	1.25E-03	6.10E-04	2.17E-06
241-C-109	0.0010	0.0001	0.0365	63	169,853	13.0	0.14%	1.30E-04	4.76E-03	6.71E-04	1.19E-05
241-C-110	0.0123	0.0031	0.0014	178	154,527	7.9	0.36%	9.69E-04	1.08E-04	6.80E-04	2.46E-04
241-C-111	0.0004	0.0001	0.0053	57	170,665	7.0	0.25%	2.74E-05	3.73E-04	6.83E-04	3.54E-06
241-C-112	0.0023	0.0001	0.0538	104	164,450	11.2	0.20%	2.52E-04	6.02E-03	8.26E-04	1.12E-05
241-C-201	0.0001	0.0000	0.0007	1	7,799	3.9	0.03%	4.02E-06	2.87E-05	4.04E-05	1.84E-06
241-C-202	0.0001	0.0000	0.0004	1	7,799	3.6	0.03%	2.48E-06	1.44E-05	4.03E-05	9.22E-07
241-C-203	0.0005	0.0001	0.0010	3	7,587	7.0	0.02%	3.23E-05	7.18E-05	4.54E-05	4.61E-06
241-C-204	0.0001	0.0001	0.0014	3	7,587	3.0	0.04%	2.18E-06	4.31E-05	4.50E-05	2.76E-06
241-S-101*	0.0765	0.0007	0.0197	424	83,651	6.2	1.16%	4.72E-03	1.21E-03	1.57E-03	4.36E-05
241-S-102*	0.0588	0.0008	0.0394	447	80,614	2.2	1.82%	1.29E-03	8.68E-04	1.24E-03	1.83E-05

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Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-S-103	0.0149	0.0005	0.0135	237	108,688	15.3	0.25%	2.28E-03	2.06E-03	8.75E-04	6.96E-05
241-S-104	0.0025	0.0047	0.0073	288	101,872	5.6	0.51%	1.40E-04	4.10E-04	9.00E-04	2.63E-04
241-S-105	0.0036	0.0002	0.0008	406	86,123	16.7	0.18%	6.00E-04	1.25E-04	1.01E-03	3.84E-05
241-S-106	0.0014	0.0016	0.0006	455	79,520	9.2	0.31%	1.27E-04	5.11E-05	1.00E-03	1.47E-04
241-S-107	0.0181	0.0010	0.0184	376	90,113	4.4	0.72%	7.93E-04	8.08E-04	1.02E-03	4.45E-05
241-S-108	0.0025	0.0001	0.0003	550	66,842	7.0	0.39%	1.77E-04	2.08E-05	1.04E-03	7.66E-06
241-S-109	0.0025	0.0196	0.0021	533	69,138	7.0	0.77%	1.74E-04	1.48E-04	1.01E-03	1.37E-03
241-S-110	0.0146	0.0005	0.0039	389	88,348	10.4	0.38%	1.52E-03	4.07E-04	1.15E-03	5.19E-05
241-S-111	0.0120	0.0003	0.0021	540	68,114	5.4	0.59%	6.49E-04	1.14E-04	1.09E-03	1.50E-05
241-S-112	0.0088	0.0003	0.0006	515	71,504	4.0	1.65%	3.52E-04	2.53E-05	2.54E-03	1.05E-05
241-SX-101	0.0004	0.0002	0.0007	426	116,458	40.0	0.10%	1.51E-04	2.74E-04	1.45E-03	6.57E-05
241-SX-102	0.0000	0.0002	0.0006	506	105,758	40.0	0.26%	0.00E+00	2.40E-04	4.08E-03	8.00E-05
241-SX-103*	0.0031	0.0005	0.0010	509	105,334	52.5	0.73%	1.61E-03	5.41E-04	1.47E-02	2.38E-04
241-SX-104	0.0005	0.0002	0.0007	446	113,774	30	0.33%	1.50E-04	2.00E-04	3.87E-03	6.53E-05
241-SX-105	0.0027	0.0002	0.0008	378	122,849	40.5	1.05%	1.09E-03	3.38E-04	1.66E-02	7.38E-05
241-SX-106	0.0177	0.0003	0.0023	397	120,378	38.8	0.21%	6.86E-03	9.10E-04	1.39E-03	1.07E-04
241-SX-107	0.0002	0.0000	0.0004	94	160,775	387.0	0.01%	6.73E-04	1.49E-03	8.38E-04	9.58E-05
241-SX-108	0.0001	0.0000	0.0003	73	163,635	455.0	0.01%	5.63E-04	1.25E-03	9.21E-04	8.02E-05
241-SX-109	0.0017	0.0001	0.0009	241	141,141	30.0	0.35%	5.05E-04	2.72E-04	4.06E-03	3.75E-05
241-SX-110	0.0001	0.0000	0.0003	56	165,895	293.0	0.02%	4.01E-04	8.90E-04	1.88E-03	5.71E-05
241-SX-111	0.0003	0.0000	0.0007	115	157,985	264.0	0.01%	7.89E-04	1.75E-03	1.13E-03	1.12E-04
241-SX-112	0.0003	0.0000	0.0007	75	163,388	225.0	0.01%	6.99E-04	1.55E-03	7.23E-04	9.95E-05
241-SX-113	0.0029	0.0004	0.0064	19	170,874	7.0	0.23%	2.01E-04	4.45E-04	5.56E-04	2.86E-05
241-SX-114	0.0004	0.0001	0.0008	157	152,406	325.0	0.01%	1.17E-03	2.60E-03	1.09E-03	1.67E-04

Author [illegible] Date 6/13/02, Check by SAB Date 6/13/02

Table D-1. Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions. (8 Sheets)

Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-SX-115	0.0003	0.0002	0.0025	4	172,887	7.0	0.22%	1.75E-05	1.72E-04	6.08E-04	1.11E-05
241-T-101	0.0022	0.0004	0.0050	99	100,350	7.0	0.26%	1.52E-04	3.47E-04	6.64E-04	2.76E-05
241-T-102	0.0005	0.0004	0.0066	32	109,354	7.0	0.20%	3.50E-05	4.59E-04	5.39E-04	2.95E-05
241-T-103	0.0005	0.0004	0.0055	27	110,025	7.0	0.21%	3.50E-05	3.88E-04	5.57E-04	2.49E-05
241-T-104	0.0104	0.0004	0.0008	317	71,287	7.0	0.37%	7.30E-04	5.26E-05	8.08E-04	2.75E-05
241-T-105	0.0094	0.0013	0.0201	98	100,526	7.0	0.31%	6.60E-04	1.41E-03	6.09E-04	9.03E-05
241-T-106	0.0100	0.0003	0.0043	22	110,732	7.0	0.27%	7.00E-04	3.01E-04	5.43E-04	1.94E-05
241-T-107	0.0123	0.0023	0.0041	173	90,497	6.4	0.40%	7.85E-04	2.62E-04	6.98E-04	1.48E-04
241-T-108	0.0020	0.0002	0.0041	16	111,508	7.0	0.21%	1.40E-04	2.85E-04	5.39E-04	1.40E-05
241-T-109	0.0005	0.0002	0.0049	62	105,329	7.0	0.21%	3.50E-05	3.45E-04	5.75E-04	1.75E-05
241-T-110	0.0107	0.0002	0.0015	370	64,190	7.0	0.40%	7.48E-04	1.02E-04	8.98E-04	1.70E-05
241-T-111	0.0223	0.0058	0.0013	447	53,878	6.0	0.65%	1.35E-03	7.64E-05	9.36E-04	3.52E-04
241-T-112	0.0029	0.0009	0.0137	67	104,728	7.0	0.24%	2.01E-04	9.62E-04	5.75E-04	6.17E-05
241-T-201	0.0001	0.0004	0.0059	31	3,774	7.0	0.05%	7.00E-06	4.16E-04	1.29E-04	2.67E-05
241-T-202	0.0002	0.0003	0.0043	21	5,080	7.0	0.04%	1.60E-05	3.01E-04	1.06E-04	1.94E-05
241-T-203	0.0000	0.0085	0.1318	37	2,997	0.4	1.19%	0.00E+00	5.02E-04	1.56E-04	3.23E-05
241-T-204	0.0001	0.0005	0.0078	37	2,997	7.0	0.07%	8.75E-06	5.45E-04	1.56E-04	3.50E-05
241-TX-101	0.0014	0.0011	0.0050	91	128,082	7.0	0.31%	9.65E-05	3.47E-04	7.66E-04	8.02E-05
241-TX-102	0.0168	0.0002	0.0054	217	111,238	11.5	0.29%	1.93E-03	6.28E-04	7.99E-04	2.24E-05
241-TX-103	0.0107	0.0003	0.0086	145	120,878	7.0	0.32%	7.49E-04	6.05E-04	6.91E-04	2.20E-05
241-TX-104	0.0028	0.0006	0.0050	69	130,977	3.5	0.46%	9.83E-05	1.73E-04	6.06E-04	2.07E-05
241-TX-105	0.0020	0.0001	0.0013	576	63,213	14.4	0.22%	2.83E-04	1.82E-04	1.18E-03	1.98E-05
241-TX-106	0.0252	0.0007	0.0050	348	93,687	7.0	0.53%	1.77E-03	3.47E-04	9.83E-04	4.69E-05
241-TX-107	0.0204	0.0002	0.0031	30	136,274	7.0	0.34%	1.43E-03	2.14E-04	5.63E-04	1.08E-05

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Table D-1. Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions. (8 Sheets)

Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-TX-108	0.0025	0.0001	0.0022	129	122,961	9.0	0.20%	2.21E-04	1.99E-04	6.47E-04	1.01E-05
241-TX-109	0.0400	0.0043	0.0668	363	91,675	7.0	0.66%	2.80E-03	4.68E-03	8.63E-04	3.00E-04
241-TX-110	0.0974	0.0003	0.0129	467	77,832	7.0	1.01%	6.82E-03	9.01E-04	9.93E-04	2.12E-05
241-TX-111	0.0605	0.0002	0.0175	365	91,392	9.7	0.64%	5.88E-03	1.70E-03	8.94E-04	1.87E-05
241-TX-112	0.0112	0.0007	0.0050	633	55,550	7.0	0.49%	7.84E-04	3.47E-04	1.14E-03	4.57E-05
241-TX-113	0.0021	0.0004	0.0050	638	54,914	9.3	0.32%	1.99E-04	4.61E-04	1.12E-03	3.46E-05
241-TX-114	0.0160	0.0002	0.0040	532	69,075	12.0	0.31%	1.93E-03	4.79E-04	9.80E-04	2.43E-05
241-TX-115	0.0014	0.0002	0.0046	554	66,214	10.0	0.27%	1.38E-04	4.58E-04	1.04E-03	2.32E-05
241-TX-116	0.0014	0.0012	0.0050	596	60,564	3.1	0.85%	4.34E-05	1.55E-04	1.03E-03	3.69E-05
241-TX-117	0.0014	0.0003	0.0050	481	75,996	6.5	0.37%	8.97E-05	3.22E-04	9.28E-04	1.87E-05
241-TX-118	0.0036	0.0022	0.0018	256	106,047	10.0	0.28%	3.57E-04	1.80E-04	8.56E-04	2.18E-04
241-TY-101	0.0016	0.0003	0.0097	118	124,578	3.2	0.50%	5.23E-05	3.15E-04	6.23E-04	8.38E-06
241-TY-102	0.0004	0.0003	0.0066	69	131,146	7.0	0.22%	2.84E-05	4.65E-04	5.88E-04	1.93E-05
241-TY-103	0.0045	0.0015	0.0198	155	119,635	8.2	0.31%	3.73E-04	1.63E-03	8.29E-04	1.23E-04
241-TY-104	0.0059	0.0003	0.0097	44	134,466	13.4	0.15%	7.87E-04	1.30E-03	5.65E-04	4.24E-05
241-TY-105	0.0003	0.0023	0.0051	231	109,500	7.0	0.32%	1.75E-05	3.54E-04	7.76E-04	1.59E-04
241-TY-106	0.0019	0.0003	0.0043	16	138,174	7.0	0.21%	1.36E-04	3.01E-04	5.36E-04	1.94E-05
241-U-101	0.0100	0.0003	0.0051	24	110,484	7.0	0.27%	7.00E-04	3.59E-04	5.56E-04	2.30E-05
241-U-102*	0.0651	0.0012	0.0805	293	74,466	2.1	2.19%	1.37E-03	1.69E-03	1.45E-03	2.47E-05
241-U-103*	0.0722	0.0014	0.0761	417	57,904	2.4	2.38%	1.73E-03	1.83E-03	1.80E-03	3.37E-05
241-U-104	0.0001	0.0006	0.0085	122	97,313	7.0	0.29%	4.88E-06	5.96E-04	7.81E-04	3.89E-05
241-U-105*	0.1936	0.0039	0.1324	353	66,450	5.0	2.11%	9.68E-03	6.62E-03	1.49E-03	1.96E-04
241-U-106	0.0940	0.0052	0.0554	170	90,886	1.3	3.69%	1.22E-03	7.20E-04	1.54E-03	6.81E-05
241-U-107*	0.0448	0.0010	0.0445	411	58,681	11.8	0.52%	5.27E-03	5.23E-03	9.66E-04	1.12E-04

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Table D-1. Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions. (8 Sheets)

Tank	Ammonia headspace concentration $[NH_3]$ (%)	Methane headspace concentration $[CH_4]$ (%)	N_2O headspace concentration $[N_2O]$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)
241-U-108*	0.0684	0.0011	0.0485	468	51,053	3.6	1.46%	2.47E-03	1.75E-03	1.42E-03	3.94E-05
241-U-109	0.0005	0.0010	0.0499	412	58,610	4.3	0.59%	2.14E-05	2.14E-03	9.71E-04	4.45E-05
241-U-110	0.0225	0.0091	0.1418	176	90,144	1.9	1.30%	4.24E-04	2.67E-03	7.31E-04	1.71E-04
241-U-111	0.0669	0.0012	0.0324	340	68,145	1.9	1.83%	1.27E-03	6.15E-04	1.04E-03	2.27E-05
241-U-112	0.0301	0.0035	0.0203	45	107,553	1.3	1.39%	3.85E-04	2.60E-04	5.73E-04	4.52E-05
241-U-201	0.0005	0.0001	0.0010	5	7,270	7.0	0.02%	3.23E-05	7.18E-05	4.96E-05	4.61E-06
241-U-202	0.0005	0.0001	0.0010	4	7,340	7.0	0.02%	3.23E-05	7.18E-05	4.79E-05	4.61E-06
241-U-203	0.0001	0.0001	0.0021	4	7,340	2.1	0.06%	1.77E-06	4.31E-05	4.78E-05	2.76E-06
241-U-204	0.0000	0.0000	0.0004	4	7,411	10.2	0.01%	1.35E-06	4.31E-05	4.61E-05	2.76E-06

Note: For all DSTs and SSTs with "*", the ammonia was analyzed with equilibrium model.

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-AN-101	0.48	0.09	0.01	0.04	0.25	2.18	0.04	0.80	3
241-AN-102	0.15	8.164	0.09	0.22	4.28	204.09	0.57	4.33	209
241-AN-103	0.19	1.61	0.20	0.11	0.34	40.33	1.36	2.17	44
241-AN-104	0.15	3.25	0.20	0.13	0.48	81.36	1.34	2.63	85
241-AN-105	0.12	3.67	0.15	0.19	1.10	91.66	1.02	3.77	96
241-AN-106	0.57	0.05	0.01	0.00	0.04	1.28	0.08	0.04	1
241-AN-107	0.15	6.32	0.08	0.41	4.47	158.07	0.51	8.22	167
241-AP-101	0.12	0.82	0.08	0.27	5.42	20.44	0.55	5.48	26
241-AP-102	0.13	0.99	0.07	0.25	4.89	24.70	0.49	4.95	30
241-AP-103	0.47	0.12	0.02	0.02	0.36	2.90	0.17	0.37	3
241-AP-104	0.12	1.38	0.01	0.01	0.11	34.53	0.09	0.12	35
241-AP-105	0.11	1.16	0.08	0.20	4.00	29.06	0.53	4.05	34
241-AP-106	0.33	0.29	0.01	0.01	0.17	7.19	0.07	0.17	7
241-AP-107	0.18	0.90	0.09	0.16	3.25	22.49	0.61	3.29	26
241-AP-108	0.57	0.05	0.09	0.00	0.38	1.23	0.57	0.04	2
241-AW-101	0.12	4.33	0.01	0.13	0.62	108.22	0.06	2.66	111
241-AW-102	0.55	0.08	0.01	0.00	0.09	2.05	0.05	0.09	2
241-AW-103	0.13	0.80	0.04	0.37	0.97	20.05	0.29	7.37	28
241-AW-104	0.46	0.09	0.01	0.23	0.28	2.34	0.09	4.52	7
241-AW-105	0.41	0.11	0.06	0.10	0.44	2.83	0.42	1.93	5
241-AW-106	0.46	0.25	0.12	0.03	0.61	6.19	0.78	0.62	8
241-AY-101	0.51	0.16	0.03	0.03	0.43	3.97	0.19	0.56	5
241-AY-102	0.32	9.86	0.02	0.11	0.77	246.45	0.14	2.24	249
241-AZ-101	0.19	3.53	0.03	0.40	0.78	88.36	0.22	8.05	97

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-AZ-102	0.17	6.24	0.12	0.50	0.65	155.92	0.79	10.02	167
241-SY-101	0.18	1.98	0.39	0.20	1.34	49.45	2.58	3.91	56
241-SY-102	0.16	1.42	0.18	0.99	1.25	35.46	1.18	19.85	56
241-SY-103	0.27	1.21	0.56	0.11	0.68	30.18	3.72	2.29	36
241-A-101	0.25	5.25	0.29	0.02	0.54	131.13	1.95	0.44	134
241-A-102	0.53	0.14	0.36	0.00	0.32	3.38	2.41	0.05	6
241-A-103	0.40	0.98	0.29	0.01	0.56	24.51	1.95	0.20	27
241-A-104	0.54	0.86	0.01	0.00	0.07	21.40	0.06	0.10	22
241-A-105	na	na	na	na	na	na	na	na	na
241-A-106	0.52	0.47	0.53	0.02	0.38	11.87	3.54	0.45	16
241-AX-101	0.26	2.59	0.45	0.02	0.07	64.64	3.02	0.46	68
241-AX-102	0.54	0.14	0.10	0.00	0.15	3.60	0.68	0.03	4
241-AX-103	0.51	0.63	0.20	0.01	0.11	15.86	1.33	0.19	17
241-AX-104	0.55	0.12	0.01	0.00	0.02	2.89	0.06	0.03	3
241-B-101	0.31	0.24	0.03	0.01	0.22	5.98	0.21	0.22	6
241-B-102	0.34	0.16	0.01	0.00	0.13	4.00	0.06	0.06	4
241-B-103	0.33	0.17	0.02	0.01	0.13	4.30	0.12	0.11	5
241-B-104	0.20	0.43	0.02	0.17	0.27	10.70	0.12	3.43	14
241-B-105	0.23	0.33	0.04	0.01	0.28	8.18	0.24	0.28	9
241-B-106	0.30	0.21	0.01	0.04	0.55	5.17	0.08	0.71	6
241-B-107	0.29	0.23	0.05	0.02	0.04	5.77	0.34	0.34	6
241-B-108	0.32	0.19	0.08	0.01	0.19	4.72	0.50	0.19	5
241-B-109	0.30	0.22	0.10	0.01	0.27	5.57	0.64	0.27	6
241-B-110	0.25	0.31	0.14	0.09	0.14	7.79	0.92	1.77	10

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-B-111	0.25	0.35	0.03	0.08	0.12	8.66	0.23	1.59	10
241-B-112	0.34	0.16	0.06	0.01	0.14	4.05	0.42	0.18	5
241-B-201	0.01	1.10	0.29	0.22	0.34	27.43	1.92	4.41	34
241-B-202	0.01	1.05	0.15	0.20	0.98	26.30	1.02	3.96	31
241-B-203	0.003	5.86	0.04	0.06	0.90	146.42	0.29	1.15	148
241-B-204	0.004	5.35	0.04	0.05	0.77	133.65	0.25	0.99	135
241-BX-101	0.33	0.18	0.10	0.01	0.18	4.47	0.70	0.24	5
241-BX-102	0.31	0.22	0.01	0.03	0.04	5.56	0.04	0.57	6
241-BX-103	0.32	0.20	0.19	0.02	0.17	4.99	1.29	0.40	7
241-BX-104	0.31	0.21	0.59	0.03	0.36	5.29	3.94	0.58	10
241-BX-105	0.32	0.18	0.38	0.01	0.30	4.55	2.52	0.29	7
241-BX-106	0.34	0.17	0.10	0.01	0.09	4.16	0.64	0.21	5
241-BX-107	0.21	0.40	0.27	0.01	0.04	10.07	1.82	0.26	12
241-BX-108	0.34	0.16	0.05	0.01	0.11	4.05	0.33	0.14	5
241-BX-109	0.27	0.27	0.05	0.06	1.01	6.70	0.34	1.30	8
241-BX-110	0.27	0.28	0.16	0.02	0.04	6.97	1.09	0.41	8
241-BX-111	0.28	0.25	0.16	0.00	0.04	6.19	1.05	0.08	7
241-BX-112	0.29	0.23	0.30	0.05	0.83	5.80	1.98	1.06	9
241-BY-101	0.28	0.38	0.15	0.02	0.14	9.48	0.98	0.48	11
241-BY-102	0.32	0.24	0.38	0.01	0.04	6.05	2.51	0.17	9
241-BY-103	0.26	0.36	0.16	0.01	0.09	9.05	1.04	0.21	10
241-BY-104	0.29	0.49	0.69	0.02	0.66	12.31	4.57	0.37	17
241-BY-105	0.23	0.61	0.58	0.03	0.53	15.26	3.86	0.61	20
241-BY-106	0.20	1.07	0.23	0.01	0.38	26.85	1.52	0.28	29

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-BY-107	0.32	0.40	1.00	0.02	1.13	10.07	6.67	0.32	17
241-BY-108	0.35	0.30	1.00	0.01	1.08	7.44	6.67	0.30	14
241-BY-109	0.32	0.24	0.20	0.01	0.05	6.03	1.36	0.19	8
241-BY-110	0.29	0.77	1.00	0.02	0.48	19.15	6.67	0.31	26
241-BY-111	0.31	0.26	0.11	0.01	0.16	6.41	0.75	0.11	7
241-BY-112	0.32	0.25	0.27	0.01	0.17	6.24	1.79	0.11	8
241-C-101	0.32	0.21	0.11	0.01	0.72	5.37	0.74	0.27	6
241-C-102	0.43	0.22	0.52	0.02	0.39	5.44	3.45	0.46	9
241-C-103	0.47	0.77	0.32	0.03	1.55	19.18	2.11	0.66	22
241-C-104	0.45	0.27	0.66	0.06	0.94	6.87	4.39	1.21	12
241-C-105	0.50	0.16	0.26	0.02	0.56	4.02	1.72	0.50	6
241-C-106	0.54	0.15	0.08	0.02	0.12	3.69	0.54	0.36	5
241-C-107	0.45	0.38	0.02	0.00	0.02	9.56	0.11	0.05	10
241-C-108	0.53	0.12	0.00	0.00	0.24	2.88	0.02	0.01	3
241-C-109	0.53	0.13	0.02	0.00	0.90	3.16	0.16	0.04	3
241-C-110	0.48	0.14	0.20	0.05	0.02	3.52	1.34	1.02	6
241-C-111	0.53	0.13	0.01	0.00	0.07	3.20	0.03	0.01	3
241-C-112	0.51	0.16	0.05	0.00	1.17	4.02	0.33	0.04	4
241-C-201	0.02	0.17	0.02	0.01	0.12	4.14	0.11	0.15	4
241-C-202	0.02	0.17	0.01	0.00	0.06	4.13	0.07	0.08	4
241-C-203	0.02	0.19	0.14	0.02	0.30	4.79	0.91	0.39	6
241-C-204	0.02	0.19	0.01	0.01	0.18	4.74	0.06	0.23	5
241-S-101	0.26	0.60	0.58	0.02	0.46	14.98	3.88	0.33	19
241-S-102	0.25	0.49	0.43	0.01	0.34	12.30	2.87	0.15	15

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-S-103	0.34	0.26	0.67	0.02	0.61	6.44	4.47	0.41	11
241-S-104	0.32	0.28	0.04	0.08	0.13	7.07	0.29	1.65	9
241-S-105	0.27	0.37	0.22	0.01	0.05	9.34	1.49	0.29	11
241-S-106	0.25	0.40	0.05	0.06	0.02	10.09	0.34	1.18	12
241-S-107	0.28	0.36	0.28	0.02	0.29	9.05	1.88	0.32	11
241-S-108	0.21	0.50	0.08	0.00	0.01	12.41	0.57	0.07	13
241-S-109	0.22	0.47	0.08	0.63	0.07	11.69	0.54	12.67	25
241-S-110	0.28	0.42	0.55	0.02	0.15	10.42	3.66	0.38	14
241-S-111	0.21	0.51	0.30	0.01	0.05	12.83	2.03	0.14	15
241-S-112	0.22	1.14	0.16	0.00	0.01	28.45	1.05	0.09	30
241-SX-101	0.36	0.40	0.04	0.02	0.08	9.97	0.28	0.36	11
241-SX-102	0.33	1.23	0.00	0.02	0.07	30.86	0.00	0.48	31
241-SX-103	0.33	4.47	0.22	0.07	0.16	111.64	1.44	1.45	115
241-SX-104	0.36	1.09	0.04	0.02	0.06	27.18	0.28	0.37	28
241-SX-105	0.38	4.32	0.28	0.02	0.09	108.04	1.90	0.38	110
241-SX-106	0.38	0.37	1.00	0.03	0.24	9.24	5.83	0.57	16
241-SX-107	0.50	0.17	0.13	0.02	0.30	4.17	0.89	0.38	5
241-SX-108	0.51	0.18	0.11	0.02	0.24	4.50	0.73	0.31	6
241-SX-109	0.44	0.92	0.11	0.01	0.06	23.03	0.76	0.17	24
241-SX-110	0.52	0.36	0.08	0.01	0.17	9.07	0.52	0.22	10
241-SX-111	0.49	0.23	0.16	0.02	0.35	5.73	1.07	0.46	7
241-SX-112	0.51	0.14	0.14	0.02	0.30	3.54	0.91	0.39	5
241-SX-113	0.53	0.10	0.04	0.01	0.08	2.60	0.25	0.11	3
241-SX-114	0.48	0.23	0.25	0.04	0.55	5.70	1.64	0.70	8

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-SX-115	0.54	0.11	0.00	0.00	0.03	2.81	0.02	0.04	3
241-T-101	0.31	0.21	0.05	0.01	0.11	5.29	0.32	0.18	6
241-T-102	0.34	0.16	0.01	0.01	0.13	3.94	0.07	0.17	4
241-T-103	0.34	0.16	0.01	0.01	0.11	4.05	0.07	0.14	4
241-T-104	0.22	0.36	0.33	0.01	0.02	9.07	2.18	0.25	11
241-T-105	0.31	0.19	0.21	0.03	0.45	4.85	1.40	0.57	7
241-T-106	0.35	0.16	0.20	0.01	0.09	3.92	1.35	0.11	5
241-T-107	0.28	0.25	0.28	0.05	0.09	6.17	1.85	1.04	9
241-T-108	0.35	0.15	0.04	0.00	0.08	3.87	0.27	0.08	4
241-T-109	0.33	0.17	0.01	0.01	0.10	4.37	0.07	0.11	5
241-T-110	0.20	0.45	0.37	0.01	0.05	11.19	2.49	0.17	14
241-T-111	0.17	0.56	0.80	0.21	0.05	13.90	5.34	4.18	23
241-T-112	0.33	0.18	0.06	0.02	0.29	4.40	0.41	0.38	5
241-T-201	0.01	1.09	0.06	0.23	3.53	27.31	0.40	4.53	32
241-T-202	0.02	0.67	0.10	0.12	1.90	16.68	0.67	2.44	20
241-T-203	0.01	1.66	0.00	0.34	5.36	41.60	0.00	6.89	48
241-T-204	0.01	1.67	0.09	0.37	5.82	41.70	0.62	7.48	50
241-TX-101	0.40	0.19	0.02	0.02	0.09	4.78	0.16	0.40	5
241-TX-102	0.35	0.23	0.56	0.01	0.18	5.75	3.71	0.13	10
241-TX-103	0.38	0.18	0.20	0.01	0.16	4.58	1.32	0.12	6
241-TX-104	0.41	0.15	0.02	0.01	0.04	3.70	0.16	0.10	4
241-TX-105	0.20	0.60	0.14	0.01	0.09	14.97	0.95	0.20	16
241-TX-106	0.29	0.34	0.60	0.02	0.12	8.39	4.02	0.32	13
241-TX-107	0.43	0.13	0.33	0.00	0.05	3.30	2.23	0.05	6

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-TX-108	0.38	0.17	0.06	0.00	0.05	4.21	0.38	0.05	5
241-TX-109	0.29	0.30	0.98	0.10	1.63	7.53	6.52	2.10	16
241-TX-110	0.24	0.41	1.00	0.01	0.37	10.20	6.67	0.17	17
241-TX-111	0.29	0.31	1.00	0.01	0.59	7.83	6.67	0.13	15
241-TX-112	0.17	0.66	0.45	0.03	0.20	16.42	3.01	0.53	20
241-TX-113	0.17	0.65	0.12	0.02	0.27	16.31	0.77	0.40	17
241-TX-114	0.22	0.45	0.89	0.01	0.22	11.35	5.95	0.22	18
241-TX-115	0.21	0.50	0.07	0.01	0.22	12.55	0.44	0.22	13
241-TX-116	0.19	0.54	0.02	0.02	0.08	13.54	0.15	0.39	14
241-TX-117	0.24	0.39	0.04	0.01	0.14	9.77	0.25	0.16	10
241-TX-118	0.33	0.26	0.11	0.07	0.05	6.46	0.72	1.32	8
241-TY-101	0.39	0.16	0.01	0.00	0.08	4.00	0.09	0.04	4
241-TY-102	0.41	0.14	0.01	0.00	0.11	3.59	0.05	0.09	4
241-TY-103	0.37	0.22	0.10	0.03	0.44	5.54	0.67	0.66	7
241-TY-104	0.42	0.13	0.19	0.01	0.31	3.36	1.25	0.20	5
241-TY-105	0.34	0.23	0.01	0.05	0.10	5.67	0.03	0.93	7
241-TY-106	0.43	0.12	0.03	0.00	0.07	3.10	0.21	0.09	3
241-U-101	0.35	0.16	0.20	0.01	0.10	4.02	1.35	0.13	6
241-U-102	0.23	0.62	0.22	0.01	0.73	15.62	1.44	0.21	17
241-U-103	0.18	0.99	0.46	0.02	1.01	24.85	3.05	0.37	28
241-U-104	0.30	0.26	0.00	0.01	0.20	6.42	0.01	0.26	7
241-U-105	0.21	0.72	0.69	0.09	3.19	17.96	4.61	1.89	24
241-U-106	0.28	0.54	0.43	0.02	0.25	13.56	2.87	0.48	17
241-U-107	0.18	0.53	0.14	0.06	2.85	13.17	0.92	1.22	15

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Table D-2. Steady-State Gas Concentrations and Flammability Levels With Barometric Breathing Rate. (8 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
241-U-108	0.16	0.89	0.43	0.02	1.10	22.30	2.90	0.49	26
241-U-109	0.18	0.53	0.01	0.02	1.17	13.26	0.08	0.49	14
241-U-110	0.28	0.26	0.15	0.06	0.95	6.49	1.00	1.22	9
241-U-111	0.21	0.49	0.60	0.01	0.29	12.16	3.98	0.21	16
241-U-112	0.34	0.17	0.11	0.01	0.08	4.26	0.76	0.27	5
241-U-201	0.02	0.22	0.14	0.02	0.32	5.46	0.95	0.41	7
241-U-202	0.02	0.21	0.14	0.02	0.31	5.22	0.94	0.40	7
241-U-203	0.02	0.21	0.01	0.01	0.19	5.21	0.05	0.24	6
241-U-204	0.02	0.20	0.01	0.01	0.19	4.98	0.04	0.24	5

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Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-AN-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-102	27	1.28	0.94	0.09	0.03	0.49	23.44	0.57	0.50
241-AN-103	183	0.34	0.91	0.16	0.06	0.19	22.66	1.04	1.22
241-AN-104	73	0.53	0.91	0.18	0.04	0.13	22.82	1.21	0.74
241-AN-105	64	0.47	0.92	0.14	0.05	0.28	23.03	0.93	0.95
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	35	1.06	0.92	0.08	0.06	0.66	23.08	0.51	1.21
241-AP-101	637	0.13	0.77	0.08	0.26	5.11	19.28	0.55	5.17
241-AP-102	389	0.16	0.82	0.07	0.20	4.04	20.42	0.49	4.09
241-AP-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-104	281	0.18	0.99	0.01	0.00	0.08	24.82	0.09	0.08
241-AP-105	298	0.16	0.86	0.08	0.15	2.96	21.47	0.53	2.99
241-AP-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-107	649	0.19	0.85	0.09	0.16	3.08	21.27	0.61	3.11
241-AP-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-101	56	0.53	0.97	0.01	0.03	0.14	24.33	0.06	0.59
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	514	0.14	0.72	0.04	0.33	0.87	18.06	0.29	6.63
241-AW-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-102	23	3.29	0.97	0.02	0.01	0.08	24.28	0.11	0.22
241-AZ-101	66	0.76	0.91	0.01	0.10	0.20	22.78	0.10	2.08

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Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-AZ-102	35	1.17	0.92	0.04	0.07	0.10	22.90	0.27	1.47
241-SY-101	121	0.45	0.83	0.39	0.08	0.56	20.77	2.58	1.64
241-SY-102	125	0.37	0.61	0.17	0.43	0.54	15.27	1.16	8.54
241-SY-103	236	0.42	0.79	0.55	0.08	0.45	19.76	3.69	1.50
241-A-101	44	1.39	0.96	0.11	0.00	0.11	24.11	0.70	0.09
241-A-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-103	591	0.43	0.92	0.29	0.01	0.52	22.88	1.93	0.19
241-A-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-105	na	na	na	na	na	na	na	na	na
241-A-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-101	101	0.72	0.95	0.17	0.01	0.03	23.71	1.12	0.17
241-AX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-B-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-201	299	0.02	0.81	0.21	0.16	0.25	20.31	1.42	3.26
241-B-202	356	0.02	0.84	0.12	0.16	0.78	21.02	0.81	3.17
241-B-203	41	0.02	0.99	0.01	0.01	0.16	24.74	0.05	0.20
241-B-204	45	0.02	0.99	0.01	0.01	0.15	24.76	0.05	0.19
241-BX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-106	455	0.24	0.94	0.20	0.01	0.33	23.42	1.33	0.25

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-BY-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-110	632	0.37	0.72	1.00	0.01	0.45	18.05	6.67	0.29
241-BY-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-203	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-204	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen *flammability* at time $t_{25\%}$ (%)	Ammonia *flammability* at time $t_{25\%}$ (%)	Methane *flammability* at time $t_{25\%}$ (%)
241-S-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-112	413	0.27	0.96	0.13	0.00	0.01	24.03	0.89	0.08
241-SX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-102	355	0.42	0.98	0.00	0.02	0.06	24.61	0.00	0.39
241-SX-103	52	1.55	0.93	0.16	0.02	0.04	23.32	1.06	0.31
241-SX-104	508	0.40	0.98	0.04	0.02	0.05	24.42	0.25	0.33
241-SX-105	57	1.73	0.98	0.07	0.00	0.02	24.46	0.44	0.09
241-SX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-113	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-114	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-SX-115	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-201	331	0.02	0.85	0.05	0.18	2.74	21.18	0.31	3.54
241-T-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-203	147	0.02	0.86	0.00	0.17	2.67	21.57	0.00	3.43
241-T-204	154	0.02	0.84	0.05	0.19	2.92	20.94	0.31	3.76
241-TX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-TX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-113	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-114	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-115	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-116	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-117	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-118	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-103	441	0.21	0.87	0.46	0.02	0.88	21.63	3.04	0.33
241-U-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-3. Time to Reach 25% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
241-U-108	766	0.17	0.86	0.43	0.02	1.07	21.62	2.90	0.48
241-U-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-203	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-204	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-AN-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-102	143	0.31	3.88	0.09	0.10	2.03	96.90	0.57	2.06
241-AN-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	202	0.26	3.78	0.08	0.25	2.67	94.40	0.51	4.91
241-AP-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-101	514	0.13	3.90	0.01	0.12	0.56	97.54	0.06	2.40
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-102	114	0.80	3.96	0.02	0.05	0.31	98.94	0.14	0.90
241-AZ-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-AZ-102	202	0.29	3.73	0.11	0.30	0.39	93.18	0.72	5.99
241-SY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-101	303	0.34	3.91	0.27	0.02	0.40	97.76	1.79	0.33
241-A-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-105	na	na	na	na	na	na	na	na	na
241-A-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-B-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-B-203	250	0.005	3.96	0.03	0.04	0.61	99.02	0.19	0.81
241-B-204	300	0.005	3.96	0.03	0.04	0.57	99.08	0.19	0.75
241-BX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-BY-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-BY-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-203	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-C-204	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-S-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-S-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-103	455	0.38	3.89	0.22	0.06	0.14	97.24	1.44	1.26
241-SX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-105	526	0.42	3.75	0.86	0.02	0.08	93.85	5.77	0.33
241-SX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-113	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-114	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-SX-115	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-203	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-204	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-TX-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-109	not occur	not occur	not occur	not occur	not occur	8.00	not occur	not occur	not occur
241-TX-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-113	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-114	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-115	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-116	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-117	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TX-118	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-TY-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-105	not occur	not occur	1.87	0.69	0.24	7.99	not occur	not occur	not occur
241-U-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-107	not occur	not occur	not occur	not occur	not occur	7.99	not occur	not occur	not occur

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Table D-4. Time to Reach 100% LFL and Flammability Dist. Among Gases With Barometric Breathing Rate. (8 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (%)	Ammonia flammability at time $t_{100\%}$ (%)	Methane flammability at time $t_{100\%}$ (%)
241-U-108	not occur	not occur	not occur	not occur	not occur	4.68	not occur	not occur	not occur
241-U-109	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-110	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-111	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-112	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-201	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-203	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-204	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

APPENDIX E

EQUATIONS TO CALCULATE THE MASS TRANSPORT COEFFICIENT h FOR SOLUBLE GAS

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As described in RPP-4941, the overall mass transport coefficient for steady state can be written in terms of the mass transport coefficient in vapor phase h_g and in liquid h_l as:

$$h = \frac{1}{\frac{1}{h_l} + \frac{K_H RT}{h_g}}$$

with

$$h_g = 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{1/3}$$

$$h_l = 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_L}\right)^{1/3} \cdot \left(\frac{g \cdot \beta_L \cdot \rho_L^{\,2} \cdot \Delta T}{\mu_L^{\,2}}\right)^{1/3}$$

and

$$S_c = \frac{\mu_g}{D_g \cdot \rho_g} \qquad G_r = \frac{g \cdot \beta_g \cdot \rho_g^{\,2} \cdot L_c^{\,3} \cdot \Delta T}{\mu_g^{\,2}}$$

where:

ρ_g	=	Density of Gas	kg/m^3	1.17
D_g	=	Diffusion Coefficient in Gas Phase	m^2/s	2.50 E-05
μ_g	=	Viscosity of Gas	kg/m-s	2.0 E-05
S_c	=	Schmidt Number	(none)	6.84 E-01
G	=	Gravitational Constant	m/s^2	9.8
ΔT	=	Delta temperature between waste surface & gas	°K	1.00
β_g	=	Thermal expansion Coef. of Gas	$(°K)^{-1}$	3.30 E-03
L_c	=	Characteristic length(1/4of Diameter)	m	5.7825
G_r	=	Grashoff Number	(none)	2.14 E+10
h_g	=	Vapor Film Coefficient.	m/s	0.001586
D_L	=	Diffusion Coefficient in Liquid Phase	m^2/s	2.8 E-09
ρ_L	=	Density of Liquid	kg/m^3	1300
μ_L	=	Viscosity of Liquid	kg/m-s	6.82 E-04
β_L	=	Thermal Expansion Coef. of Liquid	$(°K)^{-1}$	3.02 E-04
h_L	=	Liquid Film Coefficient.	m/s	5.3047 E-06

The last column lists the typical values used in the calculation of h.

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APPENDIX F

WASTE ADDITION STUDIES: CALCULATION OF HYDROGEN GENERATION RATE CALCULATION, AMMONIA MASS TRANSPORT PROPERTIES, FLAMMABILITY LEVELS, AND TIME TO REACH 25% AND 100% OF THE LOWER FLAMMABILITY LIMITS

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Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table F-1. Water Addition Study: Input Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Water added (dilution factor) (kL)	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Aluminum in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. Tw (°C)	Dome temp. Td (°C)
241-AY-102	436 (1.25)	1.50E+03	3.75E+03	3.21E+02	9.39E+02	1.26E+03	5.47E+01	1.18	2839	76%	52	44
AY-102 liquid		1.31E+03	4.788E+03	3.28E+02	1.19E+03	1.22E+00	2.20E+01	1.12	2193	89%	45	44
AY-102 solid		2.12E+03	2.29E+02	2.95E+02	1.00E+02	5.85E+03	1.79E+02	1.40	646	38%	72	44
241-AN-101	3359 (4.51)	2.66E+02	9.52E+03	1.66E+04	2.57E+03	9.25E-03	1.88E+01	1.04	4315	93%	24	25
AN-101 liquid		2.66E+02	9.52E+03	1.66E+04	2.57E+03	9.25E-03	1.88E+01	1.04	4315	93%	24	25
AN-101 solid		2.46E+02	8.48E+03	1.52E+04	2.24E+03	7.66E-03	1.71E+01	1.04	0	0%	0	0
241-AN-102	325 (1.09)	2.39E+04	8.73E+04	2.19E+05	1.48E+04	6.13E+01	2.01E+02	1.41	4315	51%	33	31
AN-102 liquid		2.37E+04	8.67E+04	2.17E+05	1.47E+04	5.48E+01	1.97E+02	1.39	3978	52%	33	31
AN-102 solid		2.58E+04	9.44E+04	2.37E+05	1.60E+04	1.44E+02	2.78E+02	1.56	337	41%	33	31
241-AN-103	696 (1.37)	2.06E+03	1.30E+05	1.32E+05	2.37E+04	9.02E-01	2.55E+02	1.47	4315	49%	40	31
AN-103 liquid		1.76E+03	1.11E+05	1.13E+05	2.03E+04	7.43E-03	2.96E+02	1.32	2579	61%	40	31
AN-103 solid		2.60E+03	1.64E+05	1.67E+05	3.00E+04	2.80E+00	2.58E+02	1.72	1533	32%	40	31
241-AN-104	333 (1.16)	2.78E+03	9.94E+04	1.52E+05	3.45E+04	1.15E+01	2.88E+02	1.43	4315	53%	41	33
AN-104 liquid		2.54E+03	9.07E+04	1.39E+05	3.15E+04	5.07E-02	3.05E+02	1.32	2416	58%	41	33
AN-104 solid		3.14E+03	1.12E+05	1.72E+05	3.90E+04	3.09E+01	3.22E+02	1.59	1736	46%	41	33
241-AN-105	45 (1.02)	3.44E+03	1.17E+05	1.57E+05	3.98E+04	6.45E+00	2.03E+02	1.49	4315	49%	38	32
AN-105 liquid		3.37E+03	1.14E+05	1.53E+05	3.89E+04	2.49E-02	2.09E+02	1.40	2452	52%	38	32
AN-105 solid		3.56E+03	1.21E+05	1.62E+05	4.11E+04	1.67E+01	2.27E+02	1.62	1772	44%	38	32
241-AN-106	4172 (53.81)	1.55E+02	6.29E+02	2.35E+03	1.15E+02	5.11E-01	3.29E+00	1.01	4315	98%	22	23
AN-106 liquid		8.70E+01	3.53E+02	1.32E+03	6.45E+01	5.54E-04	1.12E+00	1.00	4251	99%	22	23
AN-106 solid		4.68E+03	1.90E+04	7.09E+04	3.47E+03	3.47E+01	1.49E+02	1.58	64	40%	22	23
241-AN-107	375 (1.12)	3.80E+04	6.05E+04	2.19E+05	2.69E+02	8.18E+01	2.18E+02	1.38	4315	51%	32	29
AN-107 liquid		3.70E+04	5.89E+04	2.13E+05	2.62E+02	6.43E+01	2.27E+02	1.33	3380	54%	32	29
AN-107 solid		4.16E+04	6.62E+04	2.40E+05	2.95E+02	1.59E+02	2.23E+02	1.56	935	40%	32	29

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Table F-1. Water Addition Study: Input Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Water added (dilution factor) (kL)	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Aluminum in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. Tw (°C)	Dome temp. Td (°C)
241-AP-101	99 (1.02)	1.91E+03	4.10E+04	1.29E+05	6.79E+03	6.40E-02	1.06E+02	1.30	4315	59%	23	23
AP-101 liquid		1.91E+03	4.10E+04	1.29E+05	6.79E+03	6.40E-02	1.06E+02	1.30	4315	59%	23	23
AP-101 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-102	193 (1.05)	3.27E+03	3.64E+04	7.48E+04	1.10E+04	9.58E-01	1.52E+02	1.19	4315	76%	24	24
AP-102 liquid		3.27E+03	3.64E+04	7.48E+04	1.10E+04	9.58E-01	1.52E+02	1.19	4315	76%	24	24
AP-102 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-103	3248 (4.04)	9.59E+02	2.66E+04	3.38E+04	2.11E+03	1.01E-01	4.62E+01	1.08	4315	99%	24	24
AP-103 liquid		9.59E+02	2.66E+04	3.38E+04	2.11E+03	1.01E-01	4.62E+01	1.08	4315	99%	24	24
AP-103 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-104	117 (1.03)	5.01E+03	5.77E+04	1.01E+05	1.68E+04	4.04E+00	1.46E+02	1.24	4315	97%	25	24
AP-104 liquid		5.01E+03	5.77E+04	1.01E+05	1.68E+04	4.04E+00	1.46E+02	1.24	4315	97%	25	24
AP-104 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-105	19 (1.0)	2.87E+03	1.02E+05	2.38E+05	2.08E+04	4.25E+00	1.46E+02	1.37	4315	61%	24	19
Ap-105 liquid		2.87E+03	1.02E+05	2.38E+05	2.08E+04	2.03E+00	1.49E+02	1.35	3978	62%	24	19
AP-105 solid		2.88E+03	1.02E+05	2.39E+05	2.09E+04	3.12E+01	1.34E+02	1.58	337	45%	24	19
241-AP-106	1957 (1.83)	2.32E+03	3.17E+04	5.05E+04	7.88E+03	9.88E-01	7.82E+01	1.14	4315	96%	24	24
AP-106 liquid		2.32E+03	3.17E+04	5.05E+04	7.88E+03	9.88E-01	7.82E+01	1.14	4315	96%	24	24
AP-106 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-107	607 (1.16)	3.38E+03	4.80E+04	1.14E+05	1.34E+04	1.76E+00	1.15E+02	1.21	4315	90%	29	26
AP-107 liquid		3.38E+03	4.80E+04	1.14E+05	1.34E+04	1.76E+00	1.15E+02	1.21	4315	90%	29	26
AP-107 solid		0	0	0	0	0	0	0	0	0	0	0
241-AP-108	4194 (35.66)	2.71E+01	8.04E+02	2.24E+03	2.69E+02	4.13E-03	2.00E+00	1.01	4315	99%	23	23
AP-108 liquid		2.71E+01	8.04E+02	2.24E+03	2.69E+02	4.13E-03	2.00E+00	1.01	4315	99%	23	23
AP-108 solid		0	0	0	0	0	0	0	0	0	0	0

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Table F-1. Water Addition Study: Input Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Water added (dilution factor) (kL)	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Aluminum in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. Tw (°C)	Dome temp. Td (°C)
241-AW-101	49 (1.02)	3.87E+03	1.16E+05	1.64E+05	3.18E+04	1.24E+01	2.58E+02	1.49	4315	48%	38	30
AW-101 liquid		3.81E+03	1.14E+05	1.62E+05	3.13E+04	2.59E-01	2.84E+02	1.45	2847	51%	38	30
AW-101 solid		4.00E+03	1.20E+05	1.70E+05	3.29E+04	3.95E+01	2.28E+02	1.59	1374	43%	38	30
241-AW-102	3993 (20.2)	1.78E+01	7.25E+01	3.42E+02	9.40E+00	1.35E+01	1.85E+00	1.01	4315	97%	24	23
AW-102 liquid		1.18E+01	4.81E+01	2.27E+02	6.24E+00	1.93E-04	9.00E-02	1.00	4201	99%	24	23
AW-102 solid		2.38E+02	9.71E+02	4.58E+03	1.26E+02	5.18E+02	6.77E+01	1.49	114	40%	24	23
241-AW-103	145 (1.05)	2.06E+03	3.85E+04	1.20E+05	1.14E+04	2.01E+00	7.22E+01	1.30	4315	81%	24	26
AW-103 liquid		2.03E+03	3.80E+04	1.18E+05	1.12E+04	1.01E-01	9.68E+01	1.23	3131	93%	24	26
AW-103 solid		2.13E+03	3.99E+04	1.24E+05	1.18E+04	7.50E+00	2.30E+01	1.50	1184	55%	24	26
241-AW-104	3120 (9.86)	1.71E+03	1.84E+04	2.73E+04	6.15E+03	7.47E-01	3.15E+01	1.10	4315	86%	27	22
AW-104 liquid		7.20E+01	2.23E+02	1.17E+03	1.38E+01	5.11E-04	4.04E-01	1.01	3472	98%	27	22
AW-104 solid		8.47E+03	9.33E+04	1.35E+05	3.14E+04	4.18E+00	1.75E+02	1.49	843	53%	27	22
241-AW-105	2699 (5.15)	3.51E+02	8.92E+02	1.28E+04	8.57E+01	1.23E+01	7.62E+00	1.08	4315	90%	20	21
AW-105 liquid		1.82E+02	4.63E+02	6.66E+03	4.45E+01	4.13E-03	1.86E+00	1.01	3350	98%	20	21
AW-105 solid		9.39E+02	2.38E+03	3.43E+04	2.29E+02	5.84E+01	2.98E+01	1.31	965	66%	20	21
241-AW-106	3184 (15.09)	6.74E+02	1.37E+04	4.27E+04	4.12E+03	6.53E+00	3.35E+01	1.14	4315	85%	41	33
AW-106 liquid		1.70E+02	3.46E+03	1.08E+04	1.04E+03	8.71E-03	7.69E+00	1.02	3410	96%	41	33
AW-106 solid		2.57E+03	5.22E+04	1.63E+05	1.57E+04	3.47E+01	1.49E+02	1.58	905	55%	41	33
241-AY-101	3621 (12.01)	3.13E+02	7.08E+03	8.74E+02	2.23E+02	1.76E+02	9.87E+00	1.04	4315	93%	43	41
AY-101 liquid		1.11E+02	2.61E+03	4.25E+02	2.02E+02	5.42E-02	2.78E+00	1.02	3950	98%	43	41
AY-101 solid		2.95E+03	6.53E+04	6.75E+03	5.29E+02	2.50E+03	1.05E+02	1.52	310	48%	43	41
241-AY-102	1912 (2.09)	9.85E+02	2.47E+03	2.11E+02	6.18E+02	8.38E+02	3.64E+01	1.12	4315	83%	50	44
AY-102 liquid		7.85E+02	2.86E+03	1.96E+02	7.09E+02	7.30E-01	1.31E+01	1.07	3669	93%	45	44
AY-102 solid		2.12E+03	2.29E+02	2.95E+02	1.00E+02	5.85E+03	1.79E+02	1.40	646	38%	72	44

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Table F-1. Water Addition Study: Input Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Water added (dilution factor) (kL)	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Aluminum in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. Tw (°C)	Dome temp. Td (°C)
241-AZ-101	741 (1.22)	2.67E+02	5.37E+04	5.27E+04	6.33E+03	6.72E+02	1.09E+03	1.22	4315	76%	65	64
AZ-101 liquid		2.65E+02	5.32E+04	5.22E+04	6.26E+03	5.93E-01	1.11E+03	1.20	4118	77%	64	64
AZ-101 solid		3.23E+02	6.49E+04	6.37E+04	7.64E+03	1.49E+04	1.13E+03	1.62	197	56%	75	64
241-AZ-102	541 (1.16)	9.17E+02	2.87E+04	1.50E+04	5.41E+02	3.57E+02	7.39E+02	1.14	4315	83%	72	46
AZ-102 liquid		9.03E+02	2.83E+04	1.48E+04	5.33E+02	1.59E+00	7.63E+02	1.12	3918	86%	72	46
AZ-102 solid		1.05E+03	3.29E+04	1.72E+04	6.19E+02	3.94E+03	6.70E+02	1.38	397	56%	72	46
241-SY-101	648 (1.25)	5.16E+03	7.36E+04	1.18E+05	1.12E+04	1.06E+01	1.42E+02	1.34	4315	64%	37	31
SY-101 liquid		4.86E+03	6.93E+04	1.11E+05	1.06E+04	2.13E+00	1.50E+02	1.28	3275	67%	37	31
SY-101 solid		6.17E+03	8.79E+04	1.41E+05	1.34E+04	4.13E+01	1.42E+02	1.51	984	53%	37	31
241-SY-102	401 (1.11)	1.17E+03	5.50E+04	8.76E+04	1.61E+04	9.22E+00	2.62E+02	1.24	4315	85%	41	41
SY-102 liquid		1.16E+03	5.46E+04	8.70E+04	1.60E+04	5.65E+00	2.75E+02	1.23	4046	88%	41	41
SY-102 solid		1.29E+03	6.06E+04	9.66E+04	1.78E+04	6.45E+01	1.16E+02	1.44	269	51%	41	41
241-SY-103	1477 (1.96)	3.93E+03	9.73E+04	1.07E+05	2.40E+04	9.77E+00	1.65E+02	1.34	4315	57%	35	31
SY-103 liquid		3.06E+03	7.57E+04	8.35E+04	1.87E+04	9.58E-01	1.57E+02	1.23	3020	69%	35	31
SY-103 solid		6.16E+03	1.52E+05	1.68E+05	3.76E+04	3.53E+01	2.36E+02	1.61	1213	34%	35	31

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Table F-2. Water Addition Study: Derived Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid [TOC] (wt%)	Aluminum in liquid [Al] (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AY-102	272.3	3.36E+06	85%	9765	8.70E-03	2.92E+04	0.01	0.08	0.12	0.106	0.167	0.182
AY-102 liquid	210.4	2.46E+06	100%	4131	1.12E-04	2.75E+02	0.005	0.104	0.12	0.106	0.150	0.161
AY-102 solid	62.0	9.03E+05	43%	5635	4.00E-02	3.61E+04	0.005	0.005	0.12	0.106	0.282	0.322
241-AN-101	413.9	4.48E+06	100%	12546	8.92E-05	3.99E+02	0.27	0.21	0.03	0.25	0.005	0.006
AN-101 liquid	413.9	4.48E+06	100%	8128	8.92E-05	3.99E+02	0.27	0.21	0.03	0.25	0.005	0.006
AN-101 solid	0.0	0.00E+00	0%	4418	8.10E-05	0.00E+00	0.24	0.18	0.03	0.25	0.005	0.005
241-AN-102	413.9	6.07E+06	98%	12546	1.36E-03	8.27E+03	3.53	1.90	1.70	1.06	0.005	0.086
AN-102 liquid	381.6	5.55E+06	100%	7493	1.30E-03	7.20E+03	3.51	1.89	1.70	1.06	0.005	0.086
AN-102 solid	32.3	5.26E+05	79%	5053	2.28E-03	1.20E+03	3.82	2.05	1.70	1.06	0.005	0.086
241-AN-103	413.9	6.32E+06	80%	12546	1.21E-03	7.68E+03	2.14	2.82	0.13	1.53	0.005	0.014
AN-103 liquid	266.9	3.69E+06	100%	5240	1.40E-03	5.17E+03	1.83	2.41	0.13	1.53	0.005	0.014
AN-103 solid	147.1	2.64E+06	53%	7305	1.24E-03	3.26E+03	2.70	3.57	0.13	1.53	0.005	0.014
241-AN-104	413.9	6.17E+06	91%	12546	1.44E-03	8.89E+03	2.45	2.16	0.19	2.38	0.005	0.019
AN-104 liquid	247.4	3.41E+06	100%	4858	1.44E-03	4.92E+03	2.24	1.97	0.19	2.38	0.005	0.019
AN-104 solid	166.5	2.76E+06	79%	7688	1.73E-03	4.77E+03	2.77	2.44	0.19	2.38	0.005	0.019
241-AN-105	413.9	6.42E+06	93%	12546	1.00E-03	6.46E+03	2.52	2.55	0.24	2.79	0.005	0.020
AN-105 liquid	244.0	3.55E+06	100%	4790	9.89E-04	3.52E+03	2.47	2.49	0.24	2.79	0.005	0.020
AN-105 solid	170.0	2.87E+06	85%	7755	1.19E-03	3.41E+03	2.61	2.63	0.24	2.79	0.005	0.020
241-AN-106	413.9	4.37E+06	99%	12546	1.90E-05	8.30E+01	0.04	0.01	0.01	0.01	0.159	0.159
AN-106 liquid	407.8	4.27E+06	100%	8007	5.32E-06	2.27E+01	0.02	0.01	0.01	0.01	0.210	0.210
AN-106 solid	6.1	1.01E+05	40%	4538	9.39E-04	9.49E+01	1.14	0.41	0.01	0.01	0.005	0.005
241-AN-107	413.9	5.95E+06	94%	12546	1.58E-03	9.38E+03	3.53	1.31	2.78	0.02	0.005	0.126
AN-107 liquid	324.3	4.49E+06	100%	6367	1.50E-03	6.75E+03	3.44	1.28	2.78	0.02	0.005	0.126
AN-107 solid	89.7	1.46E+06	74%	6179	2.12E-03	3.09E+03	3.86	1.44	2.78	0.02	0.005	0.126

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Table F-2. Water Addition Study: Derived Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid [TOC] (wt%)	Aluminum in liquid [Al] (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AP-101	413.9	5.62E+06	100%	12546	5.00E-04	2.81E+03	2.08	0.89	0.15	0.52	0.005	0.009
AP-101 liquid	413.9	5.62E+06	100%	12546	5.00E-04	2.81E+03	2.08	0.89	0.15	0.52	0.005	0.009
AP-101 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-102	413.9	5.14E+06	100%	12546	7.23E-04	3.72E+03	1.21	0.79	0.27	0.93	0.005	0.013
AP-102 liquid	413.9	5.14E+06	100%	12546	7.23E-04	3.72E+03	1.21	0.79	0.27	0.93	0.005	0.013
AP-102 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-103	413.9	4.65E+06	100%	12546	2.19E-04	1.02E+03	0.55	0.58	0.09	0.20	0.005	0.007
AP-103 liquid	413.9	4.65E+06	100%	12546	2.19E-04	1.02E+03	0.55	0.58	0.09	0.20	0.005	0.007
AP-103 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-104	413.9	5.36E+06	100%	12546	7.16E-04	3.84E+03	1.63	1.25	0.40	1.35	0.005	0.017
AP-104 liquid	413.9	5.36E+06	100%	12546	7.16E-04	3.84E+03	1.63	1.25	0.40	1.35	0.005	0.017
AP-104 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-105	413.9	5.90E+06	98%	12546	7.20E-04	4.24E+03	3.84	2.21	0.21	1.54	0.005	0.011
Ap-105 liquid	381.6	5.36E+06	100%	7493	7.20E-04	3.86E+03	3.84	2.21	0.21	1.54	0.005	0.011
AP-105 solid	32.3	5.32E+05	73%	5053	8.42E-04	4.48E+02	3.85	2.22	0.21	1.54	0.005	0.011
241-AP-106	413.9	4.93E+06	100%	12546	3.76E-04	1.85E+03	0.81	0.69	0.20	0.69	0.005	0.011
AP-106 liquid	413.9	4.93E+06	100%	12546	3.76E-04	1.85E+03	0.81	0.69	0.20	0.69	0.005	0.011
AP-106 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-107	413.9	5.24E+06	100%	12546	5.56E-04	2.92E+03	1.84	1.04	0.28	1.10	0.005	0.015
AP-107 liquid	413.9	5.24E+06	100%	12546	5.56E-04	2.92E+03	1.84	1.04	0.28	1.10	0.005	0.015
AP-107 solid	0	0	0	0	0	0	0	0	0	0	0	0
241-AP-108	413.9	4.35E+06	100%	12546	9.50E-06	4.13E+01	0.04	0.02	0.00	0.03	0.153	0.153
AP-108 liquid	413.9	4.35E+06	100%	12546	9.50E-06	4.13E+01	0.04	0.02	0.00	0.03	0.153	0.153
AP-108 solid	0	0	0	0	0	0	0	0	0	0	0	0

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Table F-2. Water Addition Study: Derived Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid [TOC] (wt%)	Aluminum in liquid [Al] (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AW-101	413.9	6.44E+06	95%	12546	1.30E-03	8.40E+03	2.65	2.52	0.26	2.16	0.005	0.021
AW-101 liquid	282.1	4.26E+06	100%	5540	1.35E-03	5.73E+03	2.61	2.48	0.26	2.16	0.005	0.021
AW-101 solid	131.8	2.18E+06	86%	7006	1.34E-03	2.93E+03	2.74	2.61	0.26	2.16	0.005	0.021
241-AW-102	413.9	4.37E+06	98%	12546	9.92E-05	4.34E+02	0.01	0.00	0.00	0.00	0.301	0.301
AW-102 liquid	403.0	4.20E+06	100%	7913	4.27E-07	1.80E+00	0.00	0.00	0.00	0.00	0.320	0.320
AW-102 solid	10.9	1.70E+05	40%	4633	3.79E-03	6.43E+02	0.07	0.02	0.00	0.00	0.096	0.096
241-AW-103	413.9	5.62E+06	87%	12546	3.55E-04	2.00E+03	1.93	0.84	0.17	0.91	0.005	0.010
AW-103 liquid	300.4	3.85E+06	100%	5898	4.59E-04	1.77E+03	1.91	0.83	0.17	0.91	0.005	0.010
AW-103 solid	113.6	1.77E+06	59%	6648	1.59E-04	2.82E+02	2.00	0.87	0.17	0.91	0.005	0.010
241-AW-104	413.9	4.75E+06	88%	12546	1.54E-04	7.32E+02	0.44	0.40	0.01	0.00	0.005	0.005
AW-104 liquid	333.1	3.50E+06	100%	6540	1.91E-06	6.69E+00	0.02	0.00	0.01	0.00	0.228	0.228
AW-104 solid	80.9	1.26E+06	54%	6006	8.54E-04	1.07E+03	2.18	2.03	0.01	0.00	0.005	0.005
241-AW-105	413.9	4.66E+06	91%	12546	1.18E-04	5.50E+02	0.21	0.02	0.02	0.00	0.005	0.005
AW-105 liquid	321.4	3.40E+06	100%	6310	8.80E-06	2.99E+01	0.11	0.01	0.02	0.00	0.091	0.091
AW-105 solid	92.6	1.26E+06	67%	6235	5.32E-04	6.70E+02	0.55	0.05	0.02	0.00	0.005	0.005
241-AW-106	413.9	4.91E+06	88%	12546	2.02E-04	9.92E+02	0.69	0.30	0.02	0.10	0.005	0.006
AW-106 liquid	327.1	3.48E+06	100%	6423	3.64E-05	1.27E+02	0.17	0.08	0.02	0.10	0.005	0.006
AW-106 solid	86.8	1.43E+06	57%	6122	9.37E-04	1.34E+03	2.63	1.14	0.02	0.10	0.005	0.006
241-AY-101	413.9	4.49E+06	95%	12546	1.22E-03	5.49E+03	0.01	0.15	0.01	0.020	0.084	0.085
AY-101 liquid	378.9	4.02E+06	100%	7440	1.35E-05	5.44E+01	0.01	0.06	0.01	0.020	0.178	0.179
AY-101 solid	29.7	4.72E+05	49%	5002	1.72E-02	8.13E+03	0.11	1.42	0.01	0.020	0.005	0.006
241-AY-102	413.9	4.84E+06	89%	12546	5.78E-03	2.79E+04	0.00	0.05	0.07	0.066	0.204	0.212
AY-102 liquid	352.0	3.93E+06	100%	6911	6.70E-05	2.63E+02	0.00	0.06	0.07	0.066	0.197	0.204
AY-102 solid	62.0	9.03E+05	41%	5635	4.00E-02	3.61E+04	0.00	0.00	0.07	0.066	0.282	0.307

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Table F-2. Water Addition Study: Derived Data for Hydrogen Generation Rate Model Calculations for 28 DSTs. (4 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid [TOC] (wt%)	Aluminum in liquid [Al] (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AZ-101	413.9	5.25E+06	98%	12546	9.65E-03	5.06E+04	0.85	1.17	0.02	0.52	0.005	0.010
AZ-101 liquid	395.0	4.93E+06	100%	7757	5.24E-03	2.58E+04	0.84	1.16	0.02	0.52	0.005	0.010
AZ-101 solid	18.9	3.19E+05	72%	4789	1.05E-01	3.36E+04	1.03	1.41	0.02	0.52	0.005	0.013
241-AZ-102	413.9	4.94E+06	96%	12546	5.88E-03	2.90E+04	0.24	0.62	0.08	0.05	0.005	0.032
AZ-102 liquid	375.9	4.39E+06	100%	7380	3.62E-03	1.59E+04	0.24	0.62	0.08	0.05	0.005	0.032
AZ-102 solid	38.1	5.48E+05	65%	5166	2.95E-02	1.62E+04	0.28	0.71	0.08	0.05	0.005	0.032
241-SY-101	413.9	5.76E+06	95%	12546	7.45E-04	4.29E+03	1.90	1.60	0.38	0.82	0.005	0.027
SY-101 liquid	319.6	4.28E+06	100%	6274	7.23E-04	3.09E+03	1.79	1.51	0.38	0.82	0.005	0.027
SY-101 solid	94.4	1.49E+06	79%	6271	9.48E-04	1.41E+03	2.27	1.91	0.38	0.82	0.005	0.027
241-SY-102	413.9	5.34E+06	97%	12546	1.30E-03	6.95E+03	1.41	1.20	0.09	1.31	0.005	0.012
SY-102 liquid	388.1	4.96E+06	100%	7621	1.34E-03	6.63E+03	1.40	1.19	0.09	1.31	0.005	0.012
SY-102 solid	25.8	3.87E+05	58%	4925	9.80E-04	3.80E+02	1.56	1.32	0.09	1.31	0.005	0.012
241-SY-103	413.9	5.78E+06	83%	12546	8.45E-04	4.88E+03	1.73	2.11	0.25	1.52	0.005	0.018
SY-103 liquid	297.6	3.83E+06	100%	5843	7.48E-04	2.86E+03	1.35	1.65	0.25	1.52	0.005	0.018
SY-103 solid	116.4	1.95E+06	49%	6703	1.35E-03	2.64E+03	2.71	3.31	0.25	1.52	0.005	0.018

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Table F-3. Water Addition Study: Hydrogen Generation Rates as Mole Per Unit Waste in 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AY-102	1.20E-05	3.51E-07	2.93E-07	1.26E-05	1.64E-07	4.81E-09	4.01E-09	1.73E-07
AY-102 liquid	1.61E-07	1.95E-07	1.69E-07	5.26E-07	2.09E-09	2.53E-09	2.19E-09	6.82E-09
AY-102 solid	4.91E-05	1.17E-06	6.28E-07	5.09E-05	7.94E-07	1.89E-08	1.02E-08	8.23E-07
241-AN-101	4.58E-09	5.73E-09	2.82E-07	2.92E-07	5.50E-11	6.88E-11	3.39E-09	3.51E-09
AN-101 liquid	4.58E-09	5.73E-09	1.83E-07	1.93E-07	5.50E-11	6.88E-11	2.19E-09	2.32E-09
AN-101 solid	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
241-AN-102	1.02E-06	1.86E-06	2.08E-07	3.09E-06	1.67E-08	3.02E-08	3.39E-09	5.03E-08
AN-102 liquid	9.94E-07	1.89E-06	1.36E-07	3.02E-06	1.61E-08	3.05E-08	2.19E-09	4.88E-08
AN-102 solid	1.38E-06	1.50E-06	9.67E-07	3.85E-06	2.50E-08	2.71E-08	1.75E-08	6.95E-08
241-AN-103	1.27E-07	3.15E-07	2.00E-07	6.41E-07	2.15E-09	5.34E-09	3.39E-09	1.09E-08
AN-103 liquid	1.82E-07	3.92E-07	1.43E-07	7.17E-07	2.79E-09	6.01E-09	2.19E-09	1.10E-08
AN-103 solid	8.48E-08	2.07E-07	2.79E-07	5.71E-07	1.69E-09	4.12E-09	5.55E-09	1.14E-08
241-AN-104	2.24E-07	6.54E-07	2.05E-07	1.08E-06	3.70E-09	1.08E-08	3.39E-09	1.79E-08
AN-104 liquid	2.47E-07	7.22E-07	1.43E-07	1.11E-06	3.79E-09	1.10E-08	2.19E-09	1.70E-08
AN-104 solid	2.34E-07	5.70E-07	2.80E-07	1.08E-06	4.31E-09	1.05E-08	5.16E-09	1.99E-08
241-AN-105	1.71E-07	6.69E-07	1.97E-07	1.04E-06	2.94E-09	1.15E-08	3.39E-09	1.79E-08
AN-105 liquid	1.80E-07	7.18E-07	1.36E-07	1.03E-06	2.92E-09	1.16E-08	2.19E-09	1.67E-08
AN-105 solid	1.84E-07	6.09E-07	2.72E-07	1.07E-06	3.45E-09	1.14E-08	5.10E-09	2.00E-08
241-AN-106	2.67E-08	3.18E-10	2.89E-07	3.16E-07	3.13E-10	3.72E-12	3.39E-09	3.70E-09
AN-106 liquid	1.00E-08	3.22E-10	1.89E-07	1.99E-07	1.16E-10	3.74E-12	2.19E-09	2.31E-09
AN-106 solid	1.77E-08	1.30E-10	4.52E-06	4.54E-06	3.23E-10	2.37E-12	8.26E-08	8.29E-08
241-AN-107	1.67E-06	4.96E-07	2.12E-07	2.38E-06	2.66E-08	7.92E-09	3.39E-09	3.79E-08
AN-107 liquid	1.70E-06	5.30E-07	1.43E-07	2.37E-06	2.61E-08	8.15E-09	2.19E-09	3.64E-08
AN-107 solid	1.77E-06	3.93E-07	4.26E-07	2.59E-06	3.20E-08	7.09E-09	7.70E-09	4.68E-08

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Table F-3. Water Addition Study: Hydrogen Generation Rates as Mole Per Unit Waste in 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AP-101	3.98E-08	3.81E-08	2.25E-07	3.03E-07	6.00E-10	5.75E-10	3.39E-09	4.56E-09
AP-101 liquid	3.98E-08	3.81E-08	2.25E-07	3.03E-07	6.00E-10	5.75E-10	3.39E-09	4.56E-09
AP-101 solid	0	0	0	0	0	0	0	0
241-AP-102	8.27E-08	1.03E-07	2.46E-07	4.31E-07	1.14E-09	1.41E-09	3.39E-09	5.94E-09
AP-102 liquid	8.27E-08	1.03E-07	2.46E-07	4.31E-07	1.14E-09	1.41E-09	3.39E-09	5.94E-09
AP-102 solid	0	0	0	0	0	0	0	0
241-AP-103	1.46E-08	1.66E-08	2.72E-07	3.03E-07	1.82E-10	2.07E-10	3.39E-09	3.78E-09
AP-103 liquid	1.46E-08	1.66E-08	2.72E-07	3.03E-07	1.82E-10	2.07E-10	3.39E-09	3.78E-09
AP-103 solid	0	0	0	0	0	0	0	0
241-AP-104	1.09E-07	1.93E-07	2.35E-07	5.37E-07	1.56E-09	2.77E-09	3.39E-09	7.72E-09
AP-104 liquid	1.09E-07	1.93E-07	2.35E-07	5.37E-07	1.56E-09	2.77E-09	3.39E-09	7.72E-09
AP-104 solid	0	0	0	0	0	0	0	0
241-AP-105	6.98E-08	9.77E-08	2.14E-07	3.82E-07	1.10E-09	1.54E-09	3.39E-09	6.04E-09
Ap-105 liquid	7.16E-08	1.00E-07	1.41E-07	3.12E-07	1.12E-09	1.56E-09	2.19E-09	4.87E-09
AP-105 solid	6.07E-08	7.27E-08	9.55E-07	1.09E-06	1.11E-09	1.33E-09	1.75E-08	1.99E-08
241-AP-106	3.65E-08	6.93E-08	2.56E-07	3.62E-07	4.82E-10	9.16E-10	3.39E-09	4.79E-09
AP-106 liquid	3.65E-08	6.93E-08	2.56E-07	3.62E-07	4.82E-10	9.16E-10	3.39E-09	4.79E-09
AP-106 solid	0	0	0	0	0	0	0	0
241-AP-107	7.68E-08	1.95E-07	2.41E-07	5.13E-07	1.08E-09	2.75E-09	3.39E-09	7.21E-09
AP-107 liquid	7.68E-08	1.95E-07	2.41E-07	5.13E-07	1.08E-09	2.75E-09	3.39E-09	7.21E-09
AP-107 solid	0	0	0	0	0	0	0	0
241-AP-108	1.31E-08	2.09E-10	2.91E-07	3.04E-07	1.52E-10	2.43E-12	3.39E-09	3.54E-09
AP-108 liquid	1.31E-08	2.09E-10	2.91E-07	3.04E-07	1.52E-10	2.43E-12	3.39E-09	3.54E-09
AP-108 solid	0	0	0	0	0	0	0	0

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Table F-3. Water Addition Study: Hydrogen Generation Rates as Mole Per Unit Waste in 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AW-101	2.34E-07	6.17E-07	1.96E-07	1.05E-06	4.04E-09	1.07E-08	3.39E-09	1.81E-08
AW-101 liquid	2.54E-07	6.49E-07	1.31E-07	1.03E-06	4.25E-09	1.09E-08	2.19E-09	1.73E-08
AW-101 solid	2.17E-07	5.55E-07	3.23E-07	1.09E-06	3.99E-09	1.02E-08	5.94E-09	2.01E-08
241-AW-102	2.61E-07	2.20E-11	2.89E-07	5.50E-07	3.06E-09	2.58E-13	3.39E-09	6.45E-09
AW-102 liquid	1.22E-09	2.25E-11	1.89E-07	1.91E-07	1.42E-11	2.60E-13	2.19E-09	2.21E-09
AW-102 solid	1.31E-06	9.05E-12	2.75E-06	4.06E-06	2.26E-08	1.56E-13	4.73E-08	7.00E-08
241-AW-103	2.66E-08	5.21E-08	2.25E-07	3.03E-07	4.02E-10	7.86E-10	3.39E-09	4.57E-09
AW-103 liquid	3.95E-08	5.99E-08	1.54E-07	2.54E-07	5.62E-10	8.52E-10	2.19E-09	3.61E-09
AW-103 solid	8.07E-09	3.53E-08	3.77E-07	4.21E-07	1.40E-10	6.12E-10	6.54E-09	7.29E-09
241-AW-104	6.35E-09	2.33E-10	2.66E-07	2.72E-07	8.09E-11	2.97E-12	3.39E-09	3.47E-09
AW-104 liquid	3.91E-09	2.65E-10	1.88E-07	1.92E-07	4.56E-11	3.09E-12	2.19E-09	2.24E-09
AW-104 solid	2.17E-08	1.43E-10	4.81E-07	5.03E-07	3.74E-10	2.47E-12	8.30E-09	8.68E-09
241-AW-105	5.18E-09	4.10E-10	2.71E-07	2.77E-07	6.47E-11	5.12E-12	3.39E-09	3.46E-09
AW-105 liquid	7.21E-09	4.51E-10	1.87E-07	1.95E-07	8.46E-11	5.29E-12	2.19E-09	2.28E-09
AW-105 solid	1.71E-08	3.00E-10	4.98E-07	5.15E-07	2.58E-10	4.54E-12	7.53E-09	7.79E-09
241-AW-106	9.92E-09	1.63E-08	2.57E-07	2.83E-07	1.31E-10	2.14E-10	3.39E-09	3.73E-09
AW-106 liquid	2.04E-09	1.86E-08	1.86E-07	2.06E-07	2.41E-11	2.20E-10	2.19E-09	2.44E-09
AW-106 solid	3.01E-08	1.07E-08	4.31E-07	4.72E-07	5.51E-10	1.95E-10	7.88E-09	8.63E-09
241-AY-101	8.84E-07	7.09E-09	2.81E-07	1.17E-06	1.07E-08	8.54E-11	3.39E-09	1.41E-08
AY-101 liquid	2.17E-08	7.49E-09	1.86E-07	2.15E-07	2.56E-10	8.82E-11	2.19E-09	2.54E-09
AY-101 solid	4.48E-07	3.69E-09	1.07E-06	1.52E-06	7.89E-09	6.49E-11	1.88E-08	2.68E-08
241-AY-102	9.78E-06	1.52E-07	2.61E-07	1.02E-05	1.27E-07	1.98E-09	3.39E-09	1.32E-07
AY-102 liquid	1.22E-07	1.01E-07	1.77E-07	4.00E-07	1.52E-09	1.25E-09	2.19E-09	4.97E-09
AY-102 solid	4.48E-05	5.80E-07	6.28E-07	4.60E-05	7.25E-07	9.37E-09	1.02E-08	7.44E-07

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table F-3. Water Addition Study: Hydrogen Generation Rates as Mole Per Unit Waste in 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AZ-101	8.81E-07	4.91E-07	2.41E-07	1.61E-06	1.24E-08	6.91E-09	3.39E-09	2.27E-08
AZ-101 liquid	4.79E-07	4.70E-07	1.58E-07	1.11E-06	6.63E-09	6.50E-09	2.19E-09	1.53E-08
AZ-101 solid	9.20E-06	9.08E-07	1.51E-06	1.16E-05	1.72E-07	1.70E-08	2.83E-08	2.18E-07
241-AZ-102	1.63E-06	1.29E-06	2.56E-07	3.18E-06	2.15E-08	1.71E-08	3.39E-09	4.21E-08
AZ-102 liquid	1.04E-06	1.35E-06	1.69E-07	2.56E-06	1.35E-08	1.75E-08	2.19E-09	3.32E-08
AZ-102 solid	5.52E-06	8.75E-07	9.49E-07	7.34E-06	8.81E-08	1.40E-08	1.52E-08	1.17E-07
241-SY-101	1.69E-07	5.36E-07	2.19E-07	9.24E-07	2.62E-09	8.28E-09	3.39E-09	1.43E-08
SY-101 liquid	1.74E-07	5.67E-07	1.48E-07	8.89E-07	2.58E-09	8.43E-09	2.19E-09	1.32E-08
SY-101 solid	1.79E-07	4.46E-07	4.25E-07	1.05E-06	3.14E-09	7.80E-09	7.43E-09	1.84E-08
241-SY-102	1.36E-07	2.76E-07	2.36E-07	6.48E-07	1.95E-09	3.95E-09	3.39E-09	9.29E-09
SY-102 liquid	1.44E-07	2.84E-07	1.55E-07	5.83E-07	2.05E-09	4.03E-09	2.19E-09	8.27E-09
SY-102 solid	6.14E-08	1.65E-07	1.28E-06	1.51E-06	1.02E-09	2.75E-09	2.13E-08	2.51E-08
241-SY-103	1.15E-07	3.43E-07	2.18E-07	6.77E-07	1.79E-09	5.32E-09	3.39E-09	1.05E-08
SY-103 liquid	1.23E-07	4.14E-07	1.54E-07	6.91E-07	1.76E-09	5.92E-09	2.19E-09	9.87E-09
SY-103 solid	1.09E-07	2.03E-07	3.45E-07	6.57E-07	2.03E-09	3.78E-09	6.44E-09	1.22E-08

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Table F-4. Water Addition Study: Hydrogen Generation Rates in Dome Space for 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	HGR from radiolysis percent $(G_{rad})_{\%}$	HGR from thermolysis percent $(G_{therm})_{\%}$	HGR from corrosion percent $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AY-102	2.84E-02	9.791E-04	6.23E-04	94.7%	3.3%	2.1%	3.00E-02	1228
AY-102 liquid	2.51E-04	3.06E-04	2.64E-04	30.6%	37.3%	32.1%	8.21E-04	34
AY-102 solid	2.81E-02	6.73E-04	3.60E-04	96.5%	2.3%	1.2%	2.91E-02	1194
241-AN-101	1.22E-05	1.54E-05	4.88E-04	2.4%	3.0%	94.6%	5.16E-04	21
AN-101 liquid	1.22E-05	1.54E-05	4.88E-04	2.4%	3.0%	94.6%	5.16E-04	21
AN-101 solid	0.00E+00	0.00E+00	0.00E+00	0.0%	0.0%	0.0%	0.00E+00	0
241-AN-102	3.81E-03	6.91E-03	7.70E-04	33.2%	60.1%	6.7%	1.15E-02	471
AN-102 liquid	3.36E-03	6.42E-03	4.60E-04	32.8%	62.7%	4.5%	1.02E-02	420
AN-102 solid	4.44E-04	4.82E-04	3.10E-04	35.9%	39.0%	25.1%	1.24E-03	51
241-AN-103	5.45E-04	1.22E-03	7.70E-04	21.5%	48.1%	30.4%	2.61E-03	107
AN-103 liquid	4.08E-04	8.85E-04	3.21E-04	25.3%	54.8%	19.9%	1.64E-03	67
AN-103 solid	1.36E-04	3.35E-04	4.48E-04	14.8%	36.4%	48.8%	9.71E-04	40
241-AN-104	9.11E-04	2.48E-03	7.73E-04	21.9%	59.6%	18.6%	4.34E-03	178
AN-104 liquid	5.16E-04	1.51E-03	2.99E-04	22.2%	65.0%	12.8%	2.37E-03	97
AN-104 solid	3.95E-04	9.66E-04	4.73E-04	21.5%	52.7%	25.8%	1.97E-03	81
241-AN-105	7.12E-04	2.64E-03	7.70E-04	17.3%	64.0%	18.7%	4.22E-03	173
AN-105 liquid	3.91E-04	1.56E-03	2.94E-04	17.4%	69.5%	13.1%	2.27E-03	93
AN-105 solid	3.22E-04	1.07E-03	4.76E-04	17.2%	57.3%	25.5%	1.95E-03	80
241-AN-106	2.64E-05	8.26E-07	7.48E-04	3.4%	0.1%	96.5%	7.76E-04	32
AN-106 liquid	2.53E-05	8.18E-07	4.78E-04	5.0%	0.2%	94.8%	5.04E-04	21
AN-106 solid	1.06E-06	7.82E-09	2.71E-04	0.4%	0.0%	99.6%	2.72E-04	11
241-AN-107	6.16E-03	1.79E-03	7.63E-04	70.7%	20.6%	8.7%	8.72E-03	357
AN-107 liquid	4.60E-03	1.44E-03	3.87E-04	71.5%	22.4%	6.0%	6.43E-03	264
AN-107 solid	1.56E-03	3.48E-04	3.76E-04	68.3%	15.2%	16.4%	2.29E-03	94

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Table F-4. Water Addition Study: Hydrogen Generation Rates in Dome Space for 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	HGR from radiolysis percent $(G_{rad})_{\%}$	HGR from thermolysis percent $(G_{therm})_{\%}$	HGR from corrosion percent $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AP-101	1.33E-04	1.28E-04	7.49E-04	13.2%	12.7%	74.2%	1.01E-03	41
AP-101 liquid	1.33E-04	1.28E-04	7.49E-04	13.2%	12.7%	74.2%	1.01E-03	41
AP-101 solid	0	0	0	0	0	0	0	0
241-AP-102	2.53E-04	3.16E-04	7.52E-04	19.2%	23.9%	56.9%	1.32E-03	54
AP-102 liquid	2.53E-04	3.16E-04	7.52E-04	19.2%	23.9%	56.9%	1.32E-03	54
AP-102 solid	0	0	0	0	0	0	0	0
241-AP-103	4.03E-05	4.62E-05	7.50E-04	4.8%	5.5%	89.7%	8.37E-04	34
AP-103 liquid	4.03E-05	4.62E-05	7.50E-04	4.8%	5.5%	89.7%	8.37E-04	34
AP-103 solid	0	0	0	0	0	0	0	0
241-AP-104	3.47E-04	6.19E-04	7.52E-04	20.2%	36.0%	43.8%	1.72E-03	70
AP-104 liquid	3.47E-04	6.19E-04	7.52E-04	20.2%	36.0%	43.8%	1.72E-03	70
AP-104 solid	0	0	0	0	0	0	0	0
241-AP-105	2.44E-04	3.39E-04	7.39E-04	18.4%	25.6%	55.9%	1.32E-03	54
Ap-105 liquid	2.25E-04	3.16E-04	4.41E-04	22.9%	32.2%	44.9%	9.82E-04	40
AP-105 solid	1.89E-05	2.27E-05	2.98E-04	5.6%	6.7%	87.7%	3.39E-04	14
241-AP-106	1.07E-04	2.04E-04	7.52E-04	10.1%	19.2%	70.7%	1.06E-03	44
AP-106 liquid	1.07E-04	2.04E-04	7.52E-04	10.1%	19.2%	70.7%	1.06E-03	44
AP-106 solid	0	0	0	0	0	0	0	0
241-AP-107	2.41E-04	6.17E-04	7.57E-04	14.9%	38.2%	46.9%	1.61E-03	66
AP-107 liquid	2.41E-04	6.17E-04	7.57E-04	14.9%	38.2%	46.9%	1.61E-03	66
AP-107 solid	0	0	0	0	0	0	0	0
241-AP-108	3.37E-05	5.41E-07	7.50E-04	4.3%	0.1%	95.6%	7.84E-04	32
AP-108 liquid	3.37E-05	5.41E-07	7.50E-04	4.3%	0.1%	95.6%	7.84E-04	32
AP-108 solid	0	0	0	0	0	0	0	0

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Table F-4. Water Addition Study: Hydrogen Generation Rates in Dome Space for 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	HGR from radiolysis percent $(G_{rad})_{\%}$	HGR from thermolysis percent $(G_{therm})_{\%}$	HGR from corrosion percent $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AW-101	9.43E-04	2.42E-03	7.66E-04	22.8%	58.6%	18.5%	4.20E-03	172
AW-101 liquid	6.56E-04	1.68E-03	3.38E-04	24.5%	62.9%	12.6%	2.70E-03	111
AW-101 solid	2.87E-04	7.39E-04	4.28E-04	19.7%	50.8%	29.4%	1.51E-03	62
241-AW-102	1.35E-04	5.72E-08	7.49E-04	15.3%	0.0%	84.7%	8.84E-04	36
AW-102 liquid	3.05E-06	5.63E-08	4.72E-04	0.6%	0.0%	99.3%	4.75E-04	19
AW-102 solid	1.32E-04	9.15E-10	2.76E-04	32.4%	0.0%	67.6%	4.09E-04	17
241-AW-103	9.96E-05	1.76E-04	7.56E-04	9.7%	17.1%	73.3%	1.03E-03	42
AW-103 liquid	9.11E-05	1.39E-04	3.55E-04	15.6%	23.7%	60.7%	5.85E-04	24
AW-103 solid	8.57E-06	3.76E-05	4.01E-04	1.9%	8.4%	89.7%	4.47E-04	18
241-AW-104	2.42E-05	6.56E-07	7.46E-04	3.1%	0.1%	96.8%	7.71E-04	32
AW-104 liquid	8.07E-06	5.50E-07	3.89E-04	2.0%	0.1%	97.8%	3.97E-04	16
AW-104 solid	1.61E-05	1.07E-07	3.57E-04	4.3%	0.0%	95.7%	3.73E-04	15
241-AW-105	2.71E-05	1.13E-06	7.43E-04	3.5%	0.1%	96.3%	7.71E-04	32
AW-105 liquid	1.44E-05	9.05E-07	3.74E-04	3.7%	0.2%	96.1%	3.89E-04	16
AW-105 solid	1.27E-05	2.23E-07	3.69E-04	3.3%	0.1%	96.6%	3.82E-04	16
241-AW-106	3.08E-05	4.93E-05	7.75E-04	3.6%	5.8%	90.6%	8.55E-04	35
AW-106 liquid	4.36E-06	3.99E-05	3.97E-04	1.0%	9.0%	90.0%	4.41E-04	18
AW-106 solid	2.64E-05	9.40E-06	3.78E-04	6.4%	2.3%	91.3%	4.14E-04	17
241-AY-101	1.88E-04	2.014E-05	7.88E-04	18.9%	2.0%	79.1%	9.96E-04	41
AY-101 liquid	5.50E-05	1.90E-05	4.71E-04	10.1%	3.5%	86.4%	5.45E-04	22
AY-101 solid	1.33E-04	1.10E-06	3.17E-04	29.5%	0.2%	70.3%	4.51E-04	18
241-AY-102	2.60E-02	5.868E-04	8.01E-04	94.9%	2.1%	2.9%	2.73E-02	1120
AY-102 liquid	3.05E-04	2.53E-04	4.41E-04	30.5%	25.3%	44.1%	1.00E-03	41
AY-102 solid	2.57E-02	3.33E-04	3.60E-04	97.4%	1.3%	1.4%	2.63E-02	1079

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Table F-4. Water Addition Study: Hydrogen Generation Rates in Dome Space for 28 DSTs. (4 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	HGR from radiolysis percent $(G_{rad})_{\%}$	HGR from thermolysis percent $(G_{therm})_{\%}$	HGR from corrosion percent $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AZ-101	3.57E-03	1.766E-03	8.53E-04	57.7%	28.5%	13.8%	6.19E-03	254
AZ-101 liquid	1.59E-03	1.57E-03	5.27E-04	43.2%	42.6%	14.3%	3.69E-03	151
AZ-101 solid	1.98E-03	1.97E-04	3.25E-04	79.1%	7.9%	13.0%	2.50E-03	103
241-AZ-102	4.85E-03	4.105E-03	8.07E-04	49.7%	42.0%	8.3%	9.76E-03	400
AZ-102 liquid	2.92E-03	3.80E-03	4.75E-04	40.6%	52.8%	6.6%	7.19E-03	295
AZ-102 solid	1.93E-03	3.08E-04	3.32E-04	75.1%	12.0%	12.9%	2.57E-03	105
241-SY-101	6.14E-04	1.886E-03	7.68E-04	18.8%	57.7%	23.5%	3.29E-03	135
SY-101 liquid	4.52E-04	1.48E-03	3.84E-04	19.5%	63.9%	16.6%	2.33E-03	95
SY-101 solid	1.62E-04	4.05E-04	3.84E-04	17.0%	42.6%	40.4%	9.64E-04	39
241-SY-102	4.64E-04	9.293E-04	7.93E-04	21.2%	42.5%	36.3%	2.19E-03	90
SY-102 liquid	4.49E-04	8.89E-04	4.82E-04	24.7%	48.8%	26.5%	1.82E-03	75
SY-102 solid	1.49E-05	4.04E-05	3.11E-04	4.1%	11.0%	84.9%	3.67E-04	15
241-SY-103	4.16E-04	1.211E-03	7.68E-04	17.4%	50.6%	32.1%	2.41E-03	99
SY-103 liquid	2.87E-04	9.69E-04	3.57E-04	17.8%	60.1%	22.2%	1.62E-03	66
SY-103 solid	1.29E-04	2.42E-04	4.10E-04	16.5%	31.0%	52.5%	7.95E-04	33

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Table F-5. Waste Addition Study: Calculation of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tank	Original liquid NH_3 (µg/mL)	Original waste volume (kL)	Headspace temperature T_h (°C)	Waste temperature T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H* in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
Filled up with original waste									
241-AN-101	4.00E+01	606	18	18	8.64	0.82	86	1.25	42
241-AN-102	2.10E+02	4013	29	31	18.10	1.69	47	2.03	14
241-AN-103	3.45E+02	3627	28	38	26.53	2.54	34	2.30	4
241-AN-104	2.46E+02	3986	29	36	22.85	2.24	38	2.30	6
241-AN-105	2.10E+02	4263	28	34	21.62	2.15	40	2.26	7
241-AN-106	2.10E+02	148	18	17	11.59	1.04	89	1.38	40
241-AN-107	2.10E+02	3952	26	29	21.70	1.89	51	2.26	16
241-AP-101	4.39E+02	4221	19	19	13.43	1.22	82	1.41	31
241-AP-102	4.39E+02	4134	20	20	8.15	0.82	77	1.23	35
241-AP-103	2.50E+02	1079	16	16	15.11	1.46	96	1.40	25
241-AP-104	1.33E+02	91	15	15	10.73	1.06	99	1.33	38
241-AP-105	3.24E+02	2896	19	19	19.62	1.84	79	1.95	20
241-AP-106	6.75E+01	352	17	18	9.95	0.99	86	1.31	35
241-AP-107	1.06E+03	3695	15	14	6.67	0.60	102	1.17	62
241-AP-108	8.00E+02	1397	16	16	7.83	0.74	94	1.21	49
241-AW-101	1.00E+01	4263	26	34	24.06	2.31	40	2.26	6
241-AW-102	7.43E+01	303	19	20	4.81	0.44	77	1.10	53
241-AW-103	5.12E+02	1931	17	17	3.09	0.30	89	1.10	68
241-AW-104	1.69E+02	4236	19	21	1.56	0.15	73	1.10	68
241-AW-105	1.01E+03	1624	16	16	1.59	0.12	94	1.10	92
241-AW-106	3.55E+02	1791	26	31	14.42	1.34	46	1.60	17

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Table F-5. Waste Addition Study: Calculation of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tank	Original liquid NH_3 (µg/mL)	Original waste volume (kL)	Headspace temperature T_h (°C)	Waste temperature T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H^o in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
Filled up with original waste									
241-AY-101	1.13E+02	583	29	40	4.15	0.42	31	1.00	19
241-AY-102	7.37E+01	2419	33	37	3.56	0.43	36	1.00	20
241-AZ-101	1.25E+02	3199	41	51	9.52	0.94	19	1.67	11
241-AZ-102	4.38E+02	3524	44	42	4.54	0.47	28	1.00	16
241-SY-101	1.04E+03	3685	30	32	14.89	1.37	44	1.63	16
241-SY-102	1.15E+03	2317	21	22	9.20	0.87	69	1.28	33
241-SY-103	1.29E+03	2817	27	31	19.55	1.93	46	2.25	11
Filled up with water									
241-AN-101	4.00E+01	606	18	18	1.91	0.18	86	1.00	70
241-AN-102	2.10E+02	4013	29	31	16.62	1.55	47	1.70	14
241-AN-103	3.45E+02	3627	28	38	17.96	1.72	34	2.30	11
241-AN-104	2.46E+02	3986	29	36	18.45	1.81	38	2.30	10
241-AN-105	2.10E+02	4263	28	34	20.46	2.03	40	2.26	8
241-AN-106	2.10E+02	148	18	17	0.22	0.02	89	1.00	87
241-AN-107	2.10E+02	3952	26	29	19.29	1.68	51	2.26	20
241-AP-101	4.39E+02	4221	19	19	13.12	1.19	82	1.41	32
241-AP-102	4.39E+02	4134	20	20	7.78	0.79	77	1.23	37
241-AP-103	2.50E+02	1079	16	16	3.74	0.36	96	1.00	63
241-AP-104	1.33E+02	91	15	15	10.44	1.03	99	1.33	39
241-AP-105	3.24E+02	2896	19	19	19.53	1.83	79	1.95	20
241-AP-106	6.75E+01	352	17	18	5.44	0.54	86	1.11	50

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table F-5. Waste Addition Study: Calculation of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tank	Original liquid NH_3 (µg/mL)	Original waste volume (kL)	Headspace temperature T_h (°C)	Waste temperature T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H° in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
Filled up with water									
241-AP-107	1.06E+03	3695	16	16	5.74	0.52	94	1.10	59
241-AP-108	8.00E+02	1397	26	34	0.22	0.02	40	1.00	39
241-AW-101	1.00E+01	4263	19	20	22.88	2.19	77	2.26	14
241-AW-102	7.43E+01	303	17	17	0.24	0.02	89	1.00	86
241-AW-103	5.12E+02	1931	19	21	2.94	0.29	73	1.00	52
241-AW-104	1.69E+02	4236	16	16	0.16	0.01	94	1.00	92
241-AW-105	1.01E+03	1624	26	31	0.31	0.02	46	1.00	45
241-AW-106	3.55E+02	1791	33	32	0.96	0.09	45	1.00	40
241-AY-101	1.13E+02	583	29	40	0.35	0.03	31	1.00	30
241-AY-102	7.37E+01	2355	33	37	1.71	0.21	36	1.00	27
241-AZ-101	1.25E+02	3199	41	51	7.81	0.77	19	1.67	13
241-AZ-102	4.38E+02	3524	44	42	3.91	0.41	28	1.00	17
241-SY-101	1.04E+03	3685	30	32	11.74	1.08	44	1.63	22
241-SY-102	1.15E+03	2317	21	22	8.29	0.79	69	1.28	36
241-SY-103	1.29E+03	2817	27	31	9.72	0.96	46	1.50	22

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table F-6. Waste Addition Study: Calculation of Mass Transport Product of h and A. (3 Sheets)

Tank	Liquid NH_3 concen. C_l (mole/L)	Molar volume (L/mole)	Headspace volume V_h (ft^3)	KRT coeff.	Liquid film coeff. h_l (m/s)	Gas film coeff. h_g (m/s)	Calculated hA from h and A hA (cfm)	Barometric vent rate Q (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	Off-normal $(NH_3)_{ss}$ (atm)
Filled up with original waste											
241-AN-101	0.002	23.85	36,096	1001	5.087E-06	1.586E-03	1.05E+00	0.11	2.91E-02	6.84E-08	5.60E-05
241-AN-102	0.012	24.79	36,096	358	5.480E-06	1.586E-03	2.13E+00	0.11	2.10E-02	7.28E-07	8.58E-04
241-AN-103	0.020	24.69	36,096	108	5.551E-06	1.586E-03	3.50E+00	0.11	1.02E-02	1.96E-06	4.76E-03
241-AN-104	0.014	24.79	36,096	156	5.443E-06	1.586E-03	3.08E+00	0.11	1.31E-02	1.23E-06	2.34E-03
241-AN-105	0.012	24.66	36,096	180	5.463E-06	1.586E-03	2.93E+00	0.11	1.43E-02	1.00E-06	1.72E-03
241-AN-106	0.012	23.84	36,096	960	5.164E-06	1.586E-03	1.09E+00	0.11	2.90E-02	3.72E-07	3.06E-04
241-AN-107	0.012	24.55	36,096	402	5.398E-06	1.586E-03	1.98E+00	0.11	2.19E-02	6.77E-07	7.59E-04
241-AP-101	0.026	23.98	36,096	742	5.318E-06	1.586E-03	1.33E+00	0.11	2.73E-02	9.47E-07	8.32E-04
241-AP-102	0.026	24.02	36,096	844	5.165E-06	1.586E-03	1.20E+00	0.11	2.80E-02	8.55E-07	7.34E-04
241-AP-103	0.015	23.68	36,096	585	5.318E-06	1.586E-03	1.56E+00	0.11	2.53E-02	6.35E-07	5.94E-04
241-AP-104	0.008	23.64	36,096	891	5.291E-06	1.586E-03	1.16E+00	0.11	2.86E-02	2.51E-07	2.07E-04
241-AP-105	0.019	23.96	36,096	476	5.378E-06	1.586E-03	1.79E+00	0.11	2.36E-02	9.43E-07	9.59E-04
241-AP-106	0.004	23.79	36,096	824	5.230E-06	1.586E-03	1.22E+00	0.11	2.79E-02	1.34E-07	1.15E-04
241-AP-107	0.062	23.63	36,096	1460	5.175E-06	1.586E-03	7.81E-01	0.11	3.17E-02	1.35E-06	1.01E-03
241-AP-108	0.047	23.71	36,096	1171	5.236E-06	1.586E-03	9.36E-01	0.11	3.04E-02	1.22E-06	9.51E-04
241-AW-101	0.001	24.53	36,096	163	5.521E-06	1.586E-03	3.07E+00	0.11	1.35E-02	4.99E-08	9.09E-05
241-AW-102	0.004	23.96	36,096	1276	5.092E-06	1.586E-03	8.69E-01	0.11	3.12E-02	1.07E-07	8.22E-05
241-AW-103	0.030	23.79	36,096	1629	4.893E-06	1.586E-03	7.06E-01	0.11	3.19E-02	5.88E-07	4.39E-04
241-AW-104	0.010	23.96	36,096	1650	4.956E-06	1.586E-03	7.00E-01	0.11	3.18E-02	1.92E-07	1.45E-04
241-AW-105	0.059	23.71	36,096	2186	4.893E-06	1.586E-03	5.50E-01	0.11	3.33E-02	9.03E-07	6.43E-04
241-AW-106	0.021	24.53	36,096	414	5.411E-06	1.586E-03	1.95E+00	0.11	2.24E-02	1.15E-06	1.26E-03

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Table F-6. Waste Addition Study: Calculation of Mass Transport Product of h and A. (3 Sheets)

Tank	Liquid NH_3 concen. C_l (mole/L)	Molar volume (L/mole)	Headspace volume V_h (ft^3)	KRT coeff.	Liquid film coeff. h_l (m/s)	Gas film coeff. h_g (m/s)	Calculated hA from h and A hA (cfm)	Barometric vent rate Q (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	Off-normal $(NH_3)_{ss}$ (atm)
Filled up with original waste											
241-AY-101	0.007	24.78	36,096	478	5.005E-06	1.586E-03	1.74E+00	0.11	2.10E-02	3.02E-07	3.57E-04
241-AY-102	0.004	25.11	36,096	499	5.048E-06	1.586E-03	1.70E+00	0.11	2.32E-02	2.03E-07	2.20E-04
241-AZ-101	0.007	25.76	36,096	284	5.194E-06	1.586E-03	2.34E+00	0.11	1.79E-02	4.76E-07	6.86E-04
241-AZ-102	0.026	26.01	36,096	406	5.079E-06	1.586E-03	1.92E+00	0.11	2.35E-02	1.48E-06	1.64E-03
241-SY-101	0.061	24.86	36,096	395	5.345E-06	1.586E-03	1.99E+00	0.11	2.17E-02	3.39E-06	3.88E-03
241-SY-102	0.068	24.12	36,096	796	5.208E-06	1.586E-03	1.25E+00	0.11	2.75E-02	2.35E-06	2.05E-03
241-SY-103	0.076	24.61	36,096	264	5.527E-06	1.586E-03	2.51E+00	0.11	1.81E-02	5.26E-06	7.17E-03
Filled up with water											
241-AN-101	0.001	23.85	36,096	1667	4.913E-06	1.586E-03	6.93E-01	0.11	3.20E-02	9.99E-09	7.44E-06
241-AN-102	0.011	24.79	36,096	350	5.435E-06	1.586E-03	2.15E+00	0.11	2.07E-02	6.74E-07	8.06E-04
241-AN-103	0.014	24.69	36,096	278	5.347E-06	1.586E-03	2.40E+00	0.11	1.93E-02	9.83E-07	1.26E-03
241-AN-104	0.012	24.79	36,096	260	5.340E-06	1.586E-03	2.48E+00	0.11	1.89E-02	8.67E-07	1.14E-03
241-AN-105	0.012	24.66	36,096	206	5.434E-06	1.586E-03	2.77E+00	0.11	1.61E-02	9.28E-07	1.42E-03
241-AN-106	0.000	23.84	36,096	2065	4.866E-06	1.586E-03	5.77E-01	0.11	3.31E-02	3.66E-09	2.64E-06
241-AN-107	0.011	24.55	36,096	500	5.344E-06	1.586E-03	1.73E+00	0.11	2.37E-02	5.25E-07	5.43E-04
241-AP-101	0.025	23.98	36,096	764	5.309E-06	1.586E-03	1.30E+00	0.11	2.75E-02	9.05E-07	7.89E-04
241-AP-102	0.025	24.02	36,096	883	5.152E-06	1.586E-03	1.16E+00	0.11	2.83E-02	7.90E-07	6.70E-04
241-AP-103	0.004	23.68	36,096	1498	4.982E-06	1.586E-03	7.60E-01	0.11	3.15E-02	7.63E-08	5.74E-05
241-AP-104	0.008	23.64	36,096	922	5.280E-06	1.586E-03	1.13E+00	0.11	2.88E-02	2.37E-07	1.95E-04
241-AP-105	0.019	23.96	36,096	481	5.375E-06	1.586E-03	1.78E+00	0.11	2.36E-02	9.30E-07	9.44E-04
241-AP-106	0.002	23.79	36,096	1194	5.069E-06	1.586E-03	9.15E-01	0.11	3.02E-02	5.49E-08	4.33E-05

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Table F-6. Waste Addition Study: Calculation of Mass Transport Product of h and A. (3 Sheets)

Tank	Liquid NH_3 concen. C_l (mole/L)	Molar volume (L/mole)	Headspace volume V_h (ft^3)	KRT coeff.	Liquid film coeff. h_l (m/s)	Gas film coeff. h_g (m/s)	Calculated hA from h and A hA (cfm)	Barometric vent rate Q (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	Off-normal $(NH_3)_{ss}$ (atm)
Filled up with water											
241-AP-107	0.053	23.71	36,096	1392	5.133E-06	1.586E-03	8.11E-01	0.11	2.93E-02	1.13E-06	9.11E-04
241-AP-108	0.001	24.53	36,096	993	4.872E-06	1.586E-03	1.05E+00	0.11	1.49E-02	2.03E-08	3.34E-05
241-AW-101	0.001	23.96	36,096	338	5.492E-06	1.586E-03	2.20E+00	0.11	2.80E-02	4.65E-08	3.98E-05
241-AW-102	0.000	23.79	36,096	2059	4.872E-06	1.586E-03	5.78E-01	0.11	3.76E-02	3.94E-09	2.50E-06
241-AW-103	0.029	23.96	36,096	1261	4.891E-06	1.586E-03	8.70E-01	0.11	2.62E-02	5.99E-07	5.48E-04
241-AW-104	0.001	23.71	36,096	2183	4.870E-06	1.586E-03	5.50E-01	0.11	4.04E-02	1.86E-08	1.09E-05
241-AW-105	0.012	24.53	36,096	1123	4.867E-06	1.586E-03	9.52E-01	0.11	1.69E-02	1.76E-07	2.56E-04
241-AW-106	0.001	25.10	36,096	1011	4.901E-06	1.586E-03	1.03E+00	0.11	2.90E-02	3.95E-08	3.42E-05
241-AY-101	0.001	24.78	36,096	760	4.873E-06	1.586E-03	1.27E+00	0.11	2.42E-02	1.82E-08	1.87E-05
241-AY-102	0.002	25.11	36,096	681	4.952E-06	1.586E-03	1.38E+00	0.11	2.57E-02	7.90E-08	7.72E-05
241-AZ-101	0.006	25.76	36,096	347	5.137E-06	1.586E-03	2.10E+00	0.11	1.95E-02	3.49E-07	4.61E-04
241-AZ-102	0.022	26.01	36,096	441	5.050E-06	1.586E-03	1.83E+00	0.11	2.43E-02	1.21E-06	1.30E-03
241-SY-101	0.048	24.86	36,096	544	5.250E-06	1.586E-03	1.63E+00	0.11	2.48E-02	2.22E-06	2.22E-03
241-SY-102	0.061	24.12	36,096	878	5.175E-06	1.586E-03	1.16E+00	0.11	2.72E-02	1.89E-06	1.68E-03
241-SY-103	0.038	24.61	36,096	552	5.213E-06	1.586E-03	1.61E+00	0.11	2.38E-02	1.65E-06	1.70E-03

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table F-7. Waste Addition Study: Gas Conc., Release Rate and Flammability Level Under Normal Ventilation Conditions. (3 Sheets)

Tank	Calculated hydrogen headspace conc., $[H_2](t_o)$ (%)	Ammonia headspace conc. $[NH_3](t_o)$ (%)	Methane headspace conc. $[CH_4](t_o)$ (%)	N_2O headspace conc. $[N_2O](t_o)$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)
Filled up with original waste												
241-AN-101	0.0009	0.0011	0.0008	0.0048	1,140	36,096	113	0.04%	1.28E-03	8.64E-04	5.42E-03	9.63E-04
241-AN-102	0.0109	0.0300	0.0003	0.0057	1,140	36,096	119	0.48%	3.57E-02	3.45E-04	6.82E-03	1.30E-02
241-AN-103	0.0036	0.0007	0.0002	0.0008	1,140	36,096	100	0.10%	6.65E-04	2.44E-04	7.75E-04	3.58E-03
241-AN-104	0.0052	0.0021	0.0002	0.0008	1,140	36,096	100	0.15%	2.10E-03	2.12E-04	7.69E-04	5.21E-03
241-AN-105	0.0043	0.0015	0.0002	0.0013	1,140	36,096	100	0.12%	1.51E-03	2.23E-04	1.30E-03	4.31E-03
241-AN-106	0.0010	0.0000	0.0003	0.0060	1,140	36,096	117	0.03%	0.00E+00	3.52E-04	6.96E-03	1.14E-03
241-AN-107	0.0082	0.0400	0.0005	0.0058	1,140	36,096	129	0.48%	5.16E-02	6.89E-04	7.49E-03	1.05E-02
241-AP-101	0.0009	0.0125	0.0003	0.0063	1,140	36,096	108	0.11%	1.35E-02	3.44E-04	6.80E-03	1.03E-03
241-AP-102	0.0010	0.0075	0.0003	0.0050	1,140	36,096	135	0.08%	1.02E-02	3.45E-04	6.81E-03	1.37E-03
241-AP-103	0.0007	0.0000	0.0002	0.0034	1,140	36,096	200	0.02%	0.00E+00	3.48E-04	6.88E-03	1.41E-03
241-AP-104	0.0025	0.0003	0.0000	0.0002	1,140	36,096	71	0.06%	2.23E-04	7.44E-06	1.47E-04	1.76E-03
241-AP-105	0.0008	0.0007	0.0001	0.0026	1,140	36,096	176	0.03%	1.29E-03	2.32E-04	4.58E-03	1.34E-03
241-AP-106	0.0014	0.0005	0.0000	0.0009	1,140	36,096	111	0.04%	5.92E-04	5.13E-05	1.01E-03	1.51E-03
241-AP-107	0.0005	0.0005	0.0001	0.0020	1,140	36,096	342	0.02%	1.71E-03	3.42E-04	6.75E-03	1.82E-03
241-AP-108	0.0007	0.0027	0.0003	0.0052	1,140	36,096	129	0.04%	3.43E-03	3.42E-04	6.77E-03	8.79E-04
241-AW-101	0.0051	0.0005	0.0002	0.0007	1,140	36,096	100	0.13%	5.15E-04	1.57E-04	7.38E-04	5.12E-03
241-AW-102	0.0009	0.0003	0.0001	0.0022	1,140	36,096	292	0.03%	7.44E-04	3.19E-04	6.31E-03	2.77E-03
241-AW-103	0.0008	0.0138	0.0004	0.0010	1,140	36,096	134	0.12%	1.85E-02	4.86E-04	1.28E-03	1.05E-03
241-AW-104	0.0006	0.0006	0.0026	0.0033	1,140	36,096	141	0.07%	8.46E-04	3.72E-03	4.68E-03	8.68E-04
241-AW-105	0.0004	0.0043	0.0005	0.0025	1,140	36,096	194	0.05%	8.30E-03	1.06E-03	4.78E-03	8.16E-04
241-AW-106	0.0023	0.0028	0.0003	0.0068	1,140	36,096	158	0.08%	4.40E-03	5.45E-04	1.08E-02	3.59E-03

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Table F-7. Waste Addition Study: Gas Conc., Release Rate and Flammability Level Under Normal Ventilation Conditions. (3 Sheets)

Tank	Calculated hydrogen headspace conc., $[H_2](t_o)$ (%)	Ammonia headspace conc. $[NH_3](t_o)$ (%)	Methane headspace conc. $[CH_4](t_o)$ (%)	N_2O headspace conc. $[N_2O](t_o)$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)
Filled up with original waste												
241-AY-101	0.0014	0.0005	0.0004	0.0055	1,140	36,096	250	0.05%	1.25E-03	8.79E-04	1.37E-02	3.57E-03
241-AY-102	0.0225	0.0004	0.0003	0.0018	1,140	36,096	250	0.57%	1.07E-03	6.44E-04	4.46E-03	5.62E-02
241-AZ-101	0.0054	0.0001	0.0006	0.0012	1,140	36,096	150	0.15%	1.88E-04	9.48E-04	1.83E-03	8.13E-03
241-AZ-102	0.0108	0.0006	0.0009	0.0011	1,140	36,096	112	0.29%	6.19E-04	9.82E-04	1.28E-03	1.21E-02
241-SY-101	0.0009	0.0200	0.0001	0.0006	1,140	36,096	461	0.16%	9.22E-02	4.21E-04	2.89E-03	4.20E-03
241-SY-102	0.0007	0.0012	0.0005	0.0006	1,140	36,096	363	0.03%	4.24E-03	1.79E-03	2.26E-03	2.45E-03
241-SY-103	0.0042	0.0059	0.0004	0.0025	1,140	36,096	116	0.15%	6.92E-03	4.83E-04	2.88E-03	4.93E-03
Filled up with water												
241-AN-101	0.0005	0.0002	0.0000	0.0002	1,140	36,096	113	0.01%	2.82E-04	4.25E-05	2.67E-04	5.16E-04
241-AN-102	0.0096	0.0275	0.0002	0.0049	1,140	36,096	119	0.43%	3.28E-02	2.93E-04	5.79E-03	1.15E-02
241-AN-103	0.0025	0.0005	0.0001	0.0004	1,140	36,096	100	0.07%	4.50E-04	1.39E-04	4.40E-04	2.53E-03
241-AN-104	0.0042	0.0017	0.0002	0.0006	1,140	36,096	100	0.12%	1.70E-03	1.57E-04	5.73E-04	4.16E-03
241-AN-105	0.0041	0.0014	0.0002	0.0012	1,140	36,096	100	0.12%	1.43E-03	2.08E-04	1.21E-03	4.12E-03
241-AN-106	0.0007	0.0000	0.0000	0.0000	1,140	36,096	117	0.02%	0.00E+00	2.18E-07	4.31E-06	7.76E-04
241-AN-107	0.0068	0.0356	0.0004	0.0047	1,140	36,096	129	0.41%	4.59E-02	5.59E-04	6.08E-03	8.72E-03
241-AP-101	0.0009	0.0122	0.0003	0.0060	1,140	36,096	108	0.11%	1.32E-02	3.28E-04	6.48E-03	1.01E-03
241-AP-102	0.0010	0.0072	0.0002	0.0046	1,140	36,096	135	0.08%	9.70E-03	3.14E-04	6.21E-03	1.32E-03
241-AP-103	0.0004	0.0000	0.0000	0.0002	1,140	36,096	200	0.01%	0.00E+00	2.12E-05	4.19E-04	8.37E-04
241-AP-104	0.0024	0.0003	0.0000	0.0002	1,140	36,096	71	0.06%	2.17E-04	7.03E-06	1.39E-04	1.72E-03
241-AP-105	0.0008	0.0007	0.0001	0.0026	1,140	36,096	176	0.03%	1.28E-03	2.29E-04	4.53E-03	1.32E-03
241-AP-106	0.0010	0.0003	0.0000	0.0003	1,140	36,096	111	0.03%	3.23E-04	1.53E-05	3.02E-04	1.06E-03

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Table F-7. Waste Addition Study: Gas Conc., Release Rate and Flammability Level Under Normal Ventilation Conditions. (3 Sheets)

Tank	Calculated hydrogen headspace conc., $[H_2](t_o)$ (%)	Ammonia headspace conc. $[NH_3](t_o)$ (%)	Methane headspace conc. $[CH_4](t_o)$ (%)	N_2O headspace conc. $[N_2O](t_o)$ (%)	Waste volume V_w (kgal)	Headspace volume V_h (ft^3)	Normal ventilation rate $(Vr)_{norm}$ (cfm)	Steady-state flammability at normal condition (% LFL)	Ammonia release rate $Rr(NH_3)$ (cfm)	Methane release rate $Rr(CH_4)$ (cfm)	N_2O release rate $Rr(N_2O)$ (cfm)	Model hydrogen release rate $Rr(H_2)$ (cfm)
Filled up with water												
241-AP-107	0.0005	0.0004	0.0001	0.0015	1,140	36,096	342	0.02%	1.47E-03	2.53E-04	4.99E-03	1.61E-03
241-AP-108	0.0006	0.0001	0.0000	0.0000	1,140	36,096	129	0.02%	9.62E-05	3.12E-07	6.16E-06	7.84E-04
241-AW-101	0.0041	0.0005	0.0001	0.0007	1,140	36,096	100	0.11%	4.90E-04	1.48E-04	6.93E-04	4.13E-03
241-AW-102	0.0003	0.0000	0.0000	0.0000	1,140	36,096	292	0.01%	3.68E-05	1.19E-06	2.36E-05	8.84E-04
241-AW-103	0.0008	0.0131	0.0003	0.0009	1,140	36,096	134	0.11%	1.76E-02	4.48E-04	1.18E-03	1.03E-03
241-AW-104	0.0005	0.0001	0.0001	0.0001	1,140	36,096	141	0.02%	8.58E-05	1.05E-04	1.31E-04	7.71E-04
241-AW-105	0.0004	0.0008	0.0000	0.0002	1,140	36,096	194	0.02%	1.61E-03	7.68E-05	3.47E-04	7.71E-04
241-AW-106	0.0005	0.0002	0.0000	0.0001	1,140	36,096	158	0.01%	2.92E-04	9.44E-06	1.87E-04	8.55E-04
241-AY-101	0.0004	0.0000	0.0000	0.0001	1,140	36,096	250	0.01%	1.04E-04	1.18E-05	1.84E-04	9.96E-04
241-AY-102	0.0109	0.0002	0.0001	0.0005	1,140	36,096	250	0.28%	5.13E-04	1.73E-04	1.20E-03	2.73E-02
241-AZ-101	0.0041	0.0001	0.0004	0.0008	1,140	36,096	150	0.11%	1.54E-04	6.39E-04	1.23E-03	6.19E-03
241-AZ-102	0.0087	0.0005	0.0007	0.0009	1,140	36,096	112	0.23%	5.33E-04	7.39E-04	9.65E-04	9.76E-03
241-SY-101	0.0007	0.0158	0.0001	0.0004	1,140	36,096	461	0.12%	7.27E-02	2.82E-04	1.94E-03	3.27E-03
241-SY-102	0.0006	0.0011	0.0004	0.0005	1,140	36,096	363	0.03%	3.81E-03	1.39E-03	1.76E-03	2.19E-03
241-SY-103	0.0021	0.0030	0.0001	0.0008	1,140	36,096	116	0.07%	3.44E-03	1.57E-04	9.32E-04	2.39E-03

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Table F-8. Waste Addition Study: Steady-State Gas and Flammability Levels With Barometric Breathing Rate. (3 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
Filled up with original waste									
241-AN-101	0.11	0.85	0.01	0.77	4.81	21	0.04	15.32	37
241-AN-102	0.11	11.49	0.09	0.31	6.05	287	0.57	6.12	294
241-AN-103	0.11	3.18	0.20	0.22	0.69	79	1.36	4.33	85
241-AN-104	0.11	4.62	0.20	0.19	0.68	116	1.34	3.75	121
241-AN-105	0.11	3.82	0.15	0.20	1.15	96	1.02	3.95	101
241-AN-106	0.11	1.01	0.01	0.31	6.17	25	0.08	6.25	32
241-AN-107	0.11	9.34	0.08	0.61	6.64	233	0.51	12.22	246
241-AP-101	0.11	0.91	0.08	0.30	6.02	23	0.55	6.10	29
241-AP-102	0.11	1.21	0.07	0.31	6.04	30	0.49	6.11	37
241-AP-103	0.11	1.25	0.02	0.31	6.10	31	0.17	6.17	38
241-AP-104	0.11	1.56	0.01	0.01	0.13	39	0.09	0.13	39
241-AP-105	0.11	1.19	0.08	0.21	4.06	30	0.53	4.11	34
241-AP-106	0.11	1.34	0.01	0.05	0.90	33	0.07	0.91	34
241-AP-107	0.11	1.62	0.09	0.30	5.98	40	0.61	6.06	47
241-AP-108	0.11	0.78	0.09	0.30	6.00	19	0.57	6.07	26
241-AW-101	0.11	4.54	0.01	0.14	0.65	113	0.06	2.79	116
241-AW-102	0.11	2.46	0.01	0.28	5.59	61	0.05	5.66	67
241-AW-103	0.11	0.93	0.04	0.43	1.13	23	0.29	8.62	32
241-AW-104	0.11	0.77	0.01	3.30	4.15	19	0.09	65.96	85
241-AW-105	0.11	0.72	0.06	0.94	4.23	18	0.42	18.76	37
241-AW-106	0.11	3.18	0.12	0.48	9.55	80	0.78	9.66	90

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Table F-8. Waste Addition Study: Steady-State Gas and Flammability Levels With Barometric Breathing Rate. (3 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
Filled up with original waste									
241-AY-101	0.11	3.16	0.03	0.78	12.14	79	0.19	15.59	95
241-AY-102	0.11	49.84	0.02	0.57	3.95	1246	0.14	11.42	1257
241-AZ-101	0.11	7.21	0.03	0.84	1.62	180	0.22	16.82	197
241-AZ-102	0.11	10.73	0.12	0.87	1.14	268	0.79	17.41	286
241-SY-101	0.11	3.72	0.39	0.37	2.56	93	2.58	7.46	103
241-SY-102	0.11	2.17	0.18	1.59	2.00	54	1.18	31.77	87
241-SY-103	0.11	4.37	0.56	0.43	2.55	109	3.72	8.57	122
Filled up with water									
241-AN-101	0.11	0.46	0.001	0.04	0.24	11	0.00	0.75	12
241-AN-102	0.11	10.18	0.08	0.26	5.13	254	0.54	5.20	260
241-AN-103	0.11	2.25	0.13	0.12	0.39	56	0.84	2.46	59
241-AN-104	0.11	3.69	0.11	0.14	0.51	92	0.76	2.79	96
241-AN-105	0.11	3.65	0.14	0.18	1.07	91	0.95	3.69	96
241-AN-106	0.11	0.69	0.0003	0.0002	0.004	17	0.00	0.00	17
241-AN-107	0.11	7.73	0.05	0.50	5.39	193	0.36	9.91	203
241-AP-101	0.11	0.89	0.08	0.29	5.75	22	0.53	5.82	29
241-AP-102	0.11	1.17	0.07	0.28	5.50	29	0.45	5.57	35
241-AP-103	0.11	0.74	0.01	0.02	0.37	19	0.04	0.38	19
241-AP-104	0.11	1.52	0.02	0.01	0.12	38	0.13	0.12	38
241-AP-105	0.11	1.17	0.09	0.20	4.02	29	0.63	4.07	34
241-AP-106	0.11	0.94	0.00	0.01	0.27	24	0.03	0.27	24

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Table F-8. Waste Addition Study: Steady-State Gas and Flammability Levels With Barometric Breathing Rate. (3 Sheets)

Tank	Off-normal ventilation rate $(Vr)_{bb}$ (cfm)	Steady-state hydrogen concentration $[H_2]$ (%)	Steady-state ammonia concentration $[NH_3]$ (%)	Steady-state methane concentration $[CH_4]$ (%)	Steady-state N_2O concentration $[N_2O]$ (%)	Steady-state hydrogen flammability (% LFL)	Steady-state ammonia flammability (% LFL)	Steady-state methane flammability (% LFL)	Steady-state total flammability (% LFL)
Filled up with water									
241-AP-107	0.11	1.43	0.09	0.22	4.42	36	0.61	4.48	41
241-AP-108	0.11	0.70	0.003	0.0003	0.01	17	0.02	0.01	17
241-AW-101	0.11	3.66	0.004	0.13	0.61	92	0.03	2.62	94
241-AW-102	0.11	0.78	0.0002	0.00	0.02	20	0.00	0.02	20
241-AW-103	0.11	0.91	0.05	0.40	1.04	23	0.37	7.95	31
241-AW-104	0.11	0.68	0.001	0.09	0.12	17	0.01	1.85	19
241-AW-105	0.11	0.68	0.03	0.07	0.31	17	0.17	1.36	19
241-AW-106	0.11	0.76	0.003	0.01	0.17	19	0.02	0.17	19
241-AY-101	0.11	0.88	0.002	0.01	0.16	22	0.01	0.21	22
241-AY-102	0.11	24.24	0.01	0.15	1.06	606	0.05	3.07	609
241-AZ-101	0.11	5.49	0.05	0.57	1.09	137	0.31	11.32	149
241-AZ-102	0.11	8.66	0.13	0.66	0.86	216	0.87	13.11	230
241-SY-101	0.11	2.90	0.22	0.25	1.72	72	1.48	5.01	79
241-SY-102	0.11	1.94	0.17	1.24	1.56	48	1.12	24.70	74
241-SY-103	0.11	2.12	0.17	0.14	0.83	53	1.14	2.78	57

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Table F-9. Waste Addition Study: Time to Reach 25% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
Filled up with original waste									
241-AN-101	253	0.17	0.58	0.01	0.52	3.27	14.51	0.04	10.42
241-AN-102	19	1.38	0.95	0.09	0.03	0.50	23.79	0.57	0.51
241-AN-103	66	0.44	0.82	0.48	0.06	0.18	20.47	3.17	1.12
241-AN-104	48	0.59	0.90	0.23	0.04	0.13	22.54	1.56	0.73
241-AN-105	60	0.48	0.91	0.17	0.05	0.27	22.70	1.15	0.94
241-AN-106	341	0.15	0.80	0.03	0.25	4.84	19.88	0.20	4.90
241-AN-107	23	1.15	0.93	0.08	0.06	0.66	23.14	0.51	1.21
241-AP-101	418	0.14	0.77	0.08	0.26	5.11	19.27	0.55	5.17
241-AP-102	248	0.17	0.81	0.07	0.21	4.06	20.36	0.49	4.11
241-AP-103	238	0.17	0.82	0.06	0.20	4.01	20.53	0.40	4.06
241-AP-104	223	0.18	0.99	0.02	0.00	0.08	24.78	0.14	0.08
241-AP-105	281	0.16	0.85	0.10	0.15	2.91	21.37	0.64	2.95
241-AP-106	287	0.16	0.97	0.01	0.03	0.65	24.25	0.08	0.66
241-AP-107	164	0.22	0.84	0.10	0.16	3.12	21.09	0.67	3.16
241-AP-108	682	0.12	0.74	0.10	0.29	5.72	18.57	0.63	5.79
241-AW-101	53	0.54	0.97	0.01	0.03	0.14	24.18	0.06	0.59
241-AW-102	103	0.31	0.91	0.01	0.11	2.08	22.80	0.05	2.10
241-AW-103	331	0.15	0.72	0.04	0.33	0.88	18.01	0.29	6.68
241-AW-104	76	0.39	0.22	0.01	0.96	1.20	5.58	0.10	19.14
241-AW-105	244	0.17	0.48	0.06	0.63	2.82	12.05	0.43	12.50
241-AW-106	70	0.43	0.86	0.13	0.13	2.58	21.53	0.84	2.62

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Table F-9. Waste Addition Study: Time to Reach 25% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
Filled up with original waste									
241-AY-101	67	0.44	0.82	0.04	0.20	3.16	20.61	0.24	4.06
241-AY-102	4	5.82	0.91	0.02	0.01	0.07	22.78	0.15	0.21
241-AZ-101	29	0.92	0.89	0.07	0.10	0.20	22.17	0.46	2.07
241-AZ-102	19	1.38	0.89	0.16	0.07	0.09	22.23	1.09	1.44
241-SY-101	55	0.52	0.82	0.39	0.08	0.56	20.43	2.59	1.64
241-SY-102	71	0.42	0.59	0.21	0.43	0.55	14.87	1.37	8.70
241-SY-103	41	0.67	0.74	0.72	0.07	0.43	18.51	4.78	1.45
Filled up with water									
241-AN-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-102	21	1.22	0.93	0.08	0.02	0.47	23.17	0.54	0.47
241-AN-103	111	0.29	0.91	0.16	0.05	0.17	22.75	1.06	1.04
241-AN-104	61	0.47	0.93	0.14	0.04	0.13	23.18	0.93	0.72
241-AN-105	62	0.47	0.91	0.16	0.05	0.27	22.83	1.08	0.94
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	28	0.95	0.92	0.05	0.06	0.64	23.02	0.36	1.18
241-AP-101	450	0.13	0.78	0.08	0.25	4.99	19.42	0.53	5.05
241-AP-102	270	0.16	0.82	0.07	0.20	3.87	20.59	0.45	3.92
241-AP-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-104	233	0.18	0.99	0.02	0.00	0.08	24.76	0.13	0.08
241-AP-105	291	0.16	0.86	0.09	0.15	2.93	21.38	0.63	2.97
241-AP-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

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Table F-9. Waste Addition Study: Time to Reach 25% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 25% LFL $t_{25\%}$ (day)	Minimum vent rate to prevent 25% LFL (cfm)	Hydrogen concentration at time $t_{25\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{25\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{25\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{25\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{25\%}$ (%)	Ammonia flammability at time $t_{25\%}$ (%)	Methane flammability at time $t_{25\%}$ (%)
Filled up with water									
241-AP-107	206	0.19	0.86	0.09	0.14	2.67	21.62	0.61	2.71
241-AP-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-101	66	0.44	0.96	0.00	0.03	0.16	24.02	0.03	0.70
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	356	0.14	0.73	0.05	0.32	0.83	18.27	0.37	6.35
241-AW-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-102	9	2.81	0.97	0.01	0.01	0.04	24.32	0.05	0.12
241-AZ-101	40	0.69	0.91	0.05	0.09	0.18	22.70	0.31	1.87
241-AZ-102	24	1.10	0.89	0.13	0.07	0.09	22.35	0.87	1.35
241-SY-101	79	0.38	0.87	0.23	0.08	0.52	21.82	1.54	1.52
241-SY-102	87	0.35	0.63	0.17	0.40	0.50	15.71	1.12	8.01
241-SY-103	121	0.27	0.90	0.18	0.06	0.36	22.48	1.20	1.20

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Table F-10. Waste Addition Study: Time to Reach 100% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (% LFL)	Ammonia flammability at time $t_{100\%}$ (% LFL)	Methane flammability at time $t_{100\%}$ (% LFL)
Filled up with original waste									
241-AN-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-102	91	0.33	3.87	0.09	0.10	2.04	96.72	0.57	2.06
241-AN-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-104	387	0.14	3.81	0.23	0.15	0.56	95.28	1.56	3.09
241-AN-105	1109	0.11	3.80	0.17	0.20	1.14	94.93	1.15	3.92
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	115	0.28	3.78	0.08	0.25	2.69	94.43	0.51	4.94
241-AP-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-101	436	0.13	3.90	0.01	0.12	0.56	97.53	0.06	2.40
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table F-10. Waste Addition Study: Time to Reach 100% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (% LFL)	Ammonia flammability at time $t_{100\%}$ (% LFL)	Methane flammability at time $t_{100\%}$ (% LFL)
Filled up with original waste									
241-AY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-102	18	1.42	3.90	0.02	0.04	0.31	97.46	0.15	0.89
241-AZ-101	156	0.22	3.64	0.07	0.42	0.82	90.99	0.46	8.49
241-AZ-102	94	0.33	3.71	0.16	0.30	0.39	92.72	1.09	6.02
241-SY-101	768	0.12	3.61	0.39	0.36	2.48	90.18	2.59	7.23
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	366	0.14	3.53	0.72	0.35	2.06	88.30	4.78	6.92
Filled up with water									
241-AN-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-102	107	0.29	3.90	0.08	0.10	1.97	97.40	0.54	1.99
241-AN-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-104	1495	0.11	3.84	0.14	0.15	0.54	96.09	0.93	2.98
241-AN-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	149	0.23	3.78	0.05	0.24	2.63	94.48	0.36	4.85
241-AP-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table F-10. Waste Addition Study: Time to Reach 100% LFL and Flammability With Barometric Breathing Rate. (3 Sheets)

Tank	Time to reach 100% LFL $t_{100\%}$ (day)	Minimum vent rate to prevent 100% LFL (cfm)	Hydrogen concentration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia concentration at time $t_{100\%}$ $[NH_3](t)$ (%)	Methane concentration at time $t_{100\%}$ $[CH_4](t)$ (%)	N_2O concentration at time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen flammability at time $t_{100\%}$ (% LFL)	Ammonia flammability at time $t_{100\%}$ (% LFL)	Methane flammability at time $t_{100\%}$ (% LFL)
Filled up with water									
241-AP-107	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AP-108	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-105	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AY-102	39	0.69	3.91	0.01	0.02	0.17	97.78	0.05	0.49
241-AZ-101	246	0.17	3.68	0.05	0.38	0.73	91.92	0.31	7.58
241-AZ-102	125	0.26	3.73	0.13	0.28	0.37	93.23	0.87	5.65
241-SY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur

APPENDIX G

MATHCAD MODELS FOR THE STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION AND LOWER FLAMMABILITY EVALUATION FOR HANFORD TANK WASTE SINGLE-POINT MODEL AND MONTE CARLO ANALYSIS

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G.0 Peer Review Summary

Appendix G consists of this summary section and 10 MathCAD Models. The first nine models are in groups of three.

The models

- "*RPP-5926 Rev. 2: 01 Calculation of Mass Transport Coefficient "h" for Soluble Gas*",
- "*RPP-5926 Rev. 2: 02 Decay Heat Generation Rate Based on Radionuclide Data*", and
- "*RPP-5926 Rev. 2: 03 Hydrogen Generation Rate Calculations Single-Point Calculation*"

are samples of the models used to check the calculations presented in Appendices B, C, and D.

The models

- "*RPP-5926 Rev. 2: 04 Calculation of Mass Transport Coefficient "h" for Soluble Gas*",
- "*RPP-5926 Rev. 2: 05 Decay Heat Generation Rate Based on Radionuclide Data*", and
- "*RPP-5926 Rev. 2: 06 Hydrogen Generation Rate Calculations Single-Point Calculation*"

are the same models except with the waste diluted with water as presented in Appendix F.

Finally, the models

- "*RPP-5926 Rev. 2: 07 Calculation of Mass Transport Coefficient "h" for Soluble Gas*",
- "*RPP-5926 Rev. 2: 08 Decay Heat Generation Rate Based on Radionuclide Data*", and
- "*RPP-5926 Rev. 2: 09 Hydrogen Generation Rate Calculations Single-Point Calculation*"

are the same models except with the waste diluted with additional supernatant liquids with the same properties as the supernatant originally present in the given tank as presented in Appendix F.

The model

- "*RPP-5926 Rev. 2: 10 Hydrogen Generation Rate Calculations*"

contains the Monte Carlo Calculation for Tank 241-AN-104 as presented in the report Section 4.6 "Uncertainty Analysis: Tank 241-AN-104 As An Example".

In order to make it easier on the reader, Table G-1 compares the results from the MathCad calculation to the results in the appropriate appendix, and where each of the corresponding values can be found in the report.

Table G-1. Comparison of Miscellaneous Results With Calculation Check (Tank 241-AY-102).

Variable Name	Units	Original Result	Location	MathCad Variable Name	MathCad Result	Location
Heat load (total)	Watt	3.64E+04	B-26	$heat_load_1$	3.64E+04	G-21
Heat load (supernatant)	Watt	2.83E+02	B-26	$heat_load_3$	2.82E+02	G-21
Heat load (solid layer)	Watt	3.61E+04	B-26	$heat_load_4$	3.61E+04	G-21
G_{rad} (total)	cfm	3.00E-02	B-72	$HGRradv_1$	3.00E-02	G-50
G_{rad} (supernatant)	cfm	2.26E-04	B-72	$HGRradv_3$	2.26E-04	G-50
G_{rad} (solid layer)	cfm	2.98E-02	B-72	$HGRradv_4$	3.00E-02	G-50
G_{therm} (total)	cfm	1.24E-03	B-72	$HGRthermv_1$	1.31E-03	G-50
G_{therm} (supernatant)	cfm	3.31E-04	B-72	$HGRthermv_3$	3.39E-04	G-50
G_{therm} (solid layer)	cfm	9.08E-04	B-72	$HGRthermv_4$	9.66E-04	G-50
G_{corr} (total)	cfm	5.71E-04	B-72	$HGRthermv_1$	5.71E-04	G-50
G_{corr} (supernatant)	cfm	2.11E-04	B-72	$HGRthermv_3$	2.11E-04	G-50
G_{corr} (solid layer)	cfm	3.60E-04	B-72	$HGRthermv_4$	3.59E-04	G-50
G_{mod} (total)	cfm	3.18E-02	B-72	HGR_1	3.20E-02	G-50
G_{mod} (supernatant)	cfm	7.68E-04	B-72	HGR_3	7.77E-04	G-50
G_{mod} (solid layer)	cfm	3.10E-02	B-72	HGR_4	3.10E-02	G-50
k_2	mol/(L x min)	4.31E-10	C-8	k_2	4.32E-10	G-9
h_A	cfm	1.05E-02	C-8	h_A	1.05E-02	G-9
K_H	mol/(L x atm)	19.65	C-5	K_H	21.6	G-8
Steady-state hydrogen concentration (off normal)	(%)	9.86E+00	D-9	$[H2_{ss_bb}]$	9.03E+00	G-40
Steady-state ammonia concentration (off normal)	(%)	0.02	D-9	$[NH3_{ss_bb}]$	0.019	G-41
Steady-state methane concentration (off normal)	(%)	0.11	D-9	$[CH4_{ss_bb}]$	0.11	G-41
Steady-state N_2O concentration (off normal)	(%)	0.77	D-9	$[N2O_{ss_bb}]$	0.77	G-41
Time to reach 25% LFL at loss of ventilation	day	23	D-17	$time_{1_25\%LFL}$	23	G-51
Minimum vent rate to prevent 25% LFL	cfm	3.3	D-17	$vent_{1_25\%LFL}$	3.2	G-51
Time to reach 100% LFL at loss of ventilation	day	114	D-25	$time_{1_100\%LFL}$	116	G-51
Minimum vent rate to prevent 100% LFL	cfm	0.80	D-25	$vent_{1_100\%LFL}$	0.78	G-51
Time to reach 25% LFL at loss of ventilation (water-fill case)	day	9	5-2, F-31	$time_{1_25\%LFL}$	9	G-101
Time to reach 100% LFL at loss of ventilation (water-fill case)	day	39	5-2, F-34	$time_{1_100\%LFL}$	41	G-101
Time to reach 25% LFL at loss of ventilation (waste-fill case)	day	4	5-2, F-30	$time_{1_25\%LFL}$	4	G-151
Time to reach 100% LFL at loss of ventilation (waste-fill case)	day	18	5-2, F-33	$time_{1_100\%LFL}$	18	G-151

Notes: atm = atmospheres.
cfm = cubic feet per minute.
HGR = hydrogen generation rate.
L = liter.
LFL = lower flammability limit.

G.1 RPP-5926 Rev. 2: 01 Calculation of Mass Transport Coefficient "h" for Soluble Gas -- 241-AY-102

CH2MHILL
Hanford Group, Inc.

SA Barker

Calculation of Mass Transport Coefficient "h" for Soluble Gas

241-AY-102

References

Hu, T. A., S. A. Barker, D. C. Hedengren, M.A. Kufahl, 2001, "*Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*", RPP-5926, Rev. 1, CH2MHILL Hanford Group, Inc., Richland, WA.

Input Data

Constants

$\rho_g := 1.17 \cdot \frac{kg}{m^3}$	Density of gas
$D_g := 2.50 \times 10^{-5} \cdot \frac{m^2}{s}$	Diffusion coefficient in gas phase
$\mu_g := 2.0 \cdot 10^{-5} \cdot \frac{kg}{m \cdot s}$	Viscosity of gas
$g = 9.807 \frac{m}{s^2}$	gravitational number
$\Delta T := 1 \cdot K$	Temperature difference between waste surface and gas
$\beta_g := 3.30 \cdot 10^{-3} \cdot \frac{1}{K}$	Thermal expansion coefficient of Gas
$L_c := 5.7825 \cdot m$	Characteristic Length (1/4 of Diameter)
$D_L := 2.8 \cdot 10^{-9} \cdot \frac{m^2}{s}$	Diffusion Coefficient in Liquid Phase
$\rho_L := 1300 \cdot \frac{kg}{m^3}$	Density of Liquid

+

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$\mu_L := 6.82 \cdot 10^{-4} \cdot \frac{kg}{m \cdot s}$ Viscosity of Liquid

$\beta_L := 3.02 \cdot 10^{-4} \cdot \frac{1}{K}$ Thermal expansion coefficient of Liquid

$MW_{NH3} := 17.0307 \cdot \frac{gm}{mol}$ Molecular Weight of Ammonia

$h_{g_Schumpe_model} := -0.0481 \cdot \frac{L}{mol}$ Schumpe Model Coefficient

Read Waste Information From "NH3CALInputData010829.xls"

IData :=

C:\..\NH3CALInputData010829.xls

Find Waste Properties

Tank_id := "241-AY-102"

TFI1 := search(Tank_id,"-",1) TFI1 = 3.000

TankFarm := substr(Tank_id,TFI1 + 1,2) TankFarm = "AY"

TankNames3 := stack(TankNames1,TankNames2)

j1 := 1..177

$na1_{j1} := j1$

vent_rate := 250·cfm From (Bingham 2000)

Find The Appropriate Tank Specific Information:

fi1 := FindIndex(TankNames6,Tank_id)

$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$

$tank_{idx} := fi1_1 + 1$ $tank_{idx} = 24.000$

$class_{waste} := if\left[\left(fi1_1 < 29\right), "dst", "sst"\right]$

$class_{waste} = "dst"$

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$$comp := \begin{pmatrix} \text{"Na+"} \\ \text{"AL+3"} \\ \text{"Fe+3"} \\ \text{"Cr+3"} \\ \text{"Ni+2"} \\ \text{"K+"} \\ \text{"OH-"} \\ \text{"NO3-"} \\ \text{"NO2-"} \\ \text{"CO3-2"} \\ \text{"PO4-3"} \\ \text{"SO4-2"} \\ \text{"F-"} \\ \text{"Cl-"} \end{pmatrix} \qquad Co := \begin{pmatrix} IData_{tank_{idx},2} \\ IData_{tank_{idx},3} \\ IData_{tank_{idx},4} \\ IData_{tank_{idx},5} \\ IData_{tank_{idx},6} \\ IData_{tank_{idx},7} \\ IData_{tank_{idx},8} \\ IData_{tank_{idx},9} \\ IData_{tank_{idx},10} \\ IData_{tank_{idx},11} \\ IData_{tank_{idx},12} \\ IData_{tank_{idx},13} \\ IData_{tank_{idx},14} \\ IData_{tank_{idx},15} \end{pmatrix} mL \qquad mw := \begin{pmatrix} 22.99 \\ 26.98 \\ 55.85 \\ 52 \\ 58.71 \\ 39.09 \\ 17.0074 \\ 62.0049 \\ 46.0055 \\ 60.0092 \\ 94.9676 \\ 96.0576 \\ 19 \\ 35.453 \end{pmatrix} \cdot \frac{gm}{mol} \qquad H := \begin{pmatrix} .1143 \\ .2174 \\ .1161 \\ .0648 \\ .1654 \\ .0922 \\ .0839 \\ .0128 \\ .0795 \\ .1423 \\ .2119 \\ .1117 \\ .092 \\ .0318 \end{pmatrix}$$

Component Concentration Molecular Weight

$$\frac{Co}{\frac{\mu \cdot gm}{mL}} =$$

	1
1	$5.400 \cdot 10^4$
2	$1.970 \cdot 10^3$
3	10.100
4	29.100
5	4.020
6	388.000
7	$1.439 \cdot 10^3$
8	486.000
9	$7.290 \cdot 10^3$
10	$4.865 \cdot 10^4$
11	$3.010 \cdot 10^3$
12	$2.320 \cdot 10^3$
13	91.050
14	197.343
15	
16	

$[NH3_SS_dome] := IData_{tank_{idx},16} \cdot ppm$ $\qquad [NH3_SS_dome] = 4.286\,ppm$

$[NH3_L] := IData_{tank_{idx},17} \cdot \frac{\mu \cdot gm}{mL}$ $\qquad [NH3_L] = 73.700\,\frac{\mu \cdot gm}{mL}$

$[H2O_{wt\%}] := IData_{tank_{idx},18}\,\%$ $\qquad [H2O_{wt\%}] = 92.010\,\%$

$\rho_{liq} := IData_{tank_{idx},19} \cdot \frac{gm}{mL}$ $\qquad \rho_{liq} = 1.120\,\frac{gm}{mL}$

$vol_{waste} := IData_{tank_{idx},20} \cdot kilo \cdot L$ $\qquad vol_{waste} = 2.355 \times 10^3\,kilo \cdot L$

$vol_{headspace} := 104939 \cdot ft^3$ .....AI

$Q_{normal_vent} := vent_rate$ .....AH

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$T_{headspace_c} := IData_{tank_{idx},21} \cdot C$ $\quad T_{headspace} := (T_{headspace_c} + 273.15) \cdot K$ $\quad T_{headspace} = 294.549\,K$

$T_{waste_c} := 36.666667 \cdot C$ $\quad T_{waste} := (T_{waste_c} + 273.15) \cdot K$ $\quad T_{waste} = 309.817\,K$

$K_{H_soln_corr_fact} := IData_{tank_{idx},23}$ .....AA

$K_{H_soln_corr_fact} = 1.100$

$P := 1 \cdot atm$

$t := 35 \cdot day$ time of interest

Calculations

Schmidt Number

$$S_c := \frac{\mu_g}{D_g \cdot \rho_g}$$

$$S_c = 0.683761$$

Grashoff Number

$$G_r := \frac{g \cdot \beta_g \cdot \rho_g^2 \cdot L_c^3 \cdot \Delta T}{\mu_g^2}$$

$$G_r = 2.141 \times 10^{10}$$

Film Coefficient - Vapor

$$h_g := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$ Vapor Film Coefficient

$$h_g = 1.587 \times 10^{-3} \frac{m}{s}$$

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Film Coefficient - Liquid

$$h_L := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_L}\right)^{\frac{1}{3}} \cdot \left(\frac{g \cdot \beta_L \cdot \rho_L^2 \cdot \Delta T}{\mu_L^2}\right)^{\frac{1}{3}}$$ Liquid Film Coefficient

$$h_L = 5.306 \times 10^{-6} \frac{m}{s}$$

Sum C_i

$$C_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i}}{1000}$$

$$C_{sum} = 3.555 \frac{mol}{m^3}$$ X

Sum C_i x H_i

$$CH_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i} \cdot H_i}{1000}$$

$$CH_{sum} = 0.430 \frac{mol}{m^3}$$ .....Y

K_H^o In Water

=EXP(-8.0964+3917.5/(273.15+W3)-0.003-14*(273.15+W3))

$$K_{H_o} := \exp\left(-8.0964 + \frac{3917.5 \cdot K}{T_{waste}} - .00314 \cdot \frac{T_{waste}}{K}\right)$$

$$K_{H_o} = 35.707$$ .....Z

KHo In Solution

=Z3/POWER(10,Y3+X3*I60)*AA3

$$K_H := \frac{K_{H_o} \cdot K_{H_soln_corr_fact}}{10^{\left[\left[\frac{C_{sum}}{\left(\frac{mol}{m^3}\right)}\right] \cdot \left[\frac{h_{g_Schumpe_model}}{\left(\frac{L}{mol}\right)}\right] + \left[\frac{CH_{sum}}{\left(\frac{mol}{m^3}\right)}\right]\right]}} \cdot \frac{mol}{L \cdot atm}$$

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$K_H = 21.617 \frac{mol}{L \cdot atm}$ ..... AB

$Output_3 := \frac{K_H}{\frac{mol}{L \cdot atm}}$

Ammonia Concentration

$[NH3_L] = 0.074 \frac{kg}{m^3}$

$[NH3_{liq}] := \frac{[NH3_L]}{MW_{NH3}}$

$[NH3_{liq}] = 4.327 \times 10^{-3} \frac{mol}{L}$ ..... AD

$Output_5 := \frac{[NH3_{liq}]}{\frac{mol}{L}}$

Ammonia Partial Pressure

$P_{NH3} := \frac{[NH3_{liq}]}{K_H}$

$P_{NH3} = 2.002 \times 10^{-4} atm$ ..... AE

Molar Volume

$V_m := 22.4 \cdot \frac{L}{mol} \cdot \frac{T_{headspace}}{273.15 \cdot K}$

$Output_4 := \frac{V_m}{\frac{L}{mol}}$

$V_m = 24.154842 \frac{L}{mol}$ ..... AG

Steady-State Ammonia Concentration

$[NH3_{ss}] := \frac{[NH3_SS_dome]}{V_m}$

$[NH3_{ss}] = 1.77427 \times 10^{-7} \frac{mol}{L}$ ..... AF

Equivalent Steady-State Ammonia Concentration In Liquid Phase

$[NH3_{ss_liq_eq}] := K_H \cdot V_m \cdot [NH3_{ss}] \cdot P$

$[NH3_{ss_liq_eq}] = 9.264 \times 10^{-5} \frac{mol}{L}$ ..... AJ

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Mass Transport Properties

$$h_A := Q_{normal_vent} \cdot \left(\frac{[NH3_{ss}]}{[NH3_{liq}] - [NH3_{ss_liq_eq}]} \right)$$

$$Output_2 := \frac{h_A}{cfm}$$

$h_A = 0.010474\ cfm$ ..... AK

Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_SS_dome] \cdot P \right) \cdot V_m$$

$vr_{ss_norm} = 1.071 \times 10^{-3}\ cfm$ ..... AL

Off-Normal Barometric Vent Rate

$$Q_{off_normal_vent} := .45 \cdot \frac{\%}{day} \cdot vol_{headspace}$$

$Q_{off_normal_vent} = 0.328\ cfm$ ..... AM

Off-Normal Constant, k_1 And k_2

$$k_1 := \frac{Q_{off_normal_vent} + \left(h_A \cdot K_H \cdot P \cdot V_m \right)}{vol_{headspace}}$$

$k_1 = 5.524 \times 10^{-5}\ \frac{1}{min}$ ..... AN

$$k_2 := \frac{h_A \cdot [NH3_{liq}]}{vol_{headspace}}$$

$$Output_1 := \frac{k_2}{\frac{mol}{L \cdot min}}$$

$k_2 = 4.319 \times 10^{-10}\ \frac{mol}{L \cdot min}$ ..... AO

Off-Normal Ammonia Partial Pressure

$$P_{NH3_on} := \frac{k_2}{k_1} \cdot V_m \cdot P$$

$P_{NH3_on} = 1.88866 \times 10^{-4}\ atm$ ..... AP

$\frac{P_{NH3_on}}{atm} = 188.866\ ppm$ ..... AQ

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Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_off_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot \frac{P_{NH3_on}}{atm} \cdot P \right) \cdot V_m$$

$$vr_{ss_off_norm} = 6.194 \times 10^{-5}\ cfm$$ .....AR

Ammonia Concentration At Time, t

$$[NH3_t] := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1} \right) \cdot \exp(-1 \cdot k_1 \cdot t) \right] \cdot V_m \cdot 10^6 \cdot ppm$$

$$[NH3_t] = 177.463\ ppm$$ .....AU

Ammonia Diffusion Rate At Time, t

$$\delta_{NH3_t} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_t] \cdot P \right) \cdot V_m$$

$$\delta_{NH3_t} = 1.243 \times 10^{-4}\ cfm$$ .....AV

KRT

$$KRT := T_{waste} \cdot K_H \cdot 0.082 \cdot \frac{(L \cdot atm)}{mol \cdot K}$$

$$KRT = 549.173$$ .....AW

Film Coefficient - Liquid At Time t

$$h_{Lt} := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_{liq}} \right)^{\frac{1}{3}} \cdot \left[\frac{g \cdot \beta_L \cdot (\rho_{liq})^2 \cdot \Delta T}{(\mu_L)^2} \right]^{\frac{1}{3}}$$ Liquid Film Coefficient

$$h_{Lt} = 5.049 \times 10^{-6}\ \frac{m}{s}$$ .....AX

Film Coefficient - Vapor At Time t

$$h_{gt} := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$ Vapor Film Coefficient

$$h_{gt} = 1.587 \times 10^{-3}\ \frac{m}{s}$$ .....AY

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Film Coefficient - Overall At Time t

Overall Film Coefficient

$$h := \frac{1}{\frac{1}{h_{Lt}} + \frac{KRT}{h_{gt}}}$$

$h = 1.838 \times 10^{-6} \frac{m}{s}$ ..... AZ

Surface Area

$area := \pi \cdot (37.5 \cdot ft)^2$

$area = 4.418 \times 10^3 \, ft^2$ ..... BA

$hxA := h \cdot area$

$hxA = 1.598 \, cfm$ ..... BB

Effective Surface Area (percent)

$$eff_{SA} := \frac{h_A}{hxA}$$

$eff_{SA} = 0.655\%$ ..... BC

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Ammonia Concentrations As A Function Of Time

$$time := \begin{pmatrix} -30 \\ -20 \\ -10 \\ .0001 \\ .5 \\ 3 \\ 5 \\ 10 \\ 15 \\ 30 \\ 35 \\ 50 \\ 70 \\ 90 \\ 110 \\ 120 \\ 125 \\ 127 \\ 130 \\ 135 \\ 140 \\ 145 \end{pmatrix} \cdot day$$

$i := 1..22$

$$NH3_i := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1}\right)\exp\left(-1 \cdot \frac{k_1}{\frac{1}{day}} \cdot \frac{time_i}{day}\right)\right] \cdot V_m$$

$h_A = 0.010\ cfm$

$[NH3_{liq}] = 4.327 \times 10^{-3}\ \frac{mol}{L}$

$K_H = 21.617\ \frac{mol}{L \cdot atm}$

$V_m = 24.155\ \frac{L}{mol}$

$RR_{NH3_i} := h_A \cdot \left([NH3_{liq}] - K_H \cdot P \cdot NH3_i\right) \cdot V_m$

$RR_{NH3_1} := h_A$ $\quad NH3_1 := [NH3_SS_dome]$

$RR_{NH3_2} := h_A$ $\quad NH3_2 := [NH3_SS_dome]$

$NH3_3 := [NH3_SS_dome]$

$RR_{NH3_3} := h_A$

$RR_{NH3_4} := h_A$

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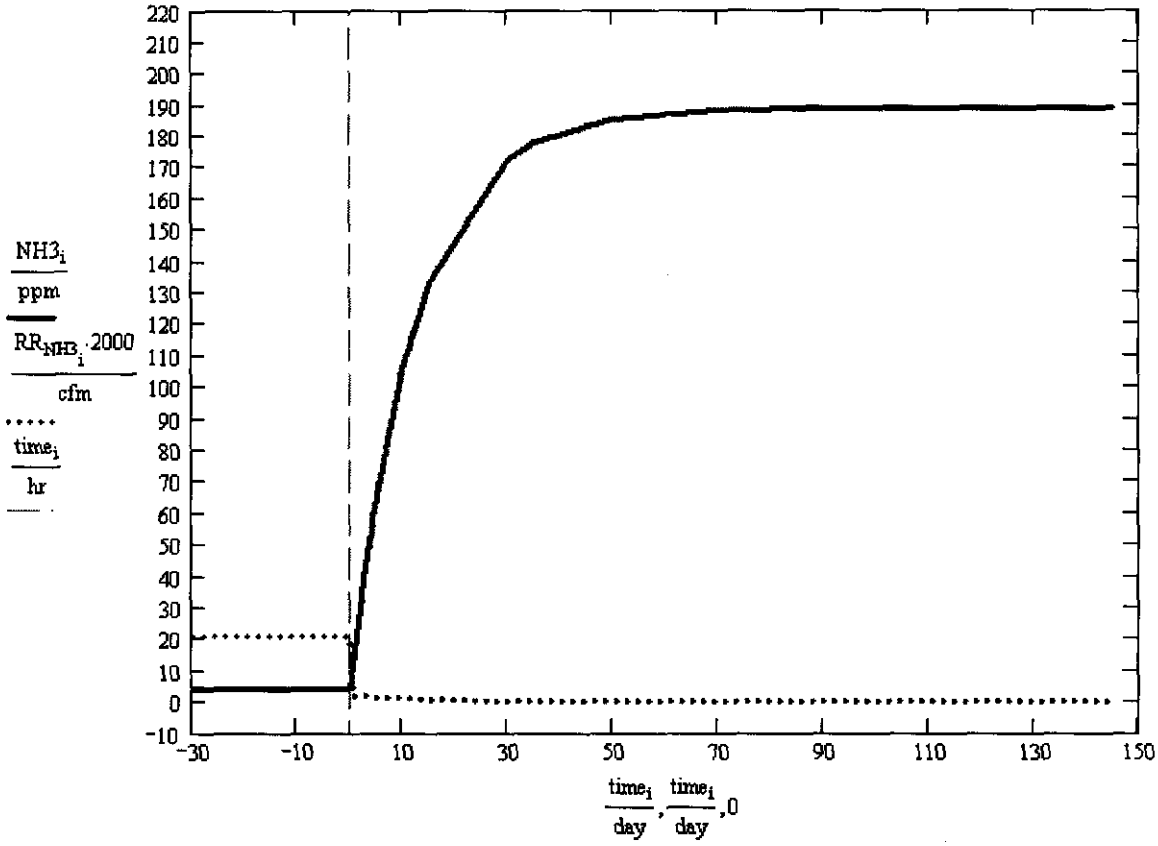

Output Results To Datafile "rpp5926_r2_01_NH3CALOutputData0020203.xls"

C:\..\rpp5926_r2_01_NH3CALOutputData0020203.xls

Output

$$\text{Output} = \begin{pmatrix} 4.319 \times 10^{-10} \\ 0.010 \\ 21.617 \\ 24.155 \\ 4.327 \times 10^{-3} \end{pmatrix}$$

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G.2. RPP-5926 Rev. 2: 02 Decay Heat Generation Rate -- Based on Radionuclide Data, 241-AY-102

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Decay Heat Generation Rate

Based On Radionuclide Data — SA Barker

Reference:

Ref: Kirkpatrick, T. D., and Brown, R. C., 1984, Basis and Values for Specific Activity and Decay Heat Generation Rates for Selected Radionuclides, RHO-SD-RE-TI-131, Rockwell Hanford Operations, Richland, Washington.

Bring In The Radionuclide Data From SD-RE-TI-131

M := READPRN("sd-re-ti-131.prn")

key VVVVVVVVVVVVVVVVVVVVVVV
0==> half-life (days); 1==> half-life multiplier 10x (days);
2==> Atomic weight (gm/gm_mol);
3==> Specific Activity (dpm/gm); 4==> Specific Activity multiplier 10x (dpm/gm);
5==> Decay Heat Generation Rate (Watt/Ci) 6==> Decay Heat Generation Rate multiplier 10x (Watt/Ci)

M =

	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	$1.925 \cdot 10^3$	0	60	2.51	15	1.54	-2
2	$3.915 \cdot 10^3$	0	85	8.71	14	1.5	-3
3	50.55	0	89	6.44	16	3.45	-3
4	$1.045 \cdot 10^4$	0	90	3.08	14	1.16	-3
5	2.671	0	90	1.21	18	5.53	-3
6	$1.045 \cdot 10^4$	0	90	6.17	14	6.69	-3
7	58.51	0	91	5.44	16	3.58	-3
8	64.02	0	95	4.77	16	5.04	-3
9	3.608	0	95	8.46	17	1.32	-3
10	35.06	0	95	8.7	16	4.79	-3
11	64.02	0	95	1.53	17	1.56	-2
12	7.78	7	99	3.76	10	5.01	-4
13	39.35	0	103	7.15	16	3.27	-3
14	0.039	0	103	7.22	19	2.3	-4
15	39.35	0	103	1.43	17	3.5	-3

Author: SA Barker Date: 6/12/02

$j := 0, 1 .. 61$

$na_j := j$ $\quad$ $name := augment(na, me)$

$k := 0 .. 3$

$kk := 0 .. 3$

excel := File Name is "FGS Input 020203 .xls"

C:\..\FGS Input 020203 .xls

excel =

	0	1	2	3	4	5	6
0	1	2	3	4	5	6	7
1	0	0	0	0	0	0	0
2	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
3	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
4	0	0	0	0	0	0	0
5	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	67.467	220.193
6	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	59.727	214.404
7	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	144.373	277.714
8	0	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	1.371	351.899

Tank_id := "241-AY-102"

...The following data is from Hu 2001b, except where noted

$tank_{idxT} := 68$

>>>> Compensate for Origin = 0 <<<<

$tank_{idxL} := tank_{idxT} + 1$

$:= tank_{idxT} + 2$

$$[137Cs] := \begin{bmatrix} excel_{tank_{idxT},(7-1)} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},(7-1)} \\ excel_{tank_{idxS},(7-1)} \end{bmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 74.771 \\ 1 \times 10^{-12} \\ 27.904 \\ 175.68 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

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$$[90Sr] := \begin{bmatrix} excel_{tank_{idxT},(6-1)} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},(6-1)} \\ excel_{tank_{idxS},(6-1)} \end{bmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$\rho_{waste} := \begin{bmatrix} excel_{tank_{idxT},(8-1)} \\ excel_{tank_{idxS},(8-1)} \\ excel_{tank_{idxL},(8-1)} \\ excel_{tank_{idxS},(8-1)} \end{bmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.21 \\ 1.427 \\ 1.13 \\ 1.427 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{bmatrix} excel_{tank_{idxT},(9-1)} \\ 1 \cdot 10^{-9} \\ excel_{tank_{idxL},(9-1)} \\ excel_{tank_{idxS},(9-1)} \end{bmatrix} \cdot kilo \cdot L \qquad vol_{waste} = \begin{pmatrix} 2403 \\ 0 \\ 1757 \\ 646 \end{pmatrix} kilo \cdot L$$

$$name_{isotope} := \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$[137Ba] := \overrightarrow{[137Cs] \cdot 0.946} \qquad [90Y] := \overrightarrow{[90Sr] \cdot 1.000}$$

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Find the appropriate radio-isotope specific information:

```
FindIndex(M, key) := | r ← rows(M) − 1
                     | c ← cols(M) − 1
                     | i ← 0
                     | j ← 0
                     | while (j ≤ c)·(M_{i,j} ≠ key)
                     |     | i ← i + 1  if  i < r
                     |     | otherwise
                     |     |     | i ← 1
                     |     |     | j ← j + 1
                     | (i, j)  if  j ≤ c
                     | 0  otherwise
```

$$name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$fi_{kk} := \text{FindIndex}\left(name, name_{isotope_{kk}}\right)$$

$$fi = \begin{pmatrix} \{2,1\} \\ \{2,1\} \\ \{2,1\} \\ \{2,1\} \end{pmatrix}$$

$$ii := \overrightarrow{fi} \qquad ii_0 = \begin{pmatrix} 31 \\ 1 \end{pmatrix} \quad ii_1 = \begin{pmatrix} 32 \\ 1 \end{pmatrix} \quad ii_2 = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad ii_3 = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$in_{kk} := \left(ii_{kk}\right)_0$$

$$in = \begin{pmatrix} 31 \\ 32 \\ 4 \\ 5 \end{pmatrix}$$

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$$half_life_{kk} := M_{in_{kk},0} \cdot 10^{M_{in_{kk},1}} \cdot day \qquad half_life = \begin{pmatrix} 30.171 \\ 4.795 \times 10^{-6} \\ 28.601 \\ 0.007 \end{pmatrix} yr \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$wt_{atomic_{kk}} := M_{in_{kk},2} \cdot \frac{gm}{g_mol} \qquad wt_{atomic} = \begin{pmatrix} 137 \\ 137 \\ 90 \\ 90 \end{pmatrix} \frac{gm}{g_mol} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA_{kk} := M_{in_{kk},3} \cdot 10^{M_{in_{kk},4}} \cdot \frac{dpm}{gm} \qquad SA = \begin{pmatrix} 1.92 \times 10^{14} \\ 1.21 \times 10^{21} \\ 3.08 \times 10^{14} \\ 1.21 \times 10^{18} \end{pmatrix} \frac{dpm}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA = \begin{pmatrix} 86.486 \\ 5.45 \times 10^{8} \\ 138.739 \\ 5.45 \times 10^{5} \end{pmatrix} \frac{Ci}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope_{kk}} := M_{in_{kk},5} \cdot 10^{M_{in_{kk},6}} \cdot \frac{watt}{Ci} \qquad q_{isotope} = \begin{pmatrix} 1.01 \times 10^{-3} \\ 3.92 \times 10^{-3} \\ 1.16 \times 10^{-3} \\ 5.53 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope} = \begin{pmatrix} 3.444 \times 10^{-3} \\ 0.013 \\ 3.955 \times 10^{-3} \\ 0.019 \end{pmatrix} \frac{mBTU}{Ci \cdot hr} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$heat_load_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[\begin{array}{l} ([137Cs])_k \cdot q_{isotope_0} + ([137Ba])_k \cdot q_{isotope_1} \cdots \\ + ([90Sr])_k \cdot q_{isotope_2} + ([90Y])_k \cdot q_{isotope_3} \end{array} \right]$$

$$heat_load = \begin{pmatrix} 3.639 \times 10^{4} \\ 0 \\ 282 \\ 3.611 \times 10^{4} \end{pmatrix} watt$$

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Check answer #1

$z := 1$

$$heat_load2 := vol_{waste_z} \cdot \rho_{waste_z} \cdot \left[\begin{array}{l} ([137Cs])_z \cdot q_{isotope_0} + ([137Ba])_z \cdot q_{isotope_1} \cdots \\ + ([90Sr])_z \cdot q_{isotope_2} + ([90Y])_z \cdot q_{isotope_3} \end{array} \right]$$

$heat_load2 = 0\,watt$

Check answer #2 (alternate calculation)

$$[137Cs] = \begin{pmatrix} 74.771 \\ 1 \times 10^{-12} \\ 27.904 \\ 175.68 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 8.486 \times 10^{4} \\ 3.531 \times 10^{-8} \\ 6.205 \times 10^{4} \\ 2.281 \times 10^{4} \end{pmatrix} ft^3 \qquad \rho_{waste} = \begin{pmatrix} 1.21 \\ 1.427 \\ 1.13 \\ 1.427 \end{pmatrix} \frac{gm}{mL}$$

$$name_{isotope} := \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$[137Cs137Ba] := \overrightarrow{[137Cs]} \cdot 1.000 \qquad [90Sr90Y] := \overrightarrow{[90Sr]} \cdot 1.000$$

$jk := 0..1$

$$name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$fi2_{jk} := FindIndex(name, name_{isotope_{jk}})$

$$fi2 = \begin{bmatrix} \begin{pmatrix} 33 \\ 1 \end{pmatrix} \\ \begin{pmatrix} 6 \\ 1 \end{pmatrix} \end{bmatrix}$$

$$ii := \overrightarrow{fi2} \qquad ii_0 = \begin{pmatrix} 33 \\ 1 \end{pmatrix} \qquad ii_1 = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$$

$in2_{jk} := (ii_{jk})_0$

$$in2 = \begin{pmatrix} 33 \\ 6 \end{pmatrix}$$

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$$half_life2_{jk} := M_{in2_{jk},0} \cdot 10^{M_{in2_{jk},1}} \cdot day \quad half_life2 = \begin{pmatrix} 11019.593 \\ 10446.150 \end{pmatrix} day \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$wt2_{atomic_{jk}} := M_{in2_{jk},2} \cdot \frac{gm}{g_mol} \quad wt2_{atomic} = \begin{pmatrix} 137 \\ 90 \end{pmatrix} \frac{gm}{g_mol} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$SA2_{jk} := M_{in2_{jk},3} \cdot 10^{M_{in2_{jk},4}} \cdot \frac{dpm}{gm} \quad SA2 = \begin{pmatrix} 3.74 \times 10^{14} \\ 6.17 \times 10^{14} \end{pmatrix} \frac{dpm}{gm} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$SA2 = \begin{pmatrix} 168.468 \\ 277.928 \end{pmatrix} \frac{Ci}{gm} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$q2_{isotope_{jk}} := M_{in2_{jk},5} \cdot 10^{M_{in2_{jk},6}} \cdot \frac{watt}{Ci} \quad q2_{isotope} = \begin{pmatrix} 4.72 \times 10^{-3} \\ 6.69 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$q2_{isotope} = \begin{pmatrix} 0.016 \\ 0.023 \end{pmatrix} \frac{mBTU}{Ci \cdot hr} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$heat_load2_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[([137Cs137Ba])_k \cdot q2_{isotope_0} + ([90Sr90Y])_k \cdot q2_{isotope_1} \right]$$

$$heat_load2 = \begin{pmatrix} 3.639 \times 10^4 \\ 0 \\ 282.093 \\ 3.611 \times 10^4 \end{pmatrix} watt \quad \text{compares to ==>} \quad heat_load = \begin{pmatrix} 3.639 \times 10^4 \\ 0 \\ 282 \\ 3.611 \times 10^4 \end{pmatrix} watt$$

$$heat_load2 = \begin{pmatrix} 1.242 \times 10^5 \\ 0 \\ 962.542 \\ 1.232 \times 10^5 \end{pmatrix} \frac{BTU}{hr} \quad heat_load = \begin{pmatrix} 1.241 \times 10^5 \\ 0 \\ 961.482 \\ 1.231 \times 10^5 \end{pmatrix} \frac{mBTU}{hr}$$

a1 :=

36388.25
1.63E-23
282.0001
36106.24

Write results to excel file
"rpp5926_r2_02_DecayHeatGRInput020203 .xls"

$$\left(\frac{heat_load}{watt} \right)$$

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G.3. RPP-5926 Rev. 2: 03 Hydrogen Generation Rate Calculations Single-Point Calculation – Calculation Note RPP-5926, Revision 2, 241-AY-102

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SA Barker

Hydrogen Generation Rate Calculations

Single-Point Calculation - Calculation Note
RPP-5926, Revision 2:

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Read Waste Information From "FGS Input 020203 .xls"

excel :=

C:\..\FGS Input 020203 .xls

Datafile Name Is "FGS Input 020203 .xls"

excel =

	1	2	3	4	5	6	7
1	1.000	2.000	3.000	4.000	5.000	6.000	7.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	$1.166 \cdot 10^3$	$4.160 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.040	82.911
4	0.000	$1.166 \cdot 10^3$	$4.160 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.040	82.911
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	67.467	220.193
7	0.000	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	59.727	214.404
8	0.000	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	144.373	277.714
9	0.000	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	1.371	351.899
10	0.000	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	0.011	434.834
11	0.000	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	2.845	262.084
12	0.000	$3.140 \cdot 10^3$	$1.123 \cdot 10^5$	$1.719 \cdot 10^5$	$3.898 \cdot 10^4$	15.096	351.079
13	0.000	$3.140 \cdot 10^3$	$1.123 \cdot 10^5$	$1.719 \cdot 10^5$	$3.898 \cdot 10^4$	0.062	374.528
14	0.000	$3.140 \cdot 10^3$	$1.123 \cdot 10^5$	$1.719 \cdot 10^5$	$3.898 \cdot 10^4$	31.297	325.809
15	0.000	$3.556 \cdot 10^3$	$1.209 \cdot 10^5$	$1.616 \cdot 10^5$	$4.113 \cdot 10^4$	7.631	223.898
16	0.000	$3.556 \cdot 10^3$	$1.209 \cdot 10^5$	$1.616 \cdot 10^5$	$4.113 \cdot 10^4$	0.026	220.893

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Input Data

Waste Properties (Crust Layer Volume Is Included In Solids Layer In This Example)
(1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

$Tank_id := \text{"241-AY-102"}$ $\quad TFI1 := search(Tank_id, \text{"-"}, 1)$ $\quad TFI1 = 3.000$

$TankFarm := substr(Tank_id, TFI1 + 1, 2)$ $\quad TankFarm = \text{"AY"}$

$TankNames3 := stack(TankNames1, TankNames2)$

$j1 := 1..177$

$na1_{j1} := j1$

$vent_rate = 250 \cdot cfm$ From (Bingham 2000)

Find The Appropriate Tank Specific Information:

$fi1 := FindIndex(TankNames3, Tank_id)$

$$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$$

$tank_{idxT} := \left[\left(fi1_1 - 1\right) \cdot 3\right] + 3$ $\quad tank_{idxT} = 69.000$

$tank_{idxL} := tank_{idxT} + 1$

$tank_{idxS} := tank_{idxT} + 2$

$class_{waste} := if\left[\left(fi1_1 < 29\right), \text{"dst"}, \text{"sst"}\right]$

$class_{waste} = \text{"dst"}$

...The Following Data Is From Hu 2001b, Except Where Noted

$$[TOC] := \begin{pmatrix} excel_{tank_{idxT},2} \\ excel_{tank_{idxS},2} \\ excel_{tank_{idxL},2} \\ excel_{tank_{idxS},2} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [TOC] = \begin{pmatrix} 1.769 \times 10^3 \\ 2.124 \times 10^3 \\ 1.639 \times 10^3 \\ 2.124 \times 10^3 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$Ci = 1.61 \cdot 10^{-2} \cdot \frac{BTU}{hr}$$

$$[NO_2] := \begin{pmatrix} excel_{tank_{idxT},3} \\ excel_{tank_{idxS},3} \\ excel_{tank_{idxL},3} \\ excel_{tank_{idxS},3} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 4.431 \times 10^3 \\ 228.866 \\ 5.976 \times 10^3 \\ 228.866 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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$$[NO_3] := \begin{pmatrix} excel_{tank_{idxT},4} \\ excel_{tank_{idxS},4} \\ excel_{tank_{idxL},4} \\ excel_{tank_{idxS},4} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 378.889 \\ 294.845 \\ 409.789 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] := \begin{pmatrix} excel_{tank_{idxT},5} \\ excel_{tank_{idxS},5} \\ excel_{tank_{idxL},5} \\ excel_{tank_{idxS},5} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \\ 1.480 \times 10^{3} \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[90Sr] := \begin{pmatrix} excel_{tank_{idxT},6} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},6} \\ excel_{tank_{idxS},6} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[137Cs] := \begin{pmatrix} excel_{tank_{idxT},7} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},7} \\ excel_{tank_{idxS},7} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 74.771 \\ 1.000 \times 10^{-12} \\ 27.904 \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$\rho_{waste} := \begin{pmatrix} excel_{tank_{idxT},8} \\ excel_{tank_{idxS},8} \\ excel_{tank_{idxL},8} \\ excel_{tank_{idxS},8} \end{pmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.210 \\ 1.427 \\ 1.130 \\ 1.427 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{pmatrix} excel_{tank_{idxT},9} \\ 1 \cdot 10^{-9} \\ excel_{tank_{idxL},9} \\ excel_{tank_{idxS},9} \end{pmatrix} \cdot kilo \cdot L \qquad vol_{waste} = \begin{pmatrix} 2403 \\ 0 \\ 1757 \\ 646 \end{pmatrix} kilo \cdot L$$

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$$F_{H2O} := \begin{pmatrix} excel_{tank_{idxT},10} \\ excel_{tank_{idxS},10} \\ excel_{tank_{idxL},10} \\ excel_{tank_{idxS},10} \end{pmatrix} \qquad F_{H2O} = \begin{pmatrix} 73.8 \\ 38.0 \\ 87.0 \\ 38.0 \end{pmatrix} \%$$

$$F_{liquid_2} := \left(\frac{F_{H2O_2}}{F_{H2O_3}}\right) \qquad F_{liquid_3} := \left(\frac{F_{H2O_3}}{F_{H2O_3}}\right) \qquad F_{liquid_4} := \left(\frac{F_{H2O_4}}{F_{H2O_3}}\right)$$

$$F_{liquid_1} := \left[\frac{F_{liquid_2}\cdot\left(vol_{waste_2}\cdot\rho_{waste_2}\right) + F_{liquid_3}\cdot\left(vol_{waste_3}\cdot\rho_{waste_3}\right) + F_{liquid_4}\cdot\left(vol_{waste_4}\cdot\rho_{waste_4}\right)}{vol_{waste_4}\cdot\rho_{waste_4} + vol_{waste_3}\cdot\rho_{waste_3} + vol_{waste_2}\cdot\rho_{waste_2}}\right]$$

$$F_{liquid} = \begin{pmatrix} 82.137 \\ 43.678 \\ 100.000 \\ 43.678 \end{pmatrix} \%$$

$$Temp_{waste} := \begin{pmatrix} excel_{tank_{idxT},11} + 273.15 \\ excel_{tank_{idxS},11} + 273.15 \\ excel_{tank_{idxL},11} + 273.15 \\ excel_{tank_{idxS},11} + 273.15 \end{pmatrix}\cdot K \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

From (Bingham 2000)

$$Temp_{vap} := \left(excel_{tank_{idxL},12} + 273.15\right)\cdot K \qquad Temp_{vap} = 316.761\,K$$

From (Bingham 2000)

Make Sure You Run The File "Decay Heat Generation Rate 011129 .MCD"

excel2 :=

C:\..\rpp5926_r2_02_DecayHeatGRInput020203 .xls

Read Results From Excel File "rpp5926_r2_02_DecayHeatGRInput020203 .xls"

$$HeatLoad_{137Cs_90Sr} := excel2\cdot watt$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.639\times10^{4} \\ 1.628\times10^{-23} \\ 282.000 \\ 3.611\times10^{4} \end{pmatrix} watt$$

Calculated By Barker In "Decay Heat Generation Rate .MCD"

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TankInfo :=

C:\..\TankInfo_post-1999.xls

Read Waste properties From Excel File "TankInfo_post-1999.xls"

$j := 1..27$

$na_j := j$ name := augment(na, TankId)

TankFarm = "AY"

fi := FindIndex(name, TankFarm)

$fi = \begin{pmatrix} 11.000 \\ 2.000 \end{pmatrix}$

$vol_{tank} := TankInfo_{fi_1,4} \cdot ft^3$

$vol_{tank} = 1407\ kilo \cdot gal$ $vol_{tank} = 188089\ ft^3$

vent_rate = 250.000 cfm

$vent_rate_{bb} := .0045 \cdot \left(vol_{tank} - vol_{waste_1}\right) \cdot \frac{1}{day}$

$vent_rate_{bb} = 0.323\ cfm$

$diam_{tank} := 2 \cdot TankInfo_{(fi_1,2)} \cdot ft$ $diam_{tank} = 75.000\ ft$

$ht_{tank} := \frac{vol_{waste}}{TankInfo_{(fi_1,8)} \cdot \frac{gal}{in}}$ estimation Of Waste Depth

$ht_{tank} = \begin{pmatrix} 230.504 \\ 9.592 \times 10^{-11} \\ 168.537 \\ 61.966 \end{pmatrix} in$ estimation Of Waste Depth

$vol_{head} := vol_{tank} - vol_{waste_1}$ $vol_{head} = 1.032 \times 10^5\ ft^3$

Dome-Space Methane Nitrous Oxide And Ammonia Concentrations (Bingham 2000)

$[H_2] := .0022 \cdot \%$ $[CH_4] := 1.4445 \cdot ppm$ $[N2O] := .0010 \cdot \%$ $[NH_3] := 4.29 \cdot ppm$

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Ammonia Diffusion Information (see Rpp5926 R1 - Calculation Of Mass Transport Coefficient H For Soluble Gas AY-102 .mcd (from File "rpp5929_r2_01_NH3CALOutputData0020203.xls"

$NH3In :=$

C:\..\rpp5926_r2_01_NH3CALOutputData0020203.xls

$k_{2_NH3} := NH3In_1 \cdot \frac{mol}{L \cdot min}$ $\qquad k_{2_NH3} = 4.319 \times 10^{-10} \frac{mol}{L \cdot min}$

$h_{A_NH3} := NH3In_2 \cdot cfm$ $\qquad h_{A_NH3} = 1.047 \times 10^{-2}\, cfm$

$K_H := NH3In_3 \cdot \frac{mol}{L \cdot atm}$ $\qquad K_H = 21.617 \frac{mol}{L \cdot atm}$

$V_m := NH3In_4 \cdot \frac{L}{mol}$ $\qquad V_m = 24.155 \frac{L}{mol}$

$[NH3_{liq}] := NH3In_5 \cdot \frac{mol}{L}$ $\qquad [NH3_{liq}] = 4.327 \times 10^{-3} \frac{mol}{L}$

$P := 1 \cdot atm$

$k_{1_NH3} := \frac{vent_rate_{bb} + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}$ $\qquad k_{1_NH3} = 5.611 \times 10^{-5}\, min^{-1}$

Gas Concentrations At LFL

$LFL_{H2} := 4 \cdot \%$ $\qquad \%LFL_{H2} := \frac{.04}{100}$

$LFL_{NH3} := 15 \cdot \%$ $\qquad \%LFL_{NH3} := \frac{.15}{100}$

$LFL_{CH4} := 5 \cdot \%$ $\qquad \%LFL_{CH4} := \frac{.05}{100}$

End Of Input Data

Calculations

$i := 1..4$

Hydrogen Generation Due To Thermolysis (Hu, 2000 - Eqn 4-8)

Define Constants (Based On Hu (2000) Eqn 4-8)

$e_{thm} := 2.76 \cdot 10^9 \frac{g_mol}{kg \cdot day}$ Thermolysis pre-exponential Factor (Hu, 2000 - Eqn 4-8)

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$E_{thm} := 89.33 \cdot \frac{kilo \cdot J}{g_mol}$ activation Energy (Hu, 2000 - Eqn 4-8)

$R_{const} = 8.3144739 \frac{J}{g_mol \cdot K}$ Gas Constant

$$r_f := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-8)

$r_f = 0.700$

Calculate The Weight Fraction Of Liquid In The Waste

$W_{H2O_i} := vol_{waste_i} \cdot \rho_{waste_i} \cdot F_{H2O_i}$

$$W_{H2O} = \begin{pmatrix} 2.147 \times 10^{6} \\ 5.424 \times 10^{-7} \\ 1.727 \times 10^{6} \\ 3.504 \times 10^{5} \end{pmatrix} kg$$

Check Units On Input Data

$$[TOC] = \begin{pmatrix} 1.769 \times 10^{3} \\ 2.124 \times 10^{3} \\ 1.639 \times 10^{3} \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$([TOC_{wt\%}])_i := \frac{([TOC])_3}{\rho_{waste_3}} \cdot 100$$

$$[TOC_{wt\%}] = \begin{pmatrix} 0.145 \\ 0.145 \\ 0.145 \\ 0.145 \end{pmatrix}$$

$$[Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \times 10^{0} \\ 1.480 \times 10^{3} \\ 100.206 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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$$\left([Al_{wt\%}]\right)_i := \frac{([Al])_3}{\rho waste_3} \cdot 100$$

$$[Al_{wt\%}] = \begin{pmatrix} 0.131 \\ 0.131 \\ 0.131 \\ 0.131 \end{pmatrix}$$

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Calculate The Hydrogen Generation Rate Due To Thermolysis (HGR_{therm})

$$HGR_{therm_scf_i} := \frac{a_{thm}}{\left(\frac{g_mol}{kg \cdot day}\right)} \cdot rf \cdot \left(\left[TOC_{wt\%}\right]\right)_i \cdot \left[\left(\left[Al_{wt\%}\right]\right)_i\right]^{.4} \cdot e^{-\left[\frac{\frac{E_{thm}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)}\right] \cdot \left(\frac{Temp_{waste_i}}{K}\right)}\right]} \cdot F_{liquid_i} \cdot \frac{g_mol}{kg \cdot day}$$

$$HGR_{therm_i} := HGR_{therm_scf_i}$$

$$HGR_{therm} = \begin{pmatrix} 3.091 \times 10^{-6} \\ 1.644 \times 10^{-6} \\ 2.681 \times 10^{-7} \\ 1.644 \times 10^{-6} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{thermv_i} := HGR_{therm_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right) \cdot \frac{Temp_{vap}}{273.15 \cdot K}$$

$$HGR_{thermv_1} := \sum_{i=2}^{4} HGR_{thermv_i}$$

$$HGR_{thermv} = \begin{pmatrix} 1.880 \\ 2.154 \times 10^{-12} \\ 0.489 \\ 1.391 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv} = \begin{pmatrix} 1.306 \times 10^{-3} \\ 1.496 \times 10^{-15} \\ 3.393 \times 10^{-4} \\ 9.662 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{thermv_scf_i} := HGR_{thermv_i} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.621 \\ 1.857 \times 10^{-12} \\ 0.421 \\ 1.200 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.126 \times 10^{-3} \\ 1.290 \times 10^{-15} \\ 2.926 \times 10^{-4} \\ 8.332 \times 10^{-4} \end{pmatrix} cfm$$

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Hydrogen Generation Due To Radiolysis (Hu, 2000 - Eqn 4-16)

Constant Definition (Based On Hu (2000) Eqn 4-16)

$E_{rad} := 44.32 \cdot \frac{kilo \cdot J}{g_mol}$ Activation Energy Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$e_{rad} := 2.49 \cdot 10^{6} \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential Factor Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$$rf := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient Of TOC (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-16)

$G_{H2O_sat} := 0.005 \cdot \frac{molecules}{100 \cdot eV}$ default Water Radiolysis G-value

Check Units On Input Data

$Temp_{waste_2} = 345.150\,K$

$mw_{NO2} := (14.0067 + 2 \cdot 15.9994) \cdot \frac{gm}{g_mol}$

$mw_{NO3} := (14.0067 + 3 \cdot 15.9994) \cdot \frac{gm}{g_mol}$

$$[NO_3] = \begin{pmatrix} 378.889 \times 10^{0} \\ 294.845 \times 10^{0} \\ 409.789 \times 10^{0} \\ 294.845 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{3_molar}] := \frac{[NO_3]}{mw_{NO3}}$$

$$[NO_{3_molar}] = \begin{vmatrix} 10^{-3} \\ 4.755 \times 10^{-3} \\ 6.609 \times 10^{-3} \\ 3 \end{vmatrix} \frac{g_mol}{liter}$$

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$$[NO_2] = \begin{pmatrix} 4.431 \times 10^{3} \\ 228.866 \times 10^{0} \\ 5.976 \times 10^{3} \\ 228.866 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{2_molar}] := \frac{[NO_2]}{mw_{NO2}}$$

$$[NO_{2_molar}] = \begin{pmatrix} 0.096 \\ 4.975 \times 10^{-3} \\ 0.130 \\ 4.975 \times 10^{-3} \end{pmatrix} \frac{g_mol}{liter}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 7.712 \times 10^{12} \\ 3.451 \times 10^{-15} \\ 5.977 \times 10^{10} \\ 7.652 \times 10^{12} \end{pmatrix} \mu \cdot Ci$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 1.242 \times 10^{5} \\ 5.557 \times 10^{-23} \\ 962.224 \\ 1.232 \times 10^{5} \end{pmatrix} \frac{BTU}{hr}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.639 \times 10^{4} \\ 1.628 \times 10^{-23} \\ 282.000 \\ 3.611 \times 10^{4} \end{pmatrix} watt$$

$$H_{load} := \overrightarrow{\left(\frac{HeatLoad_{137Cs_90Sr}}{vol_{waste} \cdot \rho_{waste}} \right)}$$

$$H_{load} = \begin{pmatrix} 0.013 \\ 1.141 \times 10^{-17} \\ 1.420 \times 10^{-4} \\ 0.039 \end{pmatrix} \frac{watt}{kg}$$

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Calculate The Hydrogen Generation Rate Due To Radiolysis (HGR_{rad})

$$G_{org_i} := \frac{e_{rad}}{\left(\frac{molecules}{100 \cdot eV}\right)} \cdot e^{-\left[\left[\frac{\frac{E_{rad}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)} \cdot \frac{Temp_{waste_i}}{K}\right]}\right]\right]} \cdot ff \cdot \left(\left[TOC_{wt\%}\right]\right)_i \cdot \frac{molecules}{100 \cdot eV}$$

$$G_{org} = \begin{pmatrix} 0.050 \\ 0.050 \\ 0.013 \\ 0.050 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \overrightarrow{\left[\left[0.45 - 0.56 \cdot \left[\frac{[NO3_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO2_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}}\right] \cdot \frac{molecules}{100 \cdot eV}\right]}$$

$$G_{H2O} = \begin{pmatrix} 0.151 \\ 0.282 \\ 0.127 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O_i} := \begin{cases} G_{H2O_i} & \text{if } G_{H2O_i} > G_{H2O_sat} \\ G_{H2O_sat} & \text{otherwise} \end{cases}$$

$$G_{H2O} = \begin{pmatrix} 0.151 \\ 0.282 \\ 0.127 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$HGR_{rad_i} := \left(G_{H2O_i} + G_{org_i}\right) \cdot H_{load_i} \cdot F_{liquid_i} \cdot \frac{g_mol}{6.02 \cdot 10^{23} \cdot molecules}$$

$$HGR_{rad} = \begin{pmatrix} 1.459 \times 10^{-5} \\ 1.173 \times 10^{-20} \\ 1.415 \times 10^{-7} \\ 4.027 \times 10^{-5} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad} = \begin{pmatrix} 1.843 \times 10^{-5} \\ 1.482 \times 10^{-20} \\ 1.788 \times 10^{-7} \\ 5.088 \times 10^{-5} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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$$HGR_{radv} := \overrightarrow{\left[HGR_{rad}\cdot\left(vol_{waste}\cdot\rho_{waste}\right)\right]}\cdot\frac{Temp_{vap}}{273.15\cdot K}$$

$$HGR_{radv_1} := \sum_{i=2}^{4} HGR_{radv_i}$$

$$HGR_{radv} = \begin{pmatrix} 43.3888 \\ 1.9422\times10^{-26} \\ 0.3259 \\ 43.0630 \end{pmatrix}\frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 0.030 \\ 1.349\times10^{-29} \\ 2.263\times10^{-4} \\ 0.030 \end{pmatrix} cfm$$

$$HGR_{radv_scf} := HGR_{radv}\cdot\frac{273.15\cdot K}{Temp_{vap}}$$

$$HGR_{radv_scf} = \begin{pmatrix} 37.415 \\ 1.675\times10^{-26} \\ 0.281 \\ 37.134 \end{pmatrix}\frac{ft^3}{day}$$

$$HGR_{radv_scf} = \begin{pmatrix} 0.026 \\ 1.163\times10^{-29} \\ 1.951\times10^{-4} \\ 0.026 \end{pmatrix} cfm$$

Hydrogen Generation Due To Corrosion (Hu, 2000 - Eqn 4-17)

Constant Definition (Based On Hu (2000) Eqn 4-17)

$$R_{corr} := \begin{cases} 3.6\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 3.6\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 1.83\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{otherwise} \end{cases}$$

Corrosion Coefficient (1.83E-08 For DSTs, 3.6E-08 For SSts) ($m^3/min/m^2$) Reference Temperature Is 25°C (Hu, 2001B - Eqn 2-1)

$$R_{corr} = 1.830\times10^{-8}\frac{m^3}{m^2\cdot min}$$

Calculate The Wetted Area Of Steel (vertical Waste Storage Tank, Assuming A Flat Bottom)

$$\left[\pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank}\right] = \pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank}$$

$$Awet_1 := \pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank_1}$$

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$$Awet_2 := \pi \cdot diam_{tank} \cdot ht_{tank_2}$$

$$Awet_3 := \pi \cdot diam_{tank} \cdot ht_{tank_3}$$

$$Awet_4 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_4}$$

$$Awet = \begin{pmatrix} 8.944 \times 10^{3} \\ 1.883 \times 10^{-9} \\ 3.309 \times 10^{3} \\ 5.635 \times 10^{3} \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due To Corrosion

$$HGR_{corr_mol} := \overrightarrow{\frac{R_{corr} \cdot Awet}{(vol_{waste} \cdot \rho_{waste})} \cdot \frac{273.15 \cdot K}{298.15 \cdot K}}$$

$$HGR_{corr_mol} = \begin{pmatrix} 3.078 \times 10^{-7} \\ 1.320 \times 10^{-7} \\ 1.668 \times 10^{-7} \\ 6.114 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{corr} := \overrightarrow{\left[HGR_{corr_mol} \cdot (vol_{waste} \cdot \rho_{waste}) \cdot \frac{Temp_{vap}}{273.15 \cdot K}\right]}$$

$$HGR_{corr} = \begin{pmatrix} 5.705 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 2.111 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr} = \begin{pmatrix} 0.822 \\ 1.730 \times 10^{-13} \\ 0.304 \\ 0.518 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_scf} := HGR_{corr} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{corr_scf} = \begin{pmatrix} 4.920 \times 10^{-4} \\ 1.036 \times 10^{-16} \\ 1.820 \times 10^{-4} \\ 3.099 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr_scf} = \begin{pmatrix} 0.708 \\ 1.492 \times 10^{-13} \\ 0.262 \\ 0.446 \end{pmatrix} \frac{ft^3}{day}$$

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Total Hydrogen Generation Rate

$$mass_{waste} = \begin{pmatrix} 2.908 \times 10^{6} \\ 1.427 \times 10^{-6} \\ 1.985 \times 10^{6} \\ 9.221 \times 10^{5} \end{pmatrix} kg$$

$$HGR_{thermv} = \begin{pmatrix} 1.880 \\ 2.154 \times 10^{-12} \\ 0.489 \\ 1.391 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 43.389 \\ 1.942 \times 10^{-26} \\ 0.326 \\ 43.063 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr} = \begin{pmatrix} 0.822 \\ 1.730 \times 10^{-13} \\ 0.304 \\ 0.518 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR := \overrightarrow{\left(HGR_{thermv} + HGR_{radv} + HGR_{corr}\right)}$$

$$HGR = \begin{pmatrix} 0.03201 \\ 1.61582 \times 10^{-15} \\ 7.76677 \times 10^{-4} \\ 0.03123 \end{pmatrix} cfm$$

$$HGR = \begin{pmatrix} 1.305 \times 10^{3} \\ 6.589 \times 10^{-11} \\ 31.670 \\ 1.273 \times 10^{3} \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

$$HGR_{stp} := HGR \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

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$$HGR_{stp} = \begin{pmatrix} 0.028 \\ 1.393 \times 10^{-15} \\ 6.697 \times 10^{-4} \\ 0.027 \end{pmatrix} cfm$$

$$HGR_{stp} = \begin{pmatrix} 39.745 \\ 2.006 \times 10^{-12} \\ 0.964 \\ 38.780 \end{pmatrix} \frac{ft^3}{day}$$

At Standard Conditions...

Steady-State Hydrogen Concentration (Assuming Normal Ventilation Rate)

$$[H2_{ss}] := \frac{HGR_1}{HGR_1 + vent_rate}$$

$$[H2_{ss}] = 128.012\,ppmv$$

$$[H2_{ss}] = 0.013\,\%$$

Steady-State Hydrogen Concentration (Assuming Barometric Breathing Ventilation Rate)

$$[H2_{ss_bb}] := \frac{HGR_1}{HGR_1 + vent_rate_{bb}}$$

$$[H2_{ss_bb}] = 9.026 \times 10^4\,ppmv$$

$$[H2_{ss_bb}] = 9.026\,\%$$

$$[H2_{ss_bb}] = 225.661\,\%LFL_{H2}$$

Gas Release Rate (Independent Of Ventilation Rate)

$$rate_{H2_rel} := [H2_{ss}] \cdot \frac{vent_rate}{1 - [H2_{ss}]}$$

$$rate_{H2_rel} = 0.0320\,cfm$$

$$rate_{H2_rel_bb} := [H2_{ss_bb}] \cdot \frac{vent_rate_{bb}}{1 - [H2_{ss_bb}]}$$

$$rate_{H2_rel_bb} = 0.032\,cfm$$

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Calculate Generation Rates Of Ammonia, Methane, And Nitrous Oxide (Assuming No Gas Retention)

$$GR_{NH3} := \frac{[NH_3] \cdot vent_rate}{1 - [NH_3]} \qquad GR_{NH3} = 1.07250 \times 10^{-3}\,cfm$$

$$GR_{CH4} := \frac{[CH_4] \cdot vent_rate}{1 - [CH_4]} \qquad GR_{CH4} = 3.611 \times 10^{-4}\,cfm$$

$$GR_{N2O} := \frac{[N2O] \cdot vent_rate}{1 - [N2O]} \qquad GR_{N2O} = 2.500 \times 10^{-3}\,cfm$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Normal Ventilation Rate)(Just A Check Of Methodology)

$$[NH3_{ss}] := \frac{GR_{NH3}}{GR_{NH3} + vent_rate} \qquad [NH3_{ss}] = 4.290 \times 10^{-4}\,\%$$

$$[CH4_{ss}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate} \qquad [CH4_{ss}] = 1.444 \times 10^{-4}\,\%$$

$$[N2O_{ss}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate} \qquad [N2O_{ss}] = 1.000 \times 10^{-3}\,\%$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Barometric Breathing Ventilation Rate)

$$NH3_1000_day := \left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1 \cdot \frac{k1_NH3}{\frac{1}{day}} \cdot 1000\right)\right] \cdot V_m$$

$$NH3_1000_day = 185.957\,ppm$$

$$[NH3_{ss_bb}] := NH3_1000_day \qquad [NH3_{ss_bb}] = 0.019\,\%$$

$$[NH3_{ss_bb}] = 0.124\,\%LFL_{NH3}$$

$$[CH4_{ss_bb}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate_{bb}} \qquad [CH4_{ss_bb}] = 0.112\,\%$$

$$[CH4_{ss_bb}] = 2.236\,\%LFL_{CH4}$$

$$[N2O_{ss_bb}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate_{bb}} \qquad [N2O_{ss_bb}] = 0.769\,\%$$

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Determine The Overall Steady-State Flammable Gas Concentration With Loss Of Ventilation

$$[Conc_mix_{ss_bb}] := \frac{[H2_{ss_bb}]}{LFL_{H2}} + \frac{[NH3_{ss_bb}]}{LFL_{NH3}} + \frac{[CH4_{ss_bb}]}{LFL_{CH4}}$$

$$[Conc_mix_{ss_bb}] = 228.022\%LFL$$

Set Variables Into Array, Where 1 => H2, 2 => NH3, 3 => CH4, And 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} 0.032 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Generation Rate

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} 0.032 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Release Rate (Assume No Retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss}] \\ [NH3_{ss}] \\ [CH4_{ss}] \\ [N2O_{ss}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 0.013 \\ 4.290 \times 10^{-4} \\ 1.444 \times 10^{-4} \\ 1.000 \times 10^{-3} \end{pmatrix} \%$$

Initial Concentration Rate (Assume At Steady-State With Normal Ops)

Calculate The Composition Of All Components At Time 't'

Special Calculation For Ammonia (Soluble Gas)

$$\lambda_i := \frac{vent_rate_{bb} + Rate_{rel_i}}{vol_{head}}$$

$$Conc_{in_i} := \frac{Rate_{rel_i} \cdot 100\%}{Rate_{rel_i} + vent_rate_{bb}}$$

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$$conc(t,i) := \begin{cases} Conc_{in_i}\cdot\left[1 - e^{\left(-\lambda_i\cdot t\right)}\right] + Conc_{init_i}\cdot\left[e^{\left(-\lambda_i\cdot t\right)}\right] & \text{if } i < 2 \\ Conc_{in_i}\cdot\left[1 - e^{\left(-\lambda_i\cdot t\right)}\right] + Conc_{init_i}\cdot\left[e^{\left(-\lambda_i\cdot t\right)}\right] & \text{if } i > 2 \\ \left[\dfrac{k2_NH3}{k1_NH3} + \left(\dfrac{[NH3_{ss}]}{V_m} - \dfrac{k2_NH3}{k1_NH3}\right)\exp\left(-1\cdot\dfrac{k1_NH3}{\frac{1}{day}}\cdot\dfrac{t}{day}\right)\right]\cdot V_m & \text{otherwise} \end{cases}$$

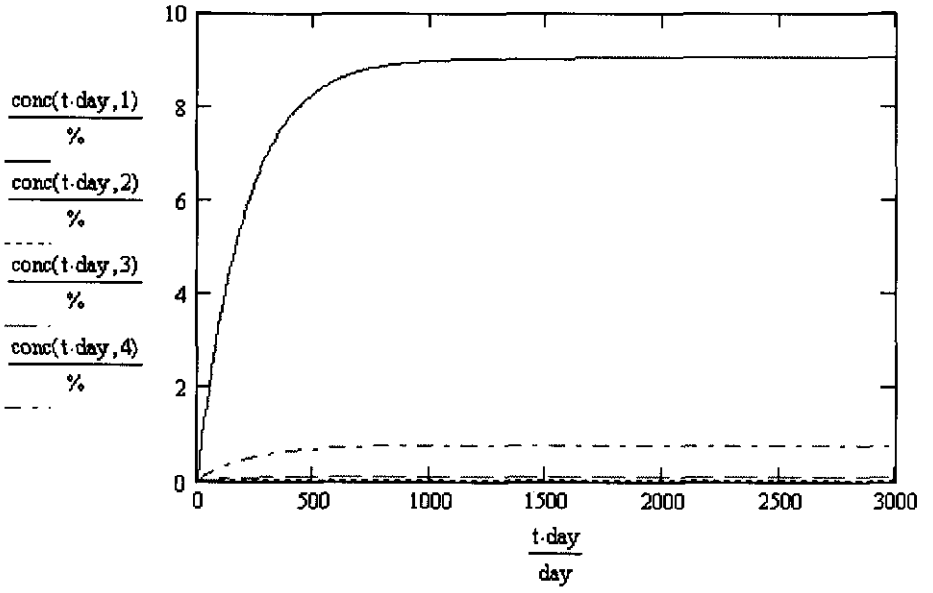
$conc(0\cdot sec,1) = 0.013\%$ $\quad conc(1000\cdot day,1) = 8.962\%$ $\quad conc(1000\cdot day,1) = 224.059\%LFL_{H2}$

$conc(0\cdot sec,2) = 4.290\times10^{-4}\%$ $\quad conc(1000\cdot day,2) = 0.019\%$ $\quad conc(1000\cdot day,2) = 0.124\%LFL_{NH3}$

$conc(0\cdot sec,3) = 1.444\times10^{-4}\%$ $\quad conc(1000\cdot day,3) = 0.111\%$ $\quad conc(1000\cdot day,3) = 2.212\%LFL_{CH4}$

$conc(0\cdot sec,4) = 1.000\times10^{-3}\%$ $\quad conc(1000\cdot day,4) = 0.761\%$

$t := 0,10..3000$



Calculate Steady-State Flammable Gas Concentration At Normal Operating Conditions

$$LFL_{mix}(z) := \frac{1}{\dfrac{conc(z,1)}{LFL_{H2}} + \dfrac{conc(z,2)}{LFL_{NH3}} + \dfrac{conc(z,3)}{LFL_{CH4}}}$$

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$LFL_{mix}(0 \cdot day) = 3.070 \times 10^{4}\%$

$LFL_{mix}(100 \cdot day) = 112.122\%$

Calculate The Time To Reach Various Fractions Of The LFL

Time To Reach 25 %LFL

TOL := .00001

$$f(z,tlfl) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - tlfl$$

tlfl := 25

z := 10·day Initial Guess

temp25 := −5·day Initial Value In Case Solution Cannot Be Found

temp25 := Re(root(f(z,tlfl),z))

temp25 = 23.119 day

$Time_{1_25\%LFL} := if\left([Conc_mix_{ss_bb}] > 25\%, if(temp25 < 0 \cdot day, 0 \cdot day, temp25), 10^{9} \cdot day\right)$

$Time_{1_25\%LFL} = 23.119\ day$

Time To Reach 50 %LFL

tlfl := 50

z := 10·day Initial Guess

temp50 := −5·day Initial Value In Case Solution Cannot Be Found

temp50 := Re(root(f(z,tlfl),z))

temp50 = 49.693 day

$Time_{1_50\%LFL} := if\left([Conc_mix_{ss_bb}] > 50\%, if(temp50 < 0 \cdot day, 0 \cdot day, temp50), 10^{9} \cdot day\right)$

$Time_{1_50\%LFL} = 49.693\ day$

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Time To Reach 75 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 75$$

$z := 10 \cdot day$ Initial Guess

$temp_{75} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := Re(root(f(z), z))$

$temp_{75} = 80.310\ day$

$Time_{1_75\%LFL} := if\left([Conc_mix_{ss_bb}] > 75\%, if\left(temp_{75} < 0 \cdot day, 0 \cdot day, temp_{75}\right), 10^9 \cdot day\right)$

$Time_{1_75\%LFL} = 80.310\ day$

Time To Reach 100 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 100$$

$z := 10 \cdot day$ Initial Guess

$temp_{100} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := Re(root(f(z), z))$

$temp_{100} = 116.405\ day$

$Time_{1_100\%LFL} := if\left([Conc_mix_{ss_bb}] > 100\%, if\left(temp_{100} < 0 \cdot day, 0 \cdot day, temp_{100}\right), 10^9 \cdot day\right)$

$Time_{1_100\%LFL} = 116.405\ day$

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Minimum Ventilation Rates Need To Prevent Headspace Concentrations From Reaching Various Levels

$$Conc_vr(V,i) := \begin{cases} \dfrac{Rate_{rel_i} \cdot 100 \cdot \%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] & \text{if } i < 2 \\ \dfrac{Rate_{rel_i} \cdot 100 \cdot \%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] & \text{if } i > 2 \\ \left[\dfrac{k2_NH3}{\frac{V + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}} + \left(\dfrac{[NH3_{ss}]}{V_m} - \dfrac{k2_NH3}{k1_NH3}\right) \exp\left[-1 \cdot \dfrac{\frac{V + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}}{\frac{1}{day}} \cdot 10^9\right]\right] \cdot V_m & \text{otherwise} \end{cases}$$

Ventilation Rate To Keep Concentration Less Than 25 %LFL

$$f2_25(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 24.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{25} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{25} := root(f2_25(z), z)$

$temp_{25} = 3.208734\ cfm$

$vent_rate_{1_25\%LFL} := if(temp_{25} < 0 \cdot cfm, 0 \cdot cfm, temp_{25} + 0.001 \cdot cfm)$

$vent_rate_{1_25\%LFL} = 3.210\ cfm$

Ventilation Rate To Keep Concentration Less Than 50 %LFL

$$f2_50(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 49.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{50} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := root(f2_50(z), z)$

$temp_{50} = 1.586387\ cfm$

$vent_rate_{1_50\%LFL} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, temp_{50} + 0.001 \cdot cfm)$

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$vent_rate_{1_50\%LFL} = 1.587\ cfm$

Ventilation Rate To Keep Concentration Less Than 75 %LFL

$$f2_75(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 74.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{75} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := root(f2_75(z), z)$

$temp_{75} = 1.046417\ cfm$

$vent_rate_{1_75\%LFL} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, temp_{75} + 0.001 \cdot cfm)$

$vent_rate_{1_75\%LFL} = 1.047\ cfm$

Ventilation Rate To Keep Concentration Less Than 100 %LFL

$$f2_100(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 99.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{1000} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := root(f2_100(z), z)$

$temp_{100} = 0.776625\ cfm$

$vent_rate_{1_100\%LFL} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, temp_{100} + 0.001 \cdot cfm)$

$vent_rate_{1_100\%LFL} = 0.778\ cfm$

Additional Calculations -- Estimated Time To LFL With Zero Ventilation

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Tank Headspace Hydrogen Concentration :

$vent_rate_{zb} := 1 \cdot 10^{-6} \cdot cfm$

$\%H_{2lim} := 100 \cdot [H2_{ss_bb}]$ $\%H_{2lim} = 9.026$ volume % Hydrogen

$\%LFL_{lim} := 100 \cdot [H2_{ss_bb}] \cdot \frac{100}{4}$ $\%LFL_{lim} = 225.661$ % LFL Based On Hydrogen

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Final H2 Concentration To Meet 25% (NH3 And CH4 Included) **Estimate Gas Concentrations At Final Conditions:**

$$H2_25\% := 0.0004\cdot\left(25 - \frac{conc(23.2\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(23.2\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_25\% = 0.987\,\%$$

Final H2 Concentration To Meet 50% (NH3 And CH4 Included):

$$H2_50\% := 0.0004\cdot\left(50 - \frac{conc(50\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(50\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_50\% = 1.977\,\%$$

Final H2 Concentration To Meet 100% (NH3 And CH4 Included):

$$H2_100\% := 0.0004\cdot\left(100 - \frac{conc(117\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(117\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_100\% = 3.958\,\%$$

Maximum %LFL With Loss Of Ventilation **(Assume Gas Conc. ~ Equal To Barometric Breathing At 100% LFL :**

$$LFL_{nat_breathing} := \frac{HGR_1}{\left(HGR_1 + vent_rate_{bb}\right)\cdot .04} + \frac{[NH3_{ss_bb}]}{\%LFL_{NH3}\cdot 100} + \frac{[CH4_{ss_bb}]}{\%LFL_{CH4}\cdot 100} \qquad LFL_{nat_breathing} = 228.022\,\%$$

Time To Reach 25% LFL With Zero Ventilation:

$$tempz_{25} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot\ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_25\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{25} = 23.118\,day$$

$$Time_zb2_25\%LFL := if\left(LFL_{nat_breathing} > 25\%, if\left(tempz_{25} < 0\cdot day, 0\cdot day, tempz_{25}\right), 999999999\cdot day\right)$$

$$Time_zb2_25\%LFL = 21.924\,day$$

Time To Reach 50% LFL With Zero Ventilation:

$$tempz_{50} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot\ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_50\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{50} = 49.690\,day$$

$$Time_zb2_50\%LFL := if\left(LFL_{nat_breathing} > 50\%, if\left(tempz_{50} < 0\cdot day, 0\cdot day, tempz_{50}\right), 999999999\cdot day\right)$$

$$Time_zb2_50\%LFL = 44.435\,day$$

Time To Reach 100% LFL With Zero Ventilation:

$$tempz_{100} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot\ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_100\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{100} = 116.399\,day$$

$$Time_zb2_100\%LFL := if\left(LFL_{nat_breathing} > 100\%, if\left(tempz_{100} < 0\cdot day, 0\cdot day, tempz_{100}\right), 999999999\cdot day\right)$$

$$Time_zb2_100\%LFL = 90.169\,day$$

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Summary Section

Input Data

Waste Properties (1 ==> Total Waste, 2 ==> Liquid Waste, 3 ==> Solid Waste)

Tank_id = "241-AY-102" $class_{waste}$ = "dst"

$$[TOC] = \begin{pmatrix} 1.769 \times 10^{3} \\ 2.124 \times 10^{3} \\ 1.639 \times 10^{3} \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 378.889 \\ 294.845 \\ 409.789 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 4.431 \times 10^{3} \\ 228.866 \\ 5.976 \times 10^{3} \\ 228.866 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \\ 1.480 \times 10^{3} \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [137Cs] = \begin{pmatrix} 74.771 \\ 1.000 \times 10^{-12} \\ 27.904 \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 634.805 \\ 2.642 \times 10^{-10} \\ 464.150 \\ 170.655 \end{pmatrix} kilo \cdot gal \qquad \rho_{waste} = \begin{pmatrix} 1.210 \\ 1.427 \\ 1.130 \\ 1.427 \end{pmatrix} \frac{gm}{mL} \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

$$F_{H2O} = \begin{pmatrix} 73.827 \\ 38.000 \\ 87.000 \\ 38.000 \end{pmatrix} \% \qquad HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.639 \times 10^{4} \\ 1.628 \times 10^{-23} \\ 282.000 \\ 3.611 \times 10^{4} \end{pmatrix} watt \qquad Temp_{vap} = 316.761\ K$$

$vol_{tank} = 1.407 \times 10^{3}\ kilo \cdot gal$ vent_rate = 250.000 cfm $vent_rate_{bb} = 0.323$ cfm

AN Tank Farm: Tank Da

$diam_{tank} = 75.000\ ft$ $$ht_{tank} = \begin{pmatrix} 230.504 \\ 9.592 \times 10^{-11} \\ 168.537 \\ 61.966 \end{pmatrix} in$$ estimation Of Waste Depth

Dome-Space Compositions

$[CH_4] = 1.444 \times 10^{-4}\%$ $[N2O] = 1.000 \times 10^{-3}\%$ $[NH_3] = 4.290 \times 10^{-4}\%$

End Of Input Data

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Output Data

Waste Properties (1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

Hydrogen Generation Rate Due To Thermolysis, Radiolysis, And Corrosion...

$$HGR_{thermv} = \begin{pmatrix} 1.306 \times 10^{-3} \\ 1.496 \times 10^{-15} \\ 3.393 \times 10^{-4} \\ 9.662 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv} = \begin{pmatrix} 0.030 \\ 1.349 \times 10^{-29} \\ 2.263 \times 10^{-4} \\ 0.030 \end{pmatrix} cfm \qquad HGR_{corr} = \begin{pmatrix} 5.705 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 2.111 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} cfm$$

Overall Hydrogen Generation Rate...

at The Headspace Conditions...

$$HGR = \begin{pmatrix} 0.032 \\ 1.616 \times 10^{-15} \\ 7.767 \times 10^{-4} \\ 0.031 \end{pmatrix} cfm \qquad HGR = \begin{pmatrix} 46.090 \\ 2.327 \times 10^{-12} \\ 1.118 \\ 44.972 \end{pmatrix} \frac{ft^3}{day}$$

at Standard Conditions (273°K)...

$$HGR_{stp} = \begin{pmatrix} 0.028 \\ 1.393 \times 10^{-15} \\ 6.697 \times 10^{-4} \\ 0.027 \end{pmatrix} cfm \qquad HGR_{stp} = \begin{pmatrix} 39.745 \\ 2.006 \times 10^{-12} \\ 0.964 \\ 38.780 \end{pmatrix} \frac{ft^3}{day}$$

Steady-State Compositions

Hydrogen At Normal Ventilation Rate...

$[H2_{ss}] = 0.320\,\%LFL_{H2}$

At Barometric Breathing Ventilation Rate

$[H2_{ss_bb}] = 225.661\,\%LFL_{H2}$

Ammonia At Normal Ventilation Rate...

$[NH3_{ss}] = 2.860 \times 10^{-3}\,\%LFL_{NH3}$

At Barometric Breathing Ventilation Rate

$[NH3_{ss_bb}] = 0.124\,\%LFL_{NH3}$

Methane At Normal Ventilation Rate...

$[CH4_{ss}] = 2.889 \times 10^{-3}\,\%LFL_{CH4}$

At Barometric Breathing Ventilation Rate

$[CH4_{ss_bb}] = 2.236\,\%LFL_{CH4}$

Nitrous Oxide At Normal Ventilation Rate...

$[N2O_{ss}] = 1.000 \times 10^{-3}\,\%$

At Barometric Breathing Ventilation Rate

$[N2O_{ss_bb}] = 0.769\,\%$

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Flammable Gas Concentrations After Loss Of Ventilation At Selected Time Periods

$conc_{mix}(0 \cdot day) = 0.326\ \%LFL$ $conc_{mix}(10 \cdot day) = 11.367\ \%LFL$

$conc_{mix}(100 \cdot day) = 89.189\ \%LFL$ $conc_{mix}(10^9 \cdot day) = 228.022\ \%LFL$

Time To Reach Various LFL Levels At Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_{1_25\%LFL} = 23.119\ day$ $Time_{1_75\%LFL} = 80.310\ day$

$Time_{1_50\%LFL} = 49.693\ day$ $Time_{1_100\%LFL} = 116.405\ day$

Time To Reach Various LFL Levels At Zero Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_zb_{2_25\%LFL} = 21.924\ day$

$Time_zb_{2_50\%LFL} = 44.435\ day$ $Time_zb_{2_100\%LFL} = 90.169\ day$

Minimum Ventilation Rates To Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL} = 3.210\ cfm$ $vent_rate_{1_75\%LFL} = 1.047\ cfm$

$vent_rate_{1_50\%LFL} = 1.587\ cfm$ $vent_rate_{1_100\%LFL} = 0.778\ cfm$

Gas Concentrations At Time To Reach 25% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{25}] = 0.987\ \%$	$[H2_{25}] = 24.671\ \%LFL_{H2}$
NH3	$[NH3_{25}] = 0.016\ \%$	$[NH3_{25}] = 0.105\ \%LFL_{NH3}$
CH4	$[CH4_{25}] = 0.011\ \%$	$[CH4_{25}] = 0.224\ \%LFL_{CH4}$

Gas Concentrations At Time To Reach 50% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{50}] = 1.977\ \%$	$[H2_{50}] = 49.427\ \%LFL_{H2}$
NH3	$[NH3_{50}] = 0.018\ \%$	$[NH3_{50}] = 0.122\ \%LFL_{NH3}$
CH4	$[CH4_{50}] = 0.023\ \%$	$[CH4_{50}] = 0.451\ \%LFL_{CH4}$

Gas Concentrations At Time To Reach 100% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{100}] = 3.958\ \%$	$[H2_{100}] = 98.962\ \%LFL_{H2}$
NH3	$[NH3_{100}] = 0.019\ \%$	$[NH3_{100}] = 0.124\ \%LFL_{NH3}$
CH4	$[CH4_{100}] = 0.046\ \%$	$[CH4_{100}] = 0.914\ \%LFL_{CH4}$

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G.4. RPP-5926 Rev. 2: 04 Calculation of Mass Transport Coefficient "h" for Soluble Gas - - 241-AY-102 Filled With Water

CH2MHILL
Hanford Group, Inc.

SA Barker

Calculation of Mass Transport Coefficient "h" for Soluble Gas

241-AY-102 Filled With Water

References

Hu, T. A., S. A. Barker, D. C. Hedengren, M.A. Kufahl, 2001, "*Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*", RPP-5926, Rev. 1, CH2MHILL Hanford Group, Inc., Richland, WA.

Input Data

Constants

$\rho_g := 1.17 \cdot \frac{kg}{m^3}$	Density of gas
$D_g := 2.50 \times 10^{-5} \cdot \frac{m^2}{s}$	Diffusion coefficient in gas phase
$\mu_g := 2.0 \cdot 10^{-5} \cdot \frac{kg}{m \cdot s}$	Viscosity of gas
$g = 9.807 \frac{m}{s^2}$	gravitational number
$\Delta T := 1 \cdot K$	Temperature difference between waste surface and gas
$\beta_g := 3.30 \cdot 10^{-3} \cdot \frac{1}{K}$	Thermal expansion coefficient of Gas
$L_c := 5.7825 \cdot m$	Characteristic Length (1/4 of Diameter)
$D_L := 2.8 \cdot 10^{-9} \cdot \frac{m^2}{s}$	Diffusion Coefficient in Liquid Phase
$\rho_L := 1300 \cdot \frac{kg}{m^3}$	Density of Liquid

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$\mu_L := 6.82 \cdot 10^{-4} \cdot \frac{kg}{m \cdot s}$ Viscosity of Liquid

$\beta_L := 3.02 \cdot 10^{-4} \cdot \frac{1}{K}$ Thermal expansion coefficient of Liquid

$MW_{NH3} := 17.0307 \cdot \frac{gm}{mol}$ Molecular Weight of Ammonia

$h_{g_Schumpe_model} := -0.0481 \cdot \frac{L}{mol}$ Schumpe Model Coefficient

Read Waste Information From "NH3CALInputData010829-04.xls"

IData :=

C:\..\NH3CALInputData010829-04.xls

Read Tank Information From "TankInfo.xls"

TData :=

C:\..\TankInfo.xls

Find Waste Properties

Tank_id := "241-AY-102"

TFI1 := search(Tank_id,"-",1) TFI1 = 3.000

TankFarm := substr(Tank_id,TFI1 + 1,2) TankFarm = "AY"

j1 := 1..177

TankNames3 := stack(TankNames1,TankNames2)

$na1_{j1} := j1$

vent_rate := 250·cfm From (Bingham 2000)

Find The Appropriate Tank Specific Information:

fi1 := FindIndex(TankNames6,Tank_id)

$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$

$tank_{idx} := fi1_1 + 1$ $tank_{idx} = 24.000$

$class_{waste} := if\left[\left(fi1_1 < 29\right), "dst", "sst"\right]$

$class_{waste} = "dst"$

fi2 := FindIndex(Farms,TankFarm)

$fi2 = \begin{pmatrix} 6.000 \\ 1.000 \end{pmatrix}$

$farm_{idx} := fi2_1 + 5$ $farm_{idx} = 11.000$

$vol_{tank} := TData_{farm_{idx},4} \cdot ft^3$

$vol_{tank} = 1.881 \times 10^5 ft^3$

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$$comp := \begin{pmatrix} \text{"Na+"} \\ \text{"AL+3"} \\ \text{"Fe+3"} \\ \text{"Cr+3"} \\ \text{"Ni+2"} \\ \text{"K+"} \\ \text{"OH-"} \\ \text{"NO3-"} \\ \text{"NO2-"} \\ \text{"CO3-2"} \\ \text{"PO4-3"} \\ \text{"SO4-2"} \\ \text{"F-"} \\ \text{"Cl-"} \end{pmatrix} \quad Co := \begin{pmatrix} IData_{tank_{idx},2} \\ IData_{tank_{idx},3} \\ IData_{tank_{idx},4} \\ IData_{tank_{idx},5} \\ IData_{tank_{idx},6} \\ IData_{tank_{idx},7} \\ IData_{tank_{idx},8} \\ IData_{tank_{idx},9} \\ IData_{tank_{idx},10} \\ IData_{tank_{idx},11} \\ IData_{tank_{idx},12} \\ IData_{tank_{idx},13} \\ IData_{tank_{idx},14} \\ IData_{tank_{idx},15} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \quad mw := \begin{pmatrix} 22.99 \\ 26.98 \\ 55.85 \\ 52 \\ 58.71 \\ 39.09 \\ 17.0074 \\ 62.0049 \\ 46.0055 \\ 60.0092 \\ 94.9676 \\ 96.0576 \\ 19 \\ 35.453 \end{pmatrix} \cdot \frac{gm}{mol} \quad H := \begin{pmatrix} .1143 \\ .2174 \\ .1161 \\ .0648 \\ .1654 \\ .0922 \\ .0839 \\ .0128 \\ .0795 \\ .1423 \\ .2119 \\ .1117 \\ .092 \\ .0318 \end{pmatrix}$$

Concentration Molecular Weight

$$\frac{Co}{\frac{\mu \cdot gm}{mL}} =$$

	1
1	$5.400 \cdot 10^4$
2	$1.970 \cdot 10^3$
3	10.100
4	29.100
5	4.020
6	388.000
7	$1.439 \cdot 10^3$
8	486.000
9	$7.290 \cdot 10^3$
10	$4.865 \cdot 10^4$
11	$3.010 \cdot 10^3$
12	$2.320 \cdot 10^3$
13	91.050
14	197.343
15	
16	

$[NH3_SS_dome] := IData_{tank_{idx},16} \cdot ppm$ $\quad [NH3_SS_dome] = 4.286\, ppm$

$[NH3_L] := IData_{tank_{idx},17} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [NH3_L] = 35.293\, \frac{\mu \cdot gm}{mL}$

$[H2O_{wt\%}] := IData_{tank_{idx},18}\, \%$ $\quad [H2O_{wt\%}] = 93.775\, \%$

$\rho_{liq} := IData_{tank_{idx},19} \cdot \frac{gm}{mL}$ $\quad \rho_{liq} = 1.070\, \frac{gm}{mL}$

$vol_{waste} := IData_{tank_{idx},20} \cdot kilo \cdot L$ $\quad vol_{waste} = 4.315 \times 10^3\, kilo \cdot L$

$vol_{headspace} := vol_{tank} - vol_{waste}$

$vol_{headspace} = 35693\, ft^3$ ..... .AI

$Q_{normal_vent} := vent_rate$ .....AH

Author: A Baker Date: 6/12/02

$T_{headspace_c} := IData_{tank_{idx},21} \cdot C$ $\quad T_{headspace} := (T_{headspace_c} + 273.15) \cdot K$ $\quad T_{headspace} = 294.549\,K$

$T_{waste_c} := IData_{tank_{idx},22} \cdot C$ $\quad T_{waste} := (T_{waste_c} + 273.15) \cdot K$ $\quad T_{waste} = 309.817\,K$

$K_{H_soln_corr_fact} := IData_{tank_{idx},23}$ .....AA

$K_{H_soln_corr_fact} = 1.100$

$P := 1 \cdot atm$

$t := 35 \cdot day$ time of interest

Calculations

Schmidt Number

$$S_c := \frac{\mu_g}{D_g \cdot \rho_g}$$

$$S_c = 0.683761$$

Grashoff Number

$$G_r := \frac{g \cdot \beta_g \cdot \rho_g^2 \cdot L_c^3 \cdot \Delta T}{\mu_g^2}$$

$$G_r = 2.141 \times 10^{10}$$

Film Coefficient - Vapor

$$h_g := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$ Vapor Film Coefficient

$$h_g = 1.587 \times 10^{-3} \frac{m}{s}$$

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Film Coefficient - Liquid

$$h_L := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_L}\right)^{\frac{1}{3}} \cdot \left(\frac{g \cdot \beta_L \cdot \rho_L^2 \cdot \Delta T}{\mu_L^2}\right)^{\frac{1}{3}}$$ Liquid Film Coefficient

$$h_L = 5.306 \times 10^{-6} \frac{m}{s}$$

Sum C_i

$$C_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i}}{1000}$$

$$C_{sum} = 3.555 \frac{mol}{m^3}$$ X

Sum C_i x H_i

$$CH_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i} \cdot H_i}{1000}$$

$$CH_{sum} = 0.430 \frac{mol}{m^3}$$ .....Y

K_H^o In Water

=EXP(-8.0964+3917.5/(273.15+W3)-0.003-14*(273.15+W3))

$$K_{H_o} := \exp\left(-8.0964 + \frac{3917.5 \cdot K}{T_{waste}} - .00314 \cdot \frac{T_{waste}}{K}\right)$$

$$K_{H_o} = 35.707$$ .....Z

KHo In Solution

=Z3/POWER(10,Y3+X3*I60)*AA3

$$K_H := \frac{K_{H_o} \cdot K_{H_soln_corr_fact}}{10^{\left[\left[\frac{C_{sum}}{\left(\frac{mol}{m^3}\right)}\right] \cdot \left[\frac{h_{g_Schumpe_model}}{\left(\frac{L}{mol}\right)}\right] + \left[\frac{CH_{sum}}{\left(\frac{mol}{m^3}\right)}\right]\right]}} \cdot \frac{mol}{L \cdot atm}$$

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$K_H = 21.617 \frac{mol}{L \cdot atm}$ ..... AB

Ammonia Concentration

$Output_3 := \frac{K_H}{\frac{mol}{L \cdot atm}}$

$[NH3_L] = 0.035 \frac{kg}{m^3}$

$[NH3_{liq}] := \frac{[NH3_L]}{MW_{NH3}}$

$[NH3_{liq}] = 2.072 \times 10^{-3} \frac{mol}{L}$ ..... AD

Ammonia Partial Pressure

$Output_5 := \frac{[NH3_{liq}]}{\frac{mol}{L}}$

$P_{NH3} := \frac{[NH3_{liq}]}{K_H}$

$P_{NH3} = 9.587 \times 10^{-5} atm$ ..... AE

Molar Volume

$V_m := 22.4 \cdot \frac{L}{mol} \cdot \frac{T_{headspace}}{273.15 \cdot K}$

$Output_4 := \frac{V_m}{\frac{L}{mol}}$

$V_m = 24.154842 \frac{L}{mol}$ ..... AG

Steady-State Ammonia Concentration

$[NH3_{ss}] := \frac{[NH3_SS_dome]}{V_m}$

$[NH3_{ss}] = 1.77427 \times 10^{-7} \frac{mol}{L}$ ..... AF

Equivalent Steady-State Ammonia Concentration In Liquid Phase

$[NH3_{ss_liq_eq}] := K_H \cdot V_m \cdot [NH3_{ss}] \cdot P$

$[NH3_{ss_liq_eq}] = 9.264 \times 10^{-5} \frac{mol}{L}$ ..... AJ

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Mass Transport Properties

$$h_A := Q_{normal_vent} \cdot \left(\frac{[NH3_{ss}]}{[NH3_{liq}] - [NH3_{ss_liq_eq}]} \right) \qquad Output_2 := \frac{h_A}{cfm}$$

$h_A = 0.022406\ cfm$ .....AK

Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_SS_dome] \cdot P \right) \cdot V_m$$

$vr_{ss_norm} = 1.071 \times 10^{-3}\ cfm$ .....AL

Off-Normal Barometric Vent Rate

$$Q_{off_normal_vent} := .45 \cdot \frac{\%}{day} \cdot vol_{headspace}$$

$Q_{off_normal_vent} = 0.112\ cfm$ .....AM

Off-Normal Constant, k_1 And k_2

$$k_1 := \frac{Q_{off_normal_vent} + \left(h_A \cdot K_H \cdot P \cdot V_m \right)}{vol_{headspace}}$$

$k_1 = 3.309 \times 10^{-4}\ \frac{1}{min}$ .....AN

$$k_2 := \frac{h_A \cdot [NH3_{liq}]}{vol_{headspace}} \qquad Output_1 := \frac{k_2}{\frac{mol}{L \cdot min}}$$

$k_2 = 1.301 \times 10^{-9}\ \frac{mol}{L \cdot min}$ .....AO

Off-Normal Ammonia Partial Pressure

$$P_{NH3_on} := \frac{k_2}{k_1} \cdot V_m \cdot P$$

$P_{NH3_on} = 9.49615 \times 10^{-5}\ atm$ .....AP

$\frac{P_{NH3_on}}{atm} = 94.962\ ppm$ .....AQ

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Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_off_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot \frac{P_{NH3_on}}{atm} \cdot P \right) \cdot V_m$$

$$vr_{ss_off_norm} = 1.059 \times 10^{-5}\ cfm$$ .....AR

Ammonia Concentration At Time, t

$$[NH3_t] := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1} \right) \cdot \exp(-1 \cdot k_1 \cdot t) \right] \cdot V_m \cdot 10^6 \cdot ppm$$

$$[NH3_t] = 94.962\ ppm$$ .....AU

Ammonia Diffusion Rate At Time, t

$$\delta_{NH3_t} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_t] \cdot P \right) \cdot V_m$$

$$\delta_{NH3_t} = 1.059 \times 10^{-5}\ cfm$$ .....AV

KRT

$$KRT := T_{waste} \cdot K_H \cdot 0.082 \cdot \frac{(L \cdot atm)}{mol \cdot K}$$

$$KRT = 549.173$$ .....AW

Film Coefficient - Liquid At Time t

$$h_{Lt} := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_{liq}} \right)^{\frac{1}{3}} \cdot \left[\frac{g \cdot \beta_L \cdot (\rho_{liq})^2 \cdot \Delta T}{(\mu_L)^2} \right]^{\frac{1}{3}}$$ Liquid Film Coefficient

$$h_{Lt} = 4.972 \times 10^{-6}\ \frac{m}{s}$$ .....AX

Film Coefficient - Vapor At Time t

$$h_{gt} := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$ Vapor Film Coefficient

$$h_{gt} = 1.587 \times 10^{-3}\ \frac{m}{s}$$ .....AY

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Film Coefficient - Overall At Time t

Overall Film Coefficient

$$h := \frac{1}{\frac{1}{h_{Lt}} + \frac{KRT}{h_{gt}}}$$

$h = 1.827 \times 10^{-6} \frac{m}{s}$ .....AZ

Surface Area

$area := \pi \cdot (37.5 \cdot ft)^2$

$area = 4.418 \times 10^3 ft^2$ .....BA

$hxA := h \cdot area$

$hxA = 1.589\ cfm$ .....BB

Effective Surface Area (percent)

$$eff_{SA} := \frac{h_A}{hxA}$$

$eff_{SA} = 1.410\%$ .....BC

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Ammonia Concentrations As A Function Of Time

$$time := \begin{pmatrix} -30 \\ -20 \\ -10 \\ .0001 \\ .5 \\ 3 \\ 5 \\ 10 \\ 15 \\ 30 \\ 35 \\ 50 \\ 70 \\ 90 \\ 110 \\ 120 \\ 125 \\ 127 \\ 130 \\ 135 \\ 140 \\ 145 \end{pmatrix} \cdot day$$

$i := 1 .. 22$

$$NH3_i := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1} \right) \exp\left(-1 \cdot \frac{k_1}{\frac{1}{day}} \cdot \frac{time_i}{day} \right) \right] \cdot V_m$$

$h_A = 0.022\ cfm$

$RR_{NH3_i} := h_A \cdot \left([NH3_{liq}] - K_H \cdot P \cdot NH3_i \right) \cdot V_m$

$[NH3_{liq}] = 2.072 \times 10^{-3} \frac{mol}{L}$

$RR_{NH3_1} := h_A$ $\quad NH3_1 := [NH3_SS_dome]$

$K_H = 21.617 \frac{mol}{L \cdot atm}$

$RR_{NH3_2} := h_A$ $\quad NH3_2 := [NH3_SS_dome]$

$V_m = 24.155 \frac{L}{mol}$

$NH3_3 := [NH3_SS_dome]$

$RR_{NH3_3} := h_A$

$RR_{NH3_4} := h_A$

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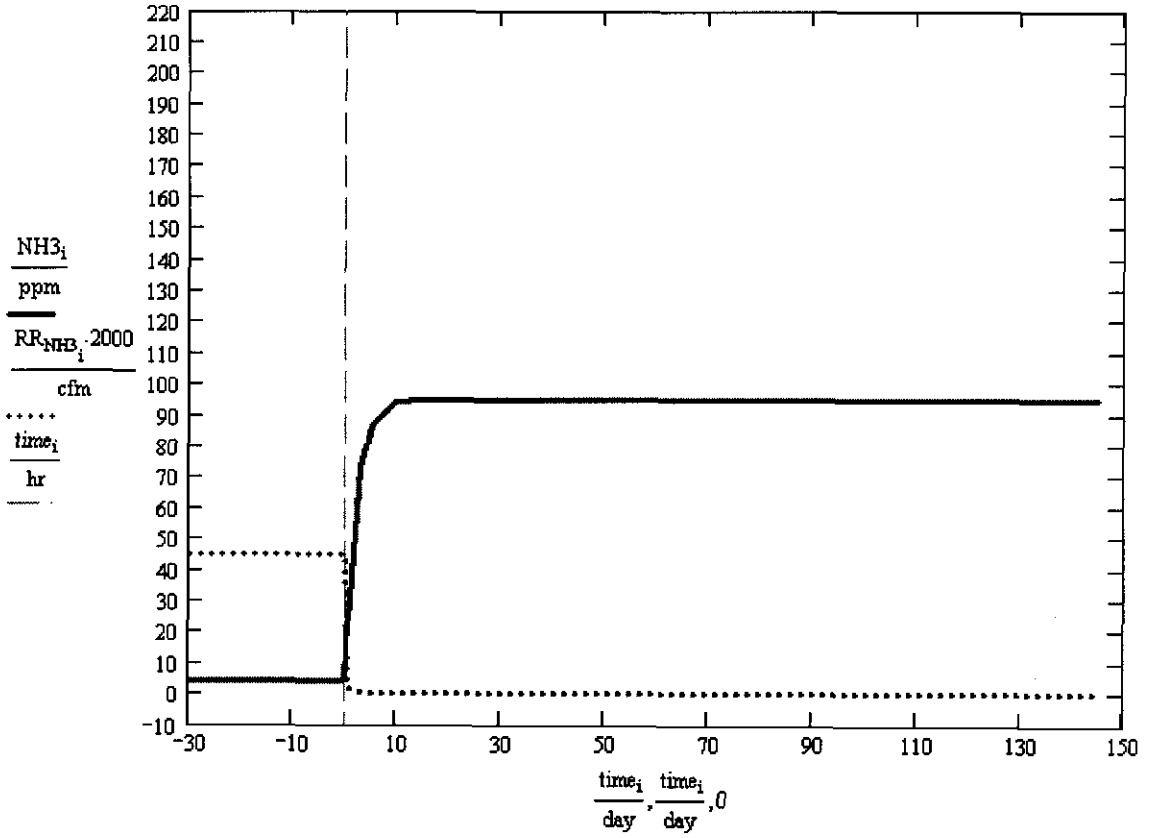
$time_i$ / day =	$NH3_i$ / ppm =	RR_{NH3_i} / cfm =
-30	4.286	0.022
-20	4.286	0.022
-10	4.286	0.022
$1 \cdot 10^{-4}$	4.290	0.022
1	23.508	$8.465 \cdot 10^{-4}$
3	73.251	$2.646 \cdot 10^{-4}$
5	86.590	$1.085 \cdot 10^{-4}$
10	94.189	$1.963 \cdot 10^{-5}$
15	94.890	$1.143 \cdot 10^{-5}$
30	94.961	$1.059 \cdot 10^{-5}$
35	94.962	$1.059 \cdot 10^{-5}$
50	94.962	$1.059 \cdot 10^{-5}$
70	94.962	$1.059 \cdot 10^{-5}$
90	94.962	$1.059 \cdot 10^{-5}$
110	94.962	$1.059 \cdot 10^{-5}$
120	94.962	$1.059 \cdot 10^{-5}$
125	94.962	$1.059 \cdot 10^{-5}$
127	94.962	$1.059 \cdot 10^{-5}$
130	94.962	$1.059 \cdot 10^{-5}$
135	94.962	$1.059 \cdot 10^{-5}$
140	94.962	$1.059 \cdot 10^{-5}$
145	94.962	$1.059 \cdot 10^{-5}$

Author: SA Barton Date: 6/12/02



Output Results To Datafile "rpp5926_r2_04_NH3CALOutputData0020203.xls"

C:\..\rpp5926_r2_04_NH3CALOutputData0020203.xls

Output

$$\text{Output} = \begin{pmatrix} 1.301 \times 10^{-9} \\ 0.022 \\ 21.617 \\ 24.155 \\ 2.072 \times 10^{-3} \end{pmatrix}$$

Author: _____ Date: 6/12/02

G.5. RPP-5926 Rev. 2: 05 Decay Heat Generation Rate -- Based on Radionuclide Data, 241-AY-102

CH2MHILL
Hanford Group, Inc.

Decay Heat Generation Rate

Based On Radionuclide Data

SA Barker

Reference:

Ref: Kirkpatrick, T. D., and Brown, R. C., 1984, Basis and Values for Specific Activity and Decay Heat Generation Rates for Selected Radionuclides, RHO-SD-RE-TI-131, Rockwell Hanford Operations, Richland, Washington.

Bring In The Radionuclide Data From SD-RE-TI-131

M := READPRN("sd-re-ti-131.prm")

key VVVVVVVVVVVVVVVVVVVVVVV
0==> half-life (days); 1==> half-life multiplier 10x (days);
2==> Atomic weight (gm/gm_mol);
3==> Specific Activity (dpm/gm); 4==> Specific Activity multiplier 10x (dpm/gm);
5==> Decay Heat Generation Rate (Watt/Ci) 6==> Decay Heat Generation Rate multiplier 10x (Watt/Ci)

M =

	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	$1.925 \cdot 10^3$	0	60	2.51	15	1.54	-2
2	$3.915 \cdot 10^3$	0	85	8.71	14	1.5	-3
3	50.55	0	89	6.44	16	3.45	-3
4	$1.045 \cdot 10^4$	0	90	3.08	14	1.16	-3
5	2.671	0	90	1.21	18	5.53	-3
6	$1.045 \cdot 10^4$	0	90	6.17	14	6.69	-3
7	58.51	0	91	5.44	16	3.58	-3
8	64.02	0	95	4.77	16	5.04	-3
9	3.608	0	95	8.46	17	1.32	-3
10	35.06	0	95	8.7	16	4.79	-3
11	64.02	0	95	1.53	17	1.56	-2
12	7.78	7	99	3.76	10	5.01	-4
13	39.35	0	103	7.15	16	3.27	-3
14	0.039	0	103	7.22	19	2.3	-4
15	39.35	0	103	1.43	17	3.5	-3

Author: SABarker Date: 6/12/02

$j := 0, 1 .. 61$

$na_j := j$ name := augment(na, me)

$k := 0..3$

$kk := 0..3$

excel := C:\..\FGS Input 020203 .xls

File Name is "FGS Input 020203 .xls"

excel =

	0	1	2	3	4	5	6
0	1	2	3	4	5	6	7
1	0	0	0	0	0	0	0
2	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
3	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
4	0	0	0	0	0	0	0
5	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	67.467	220.193
6	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	59.727	214.404
7	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	144.373	277.714
8	0	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	1.371	351.899

Tank_id := "241-AY-102"

The following data is from Hu 2001b, except where noted

$tank_{idxT} := 68$

>>>> Compensate for Origin = 0 <<<<

$tank_{idxL} := tank_{idxT} + 1$

$tank_{idxS} := tank_{idxT} + 2$

$idcol := 20 - 1$

$$[137Cs] := \begin{pmatrix} excel_{tank_{idxT}, idcol} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL}, idcol} \\ excel_{tank_{idxS}, idcol} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 33.506 \\ 1 \times 10^{-12} \\ 6.354 \times 10^{-3} \\ 179.452 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

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$$[90Sr] := \begin{bmatrix} excel_{tank_{idxT},(idcol-1)} \\ 1\cdot 10^{-12} \\ excel_{tank_{idxL},(idcol-1)} \\ excel_{tank_{idxS},(idcol-1)} \end{bmatrix} \cdot \frac{\mu\cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.093\times 10^{3} \\ 1\times 10^{-12} \\ 0.676 \\ 5.85\times 10^{3} \end{pmatrix} \frac{\mu\cdot Ci}{gm}$$

$$\rho_{waste} := \begin{bmatrix} excel_{tank_{idxT},(idcol+1)} \\ excel_{tank_{idxS},(idcol+1)} \\ excel_{tank_{idxL},(idcol+1)} \\ excel_{tank_{idxS},(idcol+1)} \end{bmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.121 \\ 1.397 \\ 1.072 \\ 1.397 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{bmatrix} excel_{tank_{idxT},(idcol+2)} \\ 1\cdot 10^{-9} \\ excel_{tank_{idxL},(idcol+2)} \\ excel_{tank_{idxS},(idcol+2)} \end{bmatrix} \cdot kilo\cdot L \qquad vol_{waste} = \begin{pmatrix} 4315 \\ 0 \\ 3669 \\ 646 \end{pmatrix} kilo\cdot L$$

$$name_{isotope} := \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$[137Ba] := \overrightarrow{[137Cs]}\cdot 0.946 \qquad [90Y] := \overrightarrow{[90Sr]}\cdot 1.000$$

Author: _____ Date: 6/12/02

Find the appropriate radio-isotope specific information:

```
FindIndex(M, key) := | r ← rows(M) − 1
                     | c ← cols(M) − 1
                     | i ← 0
                     | j ← 0
                     | while (j ≤ c)·(M_{i,j} ≠ key)
                     |     | i ← i + 1  if  i < r
                     |     | otherwise
                     |     |     | i ← 1
                     |     |     | j ← j + 1
                     | (i, j)  if  j ≤ c
                     | 0  otherwise
```

$$name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$fi_{kk} := FindIndex(name, name_{isotope_{kk}})$$

$$fi = \begin{pmatrix} \{2,1\} \\ \{2,1\} \\ \{2,1\} \\ \{2,1\} \end{pmatrix}$$

$$ii := \overrightarrow{fi} \qquad ii_0 = \begin{pmatrix} 31 \\ 1 \end{pmatrix} \qquad ii_1 = \begin{pmatrix} 32 \\ 1 \end{pmatrix} \qquad ii_2 = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \qquad ii_3 = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$in_{kk} := (ii_{kk})_0$$

$$in = \begin{pmatrix} 31 \\ 32 \\ 4 \\ 5 \end{pmatrix}$$

Author: DA Baker Date: 6/12/02

$$half_life_{kk} := M_{in_{kk},0} \cdot 10^{M_{in_{kk},1}} \cdot day \qquad half_life = \begin{pmatrix} 30.171 \\ 4.795 \times 10^{-6} \\ 28.601 \\ 0.007 \end{pmatrix} yr \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$wt_{atomic_{kk}} := M_{in_{kk},2} \cdot \frac{gm}{g_mol} \qquad wt_{atomic} = \begin{pmatrix} 137 \\ 137 \\ 90 \\ 90 \end{pmatrix} \frac{gm}{g_mol} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA_{kk} := M_{in_{kk},3} \cdot 10^{M_{in_{kk},4}} \cdot \frac{dpm}{gm} \qquad SA = \begin{pmatrix} 1.92 \times 10^{14} \\ 1.21 \times 10^{21} \\ 3.08 \times 10^{14} \\ 1.21 \times 10^{18} \end{pmatrix} \frac{dpm}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA = \begin{pmatrix} 86.486 \\ 5.45 \times 10^{8} \\ 138.739 \\ 5.45 \times 10^{5} \end{pmatrix} \frac{Ci}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope_{kk}} := M_{in_{kk},5} \cdot 10^{M_{in_{kk},6}} \cdot \frac{watt}{Ci} \qquad q_{isotope} = \begin{pmatrix} 1.01 \times 10^{-3} \\ 3.92 \times 10^{-3} \\ 1.16 \times 10^{-3} \\ 5.53 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope} = \begin{pmatrix} 3.444 \times 10^{-3} \\ 0.013 \\ 3.955 \times 10^{-3} \\ 0.019 \end{pmatrix} \frac{mBTU}{Ci \cdot hr} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$heat_load_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[\begin{array}{l} ([137Cs])_k \cdot q_{isotope_0} + ([137Ba])_k \cdot q_{isotope_1} \cdots \\ + ([90Sr])_k \cdot q_{isotope_2} + ([90Y])_k \cdot q_{isotope_3} \end{array} \right]$$

$$heat_load = \begin{pmatrix} 3.611 \times 10^{4} \\ 0 \\ 17.892 \\ 3.61 \times 10^{4} \end{pmatrix} watt$$

Author: _____ Date: 6/12/02

Check answer #1

$z := 1$

$$heat_load2 := vol_{waste_z} \cdot \rho_{waste_z} \cdot \left[\begin{array}{l} ([137Cs])_z \cdot q_{isotope_0} + ([137Ba])_z \cdot q_{isotope_1} \cdots \\ + ([90Sr])_z \cdot q_{isotope_2} + ([90Y])_z \cdot q_{isotope_3} \end{array} \right]$$

$heat_load2 = 0\,watt$

Check answer #2 (alternate calculation)

$$[137Cs] = \begin{pmatrix} 33.306 \\ 1 \times 10^{-12} \\ 6.354 \times 10^{-3} \\ 179.452 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.093 \times 10^{3} \\ 1 \times 10^{-12} \\ 0.676 \\ 5.85 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 1.524 \times 10^{5} \\ 3.531 \times 10^{-8} \\ 1.296 \times 10^{5} \\ 2.281 \times 10^{4} \end{pmatrix} ft^3 \qquad \rho_{waste} = \begin{pmatrix} 1.121 \\ 1.397 \\ 1.072 \\ 1.397 \end{pmatrix} \frac{gm}{mL}$$

$$name_{isotope} := \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$[137Cs137Ba] := \overrightarrow{[137Cs]} \cdot 1.000 \qquad [90Sr90Y] := \overrightarrow{[90Sr]} \cdot 1.000$$

$jk := 0 .. 1$

$$name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$fi2_{jk} := FindIndex(name, name_{isotope_{jk}})$$

$$fi2 = \begin{bmatrix} \begin{pmatrix} 33 \\ 1 \end{pmatrix} \\ \begin{pmatrix} 6 \\ 1 \end{pmatrix} \end{bmatrix}$$

$$ii := \overrightarrow{fi2} \qquad ii_0 = \begin{pmatrix} 33 \\ 1 \end{pmatrix} \qquad ii_1 = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$$

$$in2_{jk} := (ii_{jk})_0$$

$$in2 = \begin{pmatrix} 33 \\ 6 \end{pmatrix}$$

Author: _____ Date: 6/12/02

$half_life2_{jk} := M_{in2_{jk},0} \cdot 10^{M_{in2_{jk},1}} \cdot day$ $\quad half_life2 = \begin{pmatrix} 11019.593 \\ 10446.150 \end{pmatrix} day$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$wt2_{atomic_{jk}} := M_{in2_{jk},2} \cdot \frac{gm}{g_mol}$ $\quad wt2_{atomic} = \begin{pmatrix} 137 \\ 90 \end{pmatrix} \frac{gm}{g_mol}$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$SA2_{jk} := M_{in2_{jk},3} \cdot 10^{M_{in2_{jk},4}} \cdot \frac{dpm}{gm}$ $\quad SA2 = \begin{pmatrix} 3.74 \times 10^{14} \\ 6.17 \times 10^{14} \end{pmatrix} \frac{dpm}{gm}$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$SA2 = \begin{pmatrix} 168.468 \\ 277.928 \end{pmatrix} \frac{Ci}{gm}$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$q2_{isotope_{jk}} := M_{in2_{jk},5} \cdot 10^{M_{in2_{jk},6}} \cdot \frac{watt}{Ci}$ $\quad q2_{isotope} = \begin{pmatrix} 4.72 \times 10^{-3} \\ 6.69 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci}$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$q2_{isotope} = \begin{pmatrix} 0.016 \\ 0.023 \end{pmatrix} \frac{mBTU}{Ci \cdot hr}$ $\quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$

$heat_load2_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[([137Cs137Ba])_k \cdot q2_{isotope_0} + ([90Sr90Y])_k \cdot q2_{isotope_1} \right]$

$heat_load2 = \begin{pmatrix} 3.611 \times 10^4 \\ 0 \\ 17.892 \\ 3.61 \times 10^4 \end{pmatrix} watt$ compares to ==> $heat_load = \begin{pmatrix} 3.611 \times 10^4 \\ 0 \\ 17.892 \\ 3.61 \times 10^4 \end{pmatrix} watt$

$heat_load2 = \begin{pmatrix} 1.232 \times 10^5 \\ 0 \\ 61.049 \\ 1.232 \times 10^5 \end{pmatrix} \frac{BTU}{hr}$ $\quad heat_load = \begin{pmatrix} 1.231 \times 10^5 \\ 0 \\ 61.001 \\ 1.231 \times 10^5 \end{pmatrix} \frac{mBTU}{hr}$

a1 :=

36113.42	
1.59E-23	
17.89153	
36095.53	

Write results to excel file "rpp5926_r2_05_DecayHeatGRInput020203 .xls"

$\left(\frac{heat_load}{watt} \right)$

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Author: _____ Date: 6/12/02

G.6. RPP-5926 Rev. 2: 06 Hydrogen Generation Rate Calculations -- Single-Point Calculation – Calculation Note RPP-5926, Rev 2 – Tank 241-AY-102 with Water Fill

CH2MHILL
Hanford Group, Inc.

SA Barker

Hydrogen Generation Rate Calculations

Single-Point Calculation - Calculation Note RPP-5926, Rev 2 -- Tank 241-AY-102 with Water Fill:

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Author: _____ Date: 1/2/02

Read Waste Information From "FGS Input 020203 .xls"

excel :=

C:\..\FGS Input 020203 .xls

Datafile Name Is "FGS Input 020203 .xls"

excel =

	1	2	3	4	5	6	7
1	1.000	2.000	3.000	4.000	5.000	6.000	7.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	$1.166 \cdot 10^{3}$	$4.160 \cdot 10^{4}$	$7.305 \cdot 10^{4}$	$1.123 \cdot 10^{4}$	0.040	82.911
4	0.000	$1.166 \cdot 10^{3}$	$4.160 \cdot 10^{4}$	$7.305 \cdot 10^{4}$	$1.123 \cdot 10^{4}$	0.040	82.911
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	67.467	220.193
7	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	59.727	214.404
8	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	144.373	277.714
9	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	1.371	351.899
10	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	0.011	434.834
11	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	2.845	262.084
12	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	15.096	351.079
13	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	0.062	374.528
14	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	31.297	325.809
15	0.000	$3.556 \cdot 10^{3}$	$1.209 \cdot 10^{5}$	$1.616 \cdot 10^{5}$	$4.113 \cdot 10^{4}$	7.631	223.898
16	0.000	$3.556 \cdot 10^{3}$	$1.209 \cdot 10^{5}$	$1.616 \cdot 10^{5}$	$4.113 \cdot 10^{4}$	0.026	220.893

Author: _____ Date: 6/12/02

Input Data

Waste Properties (Crust Layer Volume Is Included In Solids Layer In This Example)
(1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

Tank_id := "241-AY-102" TFI1 := search(Tank_id,"-",1) TFI1 = 3 000

TankFarm := substr(Tank_id,TFI1 + 1,2) TankFarm = "AY"

TankNames3 := stack(TankNames1,TankNames2)

j1 := 1..177

$na1_{j1} := j1$

vent_rate := 250·cfm From (Bingham 2000)

Find The Appropriate Tank Specific Information:

fi1 := FindIndex(TankNames3,Tank_id)

$$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$$

$tank_{idxT} := \left[\left(fi1_1 - 1\right)\cdot 3\right] + 3$ $tank_{idxT} = 69.000$ $Col_{idx} := 15$

$tank_{idxL} := tank_{idxT} + 1$

$tank_{idxS} := tank_{idxT} + 2$

$class_{waste} := if\left[\left(fi1_1 < 29\right), "dst", "sst"\right]$

$class_{waste} = "dst"$

...The Following Data Is From Hu 2001b, Except Where Noted

$$[TOC] \begin{pmatrix} excel_{tank_{idxT},Col_{idx}} \\ excel_{tank_{idxS},Col_{idx}} \\ excel_{tank_{idxL},Col_{idx}} \\ excel_{tank_{idxS},Col_{idx}} \end{pmatrix} \cdot \frac{\mu\cdot gm}{mL} \qquad [TOC] = \begin{pmatrix} 6.674\times10^{2} \\ 2.124\times10^{3} \\ 6.674\times10^{2} \\ 2.124\times10^{3} \end{pmatrix} \frac{\mu\cdot gm}{mL} \qquad Ci = 1.61\cdot10^{-2}\cdot\frac{BTU}{hr}$$

$$[NO_2] := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+1} \\ excel_{tank_{idxS},Col_{idx}+1} \\ excel_{tank_{idxL},Col_{idx}+1} \\ excel_{tank_{idxS},Col_{idx}+1} \end{pmatrix} \cdot \frac{\mu\cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 1.205 \\ 228.866 \\ 1.205 \\ 228.866 \end{pmatrix} \frac{\mu\cdot gm}{mL}$$

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$$[NO_3] := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+2} \\ excel_{tank_{idxS}, Col_{idx}+2} \\ excel_{tank_{idxL}, Col_{idx}+2} \\ excel_{tank_{idxS}, Col_{idx}+2} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 4.273 \\ 294.845 \\ 4.273 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+3} \\ excel_{tank_{idxS}, Col_{idx}+3} \\ excel_{tank_{idxL}, Col_{idx}+3} \\ excel_{tank_{idxS}, Col_{idx}+3} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [Al] = \begin{pmatrix} 14.955 \\ 100.206 \\ 14.955 \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[90Sr] := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+4} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL}, Col_{idx}+4} \\ excel_{tank_{idxS}, Col_{idx}+4} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.097 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 0.687 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[137Cs] := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+5} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL}, Col_{idx}+5} \\ excel_{tank_{idxS}, Col_{idx}+5} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 33.616 \\ 1.000 \times 10^{-12} \\ 6.466 \times 10^{-3} \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$\rho_{waste} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+6} \\ excel_{tank_{idxS}, Col_{idx}+6} \\ excel_{tank_{idxL}, Col_{idx}+6} \\ excel_{tank_{idxS}, Col_{idx}+6} \end{pmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.117 \\ 1.427 \\ 1.062 \\ 1.427 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+7} \\ 1 \cdot 10^{-9} \\ excel_{tank_{idxL}, Col_{idx}+7} \\ excel_{tank_{idxS}, Col_{idx}+7} \end{pmatrix} \cdot kilo \cdot L \qquad vol_{waste} = \begin{pmatrix} 4315 \\ 0 \\ 3669 \\ 646 \end{pmatrix} kilo \cdot L$$

Author: _____ Date: 6/12/02

$$F_{H2O} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+8} \\ excel_{tank_{idxS}, Col_{idx}+8} \\ excel_{tank_{idxL}, Col_{idx}+8} \\ excel_{tank_{idxS}, Col_{idx}+8} \end{pmatrix} \qquad F_{H2O} = \begin{pmatrix} 85.4 \\ 38.0 \\ 93.8 \\ 38.0 \end{pmatrix} \%$$

$$F_{liquid_2} := \left(\frac{F_{H2O_2}}{F_{H2O_3}}\right) \qquad F_{liquid_3} := \left(\frac{F_{H2O_3}}{F_{H2O_3}}\right) \qquad F_{liquid_4} := \left(\frac{F_{H2O_4}}{F_{H2O_3}}\right)$$

$$F_{liquid_1} := \left[\frac{F_{liquid_2}\cdot\left(vol_{waste_2}\cdot\rho waste_2\right) + F_{liquid_3}\cdot\left(vol_{waste_3}\cdot\rho waste_3\right) + F_{liquid_4}\cdot\left(vol_{waste_4}\cdot\rho waste_4\right)}{vol_{waste_4}\cdot\rho waste_4 + vol_{waste_3}\cdot\rho waste_3 + vol_{waste_2}\cdot\rho waste_2}\right]$$

$$F_{liquid} = \begin{pmatrix} 88.621 \\ 40.522 \\ 100.000 \\ 40.522 \end{pmatrix} \%$$

$$Temp_{waste} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxS}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxL}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxS}, Col_{idx}+9} + 273.15 \end{pmatrix} \cdot K \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

From (Bingham 2000)

$$Temp_{vap} := \left(excel_{tank_{idxL}, Col_{idx}+10} + 273.15\right)\cdot K \qquad Temp_{vap} = 316.761\,K$$

From (Bingham 2000)

Make Sure You Run The File "Decay Heat Generation Rate 011129 .MCD"

excel2 :=

C:\..\rpp5926_r2_05_DecayHeatGRInput020203 .xls

Read Results From Excel File
"rpp5926_r2_05_DecayHeatGRInput020203 .xls"

$$HeatLoad_{137Cs_90Sr} := excel2\cdot watt$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.611 \times 10^{4} \\ 1.594 \times 10^{-23} \\ 17.892 \\ 3.610 \times 10^{4} \end{pmatrix} watt$$

Calculated By Barker In
"Decay Heat Generation Rate .MCD"

Author: _____ Date: 6/12/02

TankInfo :=

C:\..\TankInfo_post-1999.xls

Read Waste properties From Excel File "TankInfo_post-1999.xls"

$j := 1..27$

$na_j := j$ name := augment(na, TankId)

TankFarm = "AY"

fi := FindIndex(name, TankFarm)

$fi = \begin{pmatrix} 11.000 \\ 2.000 \end{pmatrix}$

$vol_{tank} := TankInfo_{fi_1,4} \cdot ft^3$

$vol_{tank} = 1407\,kilo \cdot gal$ $vol_{tank} = 188089\,ft^3$

vent_rate = 250.000 cfm

$vent_rate_{bb} := .0045 \cdot \left(vol_{tank} - vol_{waste_1}\right) \cdot \frac{1}{day}$

$vent_rate_{bb} = 0.112\,cfm$

$diam_{tank} := 2 \cdot TankInfo_{(fi_1,2)} \cdot ft$ $diam_{tank} = 75.000\,ft$

$ht_{tank} := \frac{vol_{waste}}{TankInfo_{(fi_1,8)} \cdot \frac{gal}{in}}$ estimation Of Waste Depth

$ht_{tank} = \begin{pmatrix} 413.944 \\ 9.592 \times 10^{-11} \\ 351.978 \\ 61.966 \end{pmatrix} in$ estimation Of Waste Depth

$vol_{head} := vol_{tank} - vol_{waste_1}$ $vol_{head} = 3.569 \times 10^4\,ft^3$

Dome-Space Methane Nitrous Oxide And Ammonia Concentrations (Bingham 2000)

$[H_2] = .0022 \cdot \%$ $[CH_4] = 1.4445 \cdot ppm$ $[N2O] = .0010 \cdot \%$ $[NH_3] = 4.29 \cdot ppm$

Author: _____ Date: 6/12/02

Ammonia Diffusion Information (see Rpp5926 R1 - Calculation Of Mass Transport Coefficient H For Soluble Gas AY-102 .mcd (from File "rpp5929_r2_04_NH3CALOutputData0020203.xls"

NH3In :=

C:\..\rpp5926_r2_04_NH3CALOutputData0020203.xls

$k_{2_NH3} := NH3In_1 \cdot \frac{mol}{L \cdot min}$ $\qquad k_{2_NH3} = 1.301 \times 10^{-9} \frac{mol}{L \cdot min}$

$h_{A_NH3} := NH3In_2 \cdot cfm$ $\qquad h_{A_NH3} = 2.241 \times 10^{-2}\, cfm$

$K_H := NH3In_3 \cdot \frac{mol}{L \cdot atm}$ $\qquad K_H = 21.617 \frac{mol}{L \cdot atm}$

$V_m := NH3In_4 \cdot \frac{L}{mol}$ $\qquad V_m = 24.155 \frac{L}{mol}$

$[NH3_{liq}] := NH3In_5 \cdot \frac{mol}{L}$ $\qquad [NH3_{liq}] = 2.072 \times 10^{-3} \frac{mol}{L}$

$P := 1 \cdot atm$

$k_{1_NH3} := \frac{vent_rate_{bb} + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}$ $\qquad k_{1_NH3} = 3.309 \times 10^{-4}\, min^{-1}$

Gas Concentrations At LFL

$LFL_{H2} := 4 \cdot \%$ $\qquad \%LFL_{H2} := \frac{.04}{100}$

$LFL_{NH3} := 15 \cdot \%$ $\qquad \%LFL_{NH3} := \frac{.15}{100}$

$LFL_{CH4} := 5 \cdot \%$ $\qquad \%LFL_{CH4} := \frac{.05}{100}$

End Of Input Data

Calculations

$i := 1..4$

Hydrogen Generation Due To Thermolysis (Hu, 2000 - Eqn 4-8)

Define Constants (Based On Hu (2000) Eqn 4-8)

$a_{thm} := 2.76 \cdot 10^9 \frac{g_mol}{kg \cdot day}$ Thermolysis pre-exponential Factor (Hu, 2000 - Eqn 4-8)

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$E_{thm} = 89.33 \frac{kilo \cdot J}{g_mol}$ activation Energy (Hu, 2000 - Eqn 4-8)

$R_{const} = 8.3144739 \frac{J}{g_mol \cdot K}$ Gas Constant

$$r_f := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-8)

$r_f = 0.700$

Calculate The Weight Fraction Of Liquid In The Waste

$W_{H2O_i} := vol_{waste_i} \cdot \rho_{waste_i} \cdot F_{H2O_i}$

$$W_{H2O} = \begin{pmatrix} 4.117 \times 10^{6} \\ 5.424 \times 10^{-7} \\ 3.655 \times 10^{6} \\ 3.504 \times 10^{5} \end{pmatrix} kg$$

Check Units On Input Data

$$[TOC] = \begin{pmatrix} 667.382 \\ 2.124 \times 10^{3} \\ 667.382 \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$\left([TOC_{wt\%}]\right)_i := \frac{([TOC])_3}{\rho_{waste_3}} \cdot 100$$

$$[TOC_{wt\%}] = \begin{pmatrix} 0.063 \\ 0.063 \\ 0.063 \\ 0.063 \end{pmatrix}$$

$$[Al] = \begin{pmatrix} 14.955 \times 10^{0} \\ 100.206 \times 10^{0} \\ 14.955 \times 10^{0} \\ 100.206 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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$$\left([Al_{wt\%}]\right)_i := \frac{([Al])_3}{\rho waste_3} \cdot 100$$

$$[Al_{wt\%}] = \begin{pmatrix} 1.408 \times 10^{-3} \\ 1.408 \times 10^{-3} \\ 1.408 \times 10^{-3} \\ 1.408 \times 10^{-3} \end{pmatrix}$$

+

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Calculate The Hydrogen Generation Rate Due To Thermolysis (HGR_{therm})

$$HGR_{therm_scf_i} := \frac{a_{thm}}{\left(\frac{g_mol}{kg \cdot day}\right)} \cdot rf \cdot \left(\left[TOC_{wt\%}\right]\right)_i \cdot \left[\left(\left[Al_{wt\%}\right]\right)_i\right]^4 \cdot e^{-\left[\frac{\frac{E_{thm}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)}\right] \cdot \left(\frac{Temp_{waste_i}}{K}\right)}\right]} \cdot F_{liquid_i} \cdot \frac{g_mol}{kg \cdot day}$$

$$HGR_{therm_i} := HGR_{therm_scf_i}$$

$$HGR_{therm} = \begin{pmatrix} 2.357 \times 10^{-7} \\ 1.078 \times 10^{-7} \\ 1.894 \times 10^{-8} \\ 1.078 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{thermv_i} := HGR_{therm_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right) \cdot \frac{Temp_{vap}}{273.15 \cdot K}$$

$$HGR_{thermv_1} := \sum_{i=2}^{4} HGR_{thermv_i}$$

$$HGR_{thermv} = \begin{pmatrix} 0.159 \\ 1.412 \times 10^{-13} \\ 0.068 \\ 0.091 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv} = \begin{pmatrix} 1.104 \times 10^{-4} \\ 9.805 \times 10^{-17} \\ 4.707 \times 10^{-5} \\ 6.334 \times 10^{-5} \end{pmatrix} cfm$$

$$HGR_{thermv_scf_i} := HGR_{thermv_i} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 0.137 \\ 1.218 \times 10^{-13} \\ 0.058 \\ 0.079 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 9.521 \times 10^{-5} \\ 8.455 \times 10^{-17} \\ 4.059 \times 10^{-5} \\ 5.462 \times 10^{-5} \end{pmatrix} cfm$$

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Hydrogen Generation Due To Radiolysis (Hu, 2000 - Eqn 4-16)

Constant Definition (Based On Hu (2000) Eqn 4-16)

$E_{rad} := 44.32 \cdot \frac{kilo \cdot J}{g_mol}$ Activation Energy Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$e_{rad} := 2.49 \cdot 10^{6} \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential Factor Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$$r_f := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient Of TOC (0.7 For DSTs 0.4 For SSts) (Hu, 2000 - Eqn 4-16)

$G_{H2O_sat} := 0.005 \cdot \frac{molecules}{100 \cdot eV}$ default Water Radiolysis G-value

$$[NO_3] = \begin{vmatrix} 4.273 \times 10 \\ 294.845 \times 10^{0} \\ 4.273 \times 10^{0} \end{vmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{3_molar}] := \frac{[NO_3]}{mw_{NO3}}$$

$$[NO_{3_molar}] = \begin{vmatrix} 6.892 \times 1(\\ 4.755 \times 10^{-3} \\ 6.892 \times 10^{-5} \end{vmatrix} \frac{g_mol}{liter}$$

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$$[NO_2] = \begin{pmatrix} 1.205 \times 10^{0} \\ 228.866 \times 10^{0} \\ 1.205 \times 10^{0} \\ 228.866 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{2_molar}] := \frac{[NO_2]}{mw_{NO2}}$$

$$[NO_{2_molar}] = \begin{pmatrix} 2.619 \times 10^{-5} \\ 4.975 \times 10^{-3} \\ 2.619 \times 10^{-5} \\ \text{[illegible]} \end{pmatrix} \frac{g_mol}{liter}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 7.654 \times 10^{12} \\ 3.379 \times 10^{-15} \\ 3.792 \times 10^{9} \\ 7.650 \times 10^{12} \end{pmatrix} \mu \cdot Ci$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 1.232 \times 10^{5} \\ 5.440 \times 10^{-23} \\ 61.048 \\ 1.232 \times 10^{5} \end{pmatrix} \frac{BTU}{hr}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.611 \times 10^{4} \\ 1.594 \times 10^{-23} \\ 17.892 \\ 3.610 \times 10^{4} \end{pmatrix} watt$$

$$H_{load} := \overrightarrow{\left(\frac{HeatLoad_{137Cs_90Sr}}{vol_{waste} \cdot \rho_{waste}} \right)}$$

$$H_{load} = \begin{pmatrix} 7.493 \times 10^{-3} \\ 1.117 \times 10^{-17} \\ 4.590 \times 10^{-6} \\ 0.039 \end{pmatrix} \frac{watt}{kg}$$

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Calculate The Hydrogen Generation Rate Due To Radiolysis (HGR_{rad})

$$G_{org_i} := \frac{a_{rad}}{\left(\frac{molecules}{100 \cdot eV}\right)} \cdot e^{\left[-\left[\frac{\frac{E_{rad}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)} \cdot \frac{Temp_{waste_i}}{K}\right]}\right]\right]} \cdot rf \cdot \left([TOC_{wt\%}]\right)_i \cdot \frac{molecules}{100 \cdot eV}$$

$$G_{org} = \begin{pmatrix} 0.021 \\ 0.021 \\ 5.795 \times 10^{-3} \\ 0.021 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \overrightarrow{\left[\left[0.45 - 0.56 \cdot \left[\frac{[NO3_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO2_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}}\right] \cdot \frac{molecules}{100 \cdot eV}\right]}$$

$$G_{H2O} = \begin{pmatrix} 0.414 \\ 0.282 \\ 0.414 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O_i} := \begin{cases} G_{H2O_i} & \text{if } G_{H2O_i} > G_{H2O_sat} \\ G_{H2O_sat} & \text{otherwise} \end{cases}$$

$$G_{H2O} = \begin{pmatrix} 0.414 \\ 0.282 \\ 0.414 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$HGR_{rad_i} := \left(G_{H2O_i} + G_{org_i}\right) \cdot H_{load_i} \cdot F_{liquid_i} \cdot \frac{g_mol}{6.02 \cdot 10^{23} \cdot molecules}$$

$$HGR_{rad} = \begin{pmatrix} 2.052 \times 10^{-5} \\ 9.754 \times 10^{-21} \\ 1.367 \times 10^{-8} \\ 3.419 \times 10^{-5} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad} = \begin{pmatrix} 2.592 \times 10^{-5} \\ 1.232 \times 10^{-20} \\ 1.727 \times 10^{-8} \\ 4.319 \times 10^{-5} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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$$HGR_{radv} := \overrightarrow{\left[HGR_{rad}\cdot\left(vol_{waste}\cdot\rho_{waste}\right)\right]}\cdot\frac{Temp_{vap}}{273.15\cdot K}$$

$$HGR_{radv_1} := \sum_{i=2}^{4} HGR_{radv_i}$$

$$HGR_{radv} = \begin{pmatrix} 36.6183 \\ 1.6146\times10^{-26} \\ 0.0618 \\ 36.5565 \end{pmatrix}\frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 0.025 \\ 1.121\times10^{-29} \\ 4.292\times10^{-5} \\ 0.025 \end{pmatrix} cfm$$

$$HGR_{radv_scf} := HGR_{radv}\cdot\frac{273.15\cdot K}{Temp_{vap}}$$

$$HGR_{radv_scf} = \begin{pmatrix} 31.577 \\ 1.392\times10^{-26} \\ 0.053 \\ 31.523 \end{pmatrix}\frac{ft^3}{day}$$

$$HGR_{radv_scf} = \begin{pmatrix} 0.022 \\ 9.669\times10^{-30} \\ 3.701\times10^{-5} \\ 0.022 \end{pmatrix} cfm$$

Hydrogen Generation Due To Corrosion (Hu, 2000 - Eqn 4-17)

Constant Definition (Based On Hu (2000) Eqn 4-17)

$$R_{corr} := \begin{cases} 3.6\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 3.6\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 1.83\cdot10^{-8}\cdot\dfrac{m^3}{m^2\cdot min} & \text{otherwise} \end{cases}$$

Corrosion Coefficient (1.83E-08 For DSTs, 3.6E-08 For SSts) ($m^3/min/m^2$) Reference Temperature Is 25°C (Hu, 2001B - Eqn 2-1)

$$R_{corr} = 1.830\times10^{-8}\,\frac{m^3}{m^2\cdot min}$$

Calculate The Wetted Area Of Steel (vertical Waste Storage Tank, Assuming A Flat Bottom)

$$\left[\pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank}\right] = \pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank}$$

$$Awet_1 := \pi\cdot\left(\frac{diam_{tank}}{2}\right)^2 + \pi\cdot diam_{tank}\cdot ht_{tank_1}$$

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$$Awet_2 := \pi \cdot diam_{tank} \cdot ht_{tank_2}$$

$$Awet_3 := \pi \cdot diam_{tank} \cdot ht_{tank_3}$$

$$Awet_4 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_4}$$

$$Awet = \begin{pmatrix} 1.255 \times 10^4 \\ 1.883 \times 10^{-9} \\ 6.911 \times 10^3 \\ 5.635 \times 10^3 \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due To Corrosion

$$HGR_{corr_mol} := \frac{\overrightarrow{R_{corr} \cdot Awet}}{(vol_{waste} \cdot \rho_{waste})} \cdot \frac{273.15 \cdot K}{298.15 \cdot K} \qquad HGR_{corr_mol_1} = \begin{pmatrix} 2.605 \times 10^{-7} \\ 1.320 \times 10^{-7} \\ 1.774 \times 10^{-7} \\ 6.114 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{corr} := \overline{\left[HGR_{corr_mol} \cdot (vol_{waste} \cdot \rho_{waste}) \cdot \frac{Temp_{vap}}{273.15 \cdot K}\right]}$$

$$HGR_{corr} = \begin{pmatrix} 8.003 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 4.408 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min} \qquad HGR_{corr_scf} := HGR_{corr} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{corr} = \begin{pmatrix} 1.152 \\ 1.730 \times 10^{-13} \\ 0.635 \\ 0.518 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_scf} = \begin{pmatrix} 6.901 \times 10^{-4} \\ 1.036 \times 10^{-16} \\ 3.801 \times 10^{-4} \\ 3.099 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr_scf} = \begin{pmatrix} 0.994 \\ 1.492 \times 10^{-13} \\ 0.547 \\ 0.446 \end{pmatrix} \frac{ft^3}{day}$$

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Total Hydrogen Generation Rate

$$mass_{waste} = \begin{pmatrix} 4.820 \times 10^{6} \\ 1.427 \times 10^{-6} \\ 3.898 \times 10^{6} \\ 9.221 \times 10^{5} \end{pmatrix} kg$$

$$HGR_{thermv} = \begin{pmatrix} 0.159 \\ 1.412 \times 10^{-13} \\ 0.068 \\ 0.091 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 36.618 \\ 1.615 \times 10^{-26} \\ 0.062 \\ 36.557 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr} = \begin{pmatrix} 1.152 \\ 1.730 \times 10^{-13} \\ 0.635 \\ 0.518 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR := \overrightarrow{\left(HGR_{thermv} + HGR_{radv} + HGR_{corr}\right)}$$

$$HGR = \begin{pmatrix} 0.02634 \\ 2.18190 \times 10^{-16} \\ 5.30826 \times 10^{-4} \\ 0.02581 \end{pmatrix} cfm$$

$$HGR = \begin{pmatrix} 1.074 \times 10^{3} \\ 8.897 \times 10^{-12} \\ 21.645 \\ 1.052 \times 10^{3} \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

$$HGR_{stp} := HGR \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

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$$HGR_{stp} = \begin{pmatrix} 0.023 \\ 1.882 \times 10^{-16} \\ 4.577 \times 10^{-4} \\ 0.022 \end{pmatrix} cfm$$

$$HGR_{stp} = \begin{pmatrix} 32.708 \\ 2.709 \times 10^{-13} \\ 0.659 \\ 32.048 \end{pmatrix} \frac{ft^3}{day}$$

At Standard Conditions...

Steady-State Hydrogen Concentration (Assuming Normal Ventilation Rate)

$$[H2_{ss}] := \frac{HGR_1}{HGR_1 + vent_rate}$$

$$[H2_{ss}] = 105.349\ ppmv$$

$$[H2_{ss}] = 0.011\ \%$$

Steady-State Hydrogen Concentration (Assuming Barometric Breathing Ventilation Rate)

$$[H2_{ss_bb}] := \frac{HGR_1}{HGR_1 + vent_rate_{bb}}$$

$$[H2_{ss_bb}] = 1.910 \times 10^5\ ppmv$$

$$[H2_{ss_bb}] = 19.104\%$$

$$[H2_{ss_bb}] = 477.591\ \%LFL_{H2}$$

Gas Release Rate (Independent Of Ventilation Rate)

$$rate_{H2_rel} := [H2_{ss}] \cdot \frac{vent_rate}{1 - [H2_{ss}]}$$

$$rate_{H2_rel} = 0.0263\ cfm$$

$$rate_{H2_rel_bb} := [H2_{ss_bb}] \cdot \frac{vent_rate_{bb}}{1 - [H2_{ss_bb}]}$$

$$rate_{H2_rel_bb} = 0.026\ cfm$$

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Calculate Generation Rates Of Ammonia, Methane, And Nitrous Oxide (Assuming No Gas Retention)

$$GR_{NH3} := \frac{[NH_3] \cdot vent_rate}{1 - [NH_3]} \qquad GR_{NH3} = 1.07250 \times 10^{-3}\ cfm$$

$$GR_{CH4} := \frac{[CH_4] \cdot vent_rate}{1 - [CH_4]} \qquad GR_{CH4} = 3.611 \times 10^{-4}\ cfm$$

$$GR_{N2O} := \frac{[N2O] \cdot vent_rate}{1 - [N2O]} \qquad GR_{N2O} = 2.500 \times 10^{-3}\ cfm$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Normal Ventilation Rate)(Just A Check Of Methodology)

$$[NH3_{ss}] := \frac{GR_{NH3}}{GR_{NH3} + vent_rate} \qquad [NH3_{ss}] = 4.290 \times 10^{-4}\%$$

$$[CH4_{ss}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate} \qquad [CH4_{ss}] = 1.444 \times 10^{-4}\%$$

$$[N2O_{ss}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate} \qquad [N2O_{ss}] = 1.000 \times 10^{-3}\%$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Barometric Breathing Ventilation Rate)

$$NH3_1000_day := \left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1 \cdot \frac{k1_NH3}{\frac{1}{day}} \cdot 1000\right)\right] \cdot V_m$$

$$NH3_1000_day = 94.962\ ppm$$

$$[NH3_{ss_bb}] := NH3_1000_day \qquad [NH3_{ss_bb}] = 9.496 \times 10^{-3}\%$$

$$[NH3_{ss_bb}] = 0.063\%LFL_{NH3}$$

$$[CH4_{ss_bb}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate_{bb}} \qquad [CH4_{ss_bb}] = 0.323\%$$

$$[CH4_{ss_bb}] = 6.454\%LFL_{CH4}$$

$$[N2O_{ss_bb}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate_{bb}} \qquad [N2O_{ss_bb}] = 2.192\%$$

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Determine The Overall Steady-State Flammable Gas Concentration With Loss Of Ventilation

$$[Conc_mix_{ss_bb}] := \frac{[H2_{ss_bb}]}{LFL_{H2}} + \frac{[NH3_{ss_bb}]}{LFL_{NH3}} + \frac{[CH4_{ss_bb}]}{LFL_{CH4}}$$

$$[Conc_mix_{ss_bb}] = 484.109\,\%LFL$$

Set Variables Into Array, Where 1 => H2, 2 => NH3, 3 => CH4, And 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} 0.026 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Generation Rate

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} 0.026 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Release Rate (Assume No Retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss}] \\ [NH3_{ss}] \\ [CH4_{ss}] \\ [N2O_{ss}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 0.011 \\ 4.290 \times 10^{-4} \\ 1.444 \times 10^{-4} \\ 1.000 \times 10^{-3} \end{pmatrix} \%$$

Initial Concentration Rate (Assume At Steady-State With Normal Ops)

Calculate The Composition Of All Components At Time 't'

Special Calculation For Ammonia (Soluble Gas)

$$\lambda_i := \frac{vent_rate_{bb} + Rate_{rel_i}}{vol_{head}}$$

$$Conc_{in_i} := \frac{Rate_{rel_i} \cdot 100\%}{Rate_{rel_i} + vent_rate_{bb}}$$

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$$conc(t,i) := \begin{cases} Conc_{in_i}\cdot\left[1 - e^{(-\lambda_i\cdot t)}\right] + Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right] & \text{if } i < 2 \\ Conc_{in_i}\cdot\left[1 - e^{(-\lambda_i\cdot t)}\right] + Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right] & \text{if } i > 2 \\ \left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1\cdot\frac{k1_NH3}{\frac{1}{day}}\cdot\frac{t}{day}\right)\right]\cdot V_m & \text{otherwise} \end{cases}$$

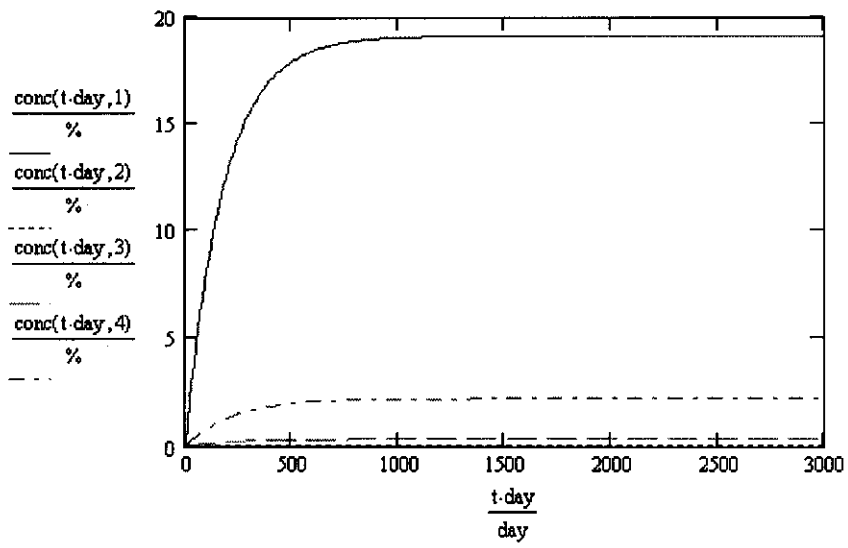
$conc(0\cdot sec,1) = 0.011\,\%$ $\quad conc(1000\cdot day,1) = 19.030\,\%$ $\quad conc(1000\cdot day,1) = 475.759\,\%LFL_{H2}$

$conc(0\cdot sec,2) = 4.290\times10^{-4}\,\%$ $\quad conc(1000\cdot day,2) = 9.496\times10^{-3}\,\%$ $\quad conc(1000\cdot day,2) = 0.063\,\%LFL_{NH3}$

$conc(0\cdot sec,3) = 1.444\times10^{-4}\,\%$ $\quad conc(1000\cdot day,3) = 0.319\,\%$ $\quad conc(1000\cdot day,3) = 6.384\,\%LFL_{CH4}$

$conc(0\cdot sec,4) = 1.000\times10^{-3}\,\%$ $\quad conc(1000\cdot day,4) = 2.170\,\%$

$t := 0, 10 .. 3000$



Calculate Steady-State Flammable Gas Concentration At Normal Operating Conditions

$$LFL_{mix}(z) := \frac{1}{\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}}$$

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$LFL_{mix}(0 \cdot day) = 3.716 \times 10^{4}\%$

$LFL_{mix}(100 \cdot day) = 48.467\%$

Calculate The Time To Reach Various Fractions Of The LFL

Time To Reach 25 %LFL

TOL := .00001

$$f(z,tlfl) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - tlfl$$

$tlfl := 25$

$z := 10 \cdot day$ Initial Guess

$temp_{25} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{25} := Re(root(f(z,tlfl),z))$

$temp_{25} = 9.433\ day$

$Time_{1_25\%LFL} := if\left([Conc_mix_{ss_bb}] > 25\%, if\left(temp_{25} < 0 \cdot day, 0 \cdot day, temp_{25}\right), 10^{9} \cdot day\right)$

$Time_{1_25\%LFL} = 9.433\ day$

Time To Reach 50 %LFL

$tlfl := 50$

$z := 10 \cdot day$ Initial Guess

$temp_{50} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := Re(root(f(z,tlfl),z))$

$temp_{50} = 19.525\ day$

$Time_{1_50\%LFL} := if\left([Conc_mix_{ss_bb}] > 50\%, if\left(temp_{50} < 0 \cdot day, 0 \cdot day, temp_{50}\right), 10^{9} \cdot day\right)$

$Time_{1_50\%LFL} = 19.525\ day$

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Time To Reach 75 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 75$$

$z := 10 \cdot day$ Initial Guess

$temp_{75} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := Re(root(f(z), z))$

$temp_{75} = 30.215\ day$

$Time_{1_75\%LFL} := if\left([Conc_mix_{ss_bb}] > 75\%, if\left(temp_{75} < 0 \cdot day, 0 \cdot day, temp_{75}\right), 10^9 \cdot day\right)$

$Time_{1_75\%LFL} = 30.215\ day$

Time To Reach 100 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 100$$

$z := 10 \cdot day$ Initial Guess

$temp_{100} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := Re(root(f(z), z))$

$temp_{100} = 41.580\ day$

$Time_{1_100\%LFL} := if\left([Conc_mix_{ss_bb}] > 100\%, if\left(temp_{100} < 0 \cdot day, 0 \cdot day, temp_{100}\right), 10^9 \cdot day\right)$

$Time_{1_100\%LFL} = 41.580\ day$

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Minimum Ventilation Rates Need To Prevent Headspace Concentrations From Reaching Various Levels

$$Conc_vr(V,i) := \begin{cases} \dfrac{Rate_{rel_i} \cdot 100 \cdot \%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] & \text{if } i < 2 \\ \dfrac{Rate_{rel_i} \cdot 100 \cdot \%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] & \text{if } i > 2 \\ \left[\dfrac{k2_NH3}{\frac{V + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}} + \left(\dfrac{[NH3_{ss}]}{V_m} - \dfrac{k2_NH3}{k1_NH3}\right) \exp\left[-1 \cdot \dfrac{\frac{V + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}}{\frac{1}{day}} \cdot 10^9\right]\right] \cdot V_m & \text{otherwise} \end{cases}$$

Ventilation Rate To Keep Concentration Less Than 25 %LFL

$$f2_25(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 24.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{25} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{25} := root(f2_25(z), z)$

$temp_{25} = 2.642510\ cfm$

$vent_rate_{1_25\%LFL} := if(temp_{25} < 0 \cdot cfm, 0 \cdot cfm, temp_{25} + 0.001 \cdot cfm)$

$vent_rate_{1_25\%LFL} = 2.644\ cfm$

Ventilation Rate To Keep Concentration Less Than 50 %LFL

$$f2_50(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 49.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{50} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := root(f2_50(z), z)$

$temp_{50} = 1.306943\ cfm$

$vent_rate_{1_50\%LFL} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, temp_{50} + 0.001 \cdot cfm)$

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$vent_rate_{1_50\%LFL} = 1.308\ cfm$

Ventilation Rate To Keep Concentration Less Than 75 %LFL

$$f2_75(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 74.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{75} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := root(f2_75(z), z)$

$temp_{75} = 0.862298\ cfm$

$vent_rate_{1_75\%LFL} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, temp_{75} + 0.001 \cdot cfm)$

$vent_rate_{1_75\%LFL} = 0.863\ cfm$

Ventilation Rate To Keep Concentration Less Than 100 %LFL

$$f2_100(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 99.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{1000} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := root(f2_100(z), z)$

$temp_{100} = 0.640087\ cfm$

$vent_rate_{1_100\%LFL} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, temp_{100} + 0.001 \cdot cfm)$

$vent_rate_{1_100\%LFL} = 0.641\ cfm$

Additional Calculations -- Estimated Time To LFL With Zero Ventilation

Tank Headspace Hydrogen Concentration :

$vent_rate_{zb} := 1 \cdot 10^{-6} \cdot cfm$

$\%H_{2lim} := 100 \cdot [H2_{ss_bb}]$ $\%H_{2lim} = 19.104$ volume % Hydrogen

$\%LFL_{lim} := 100 \cdot [H2_{ss_bb}] \cdot \frac{100}{4}$ $\%LFL_{lim} = 477.591$ % LFL Based On Hydrogen

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Final H2 Concentration To Meet 25% (NH3 And CH4 Included) **Estimate Gas Concentrations At Final Conditions:**

$$H2_25\% := 0.0004 \cdot \left(25 - \frac{conc(23.2 \cdot day, 2)}{\%LFL_{NH3}} - \frac{conc(23.2 \cdot day, 3)}{\%LFL_{CH4}}\right) \qquad H2_25\% = 0.972\%$$

Final H2 Concentration To Meet 50% (NH3 And CH4 Included):

$$H2_50\% := 0.0004 \cdot \left(50 - \frac{conc(50 \cdot day, 2)}{\%LFL_{NH3}} - \frac{conc(50 \cdot day, 3)}{\%LFL_{CH4}}\right) \qquad H2_50\% = 1.945\%$$

Final H2 Concentration To Meet 100% (NH3 And CH4 Included):

$$H2_100\% := 0.0004 \cdot \left(100 - \frac{conc(117 \cdot day, 2)}{\%LFL_{NH3}} - \frac{conc(117 \cdot day, 3)}{\%LFL_{CH4}}\right) \qquad H2_100\% = 3.891\%$$

Maximum %LFL With Loss Of Ventilation **(Assume Gas Conc. ~ Equal To Barometric Breathing At 100% LFL :**

$$LFL_{nat_breathing} := \frac{HGR_1}{(HGR_1 + vent_rate_{bb}) \cdot .04} + \frac{[NH3_{ss_bb}]}{\%LFL_{NH3} \cdot 100} + \frac{[CH4_{ss_bb}]}{\%LFL_{CH4} \cdot 100} \qquad LFL_{nat_breathing} = 484.109\%$$

Time To Reach 25% LFL With Zero Ventilation:

$$tempz_{25} := \frac{-vol_{head}}{(HGR_1 + vent_rate_{zb})} \cdot \ln\left[\frac{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_25\%}{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_init}\right] \qquad temp2_{25} = 9.285\ day$$

$$Time_zb2_25\%LFL := if(LFL_{nat_breathing} > 25\%, if(tempz_{25} < 0 \cdot day, 0 \cdot day, tempz_{25}), 999999999 \cdot day)$$

$$Time_zb2_25\%LFL = 9.089\ day$$

Time To Reach 50% LFL With Zero Ventilation:

$$tempz_{50} := \frac{-vol_{head}}{(HGR_1 + vent_rate_{zb})} \cdot \ln\left[\frac{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_50\%}{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_init}\right] \qquad temp2_{50} = 19.206\ day$$

$$Time_zb2_50\%LFL := if(LFL_{nat_breathing} > 50\%, if(tempz_{50} < 0 \cdot day, 0 \cdot day, tempz_{50}), 999999999 \cdot day)$$

$$Time_zb2_50\%LFL = 18.386\ day$$

Time To Reach 100% LFL With Zero Ventilation:

$$tempz_{100} := \frac{-vol_{head}}{(HGR_1 + vent_rate_{zb})} \cdot \ln\left[\frac{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_100\%}{HGR_1 - (HGR_1 + vent_rate_{zb}) \cdot H2_init}\right] \qquad temp2_{100} = 40.849\ day$$

$$Time_zb2_100\%LFL := if(LFL_{nat_breathing} > 100\%, if(tempz_{100} < 0 \cdot day, 0 \cdot day, tempz_{100}), 999999999 \cdot day)$$

$$Time_zb2_100\%LFL = 37.252\ day$$

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Summary Section

Input Data

Waste Properties (1 ==> Total Waste, 2 ==> Liquid Waste, 3 ==> Solid Waste)

$Tank_id = \text{"241-AY-102"}$ $\quad class_{waste} = \text{"dst"}$

$$[TOC] = \begin{pmatrix} 667.382 \\ 2.124 \times 10^{3} \\ 667.382 \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 4.273 \\ 294.845 \\ 4.273 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 1.205 \\ 228.866 \\ 1.205 \\ 228.866 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] = \begin{pmatrix} 14.955 \\ 100.206 \\ 14.955 \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [137Cs] = \begin{pmatrix} 33.616 \\ 1.000 \times 10^{-12} \\ 6.466 \times 10^{-3} \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.097 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 0.687 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 1.140 \times 10^{3} \\ 2.642 \times 10^{-10} \\ 969.345 \\ 170.655 \end{pmatrix} kilo \cdot gal \qquad \rho_{waste} = \begin{pmatrix} 1.117 \\ 1.427 \\ 1.062 \\ 1.427 \end{pmatrix} \frac{gm}{mL} \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

$$F_{H2O} = \begin{pmatrix} 85.426 \\ 38.000 \\ 93.775 \\ 38.000 \end{pmatrix} \% \qquad HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 3.611 \times 10^{4} \\ 1.594 \times 10^{-23} \\ 17.892 \\ 3.610 \times 10^{4} \end{pmatrix} watt \qquad Temp_{vap} = 316.761\,K$$

$vol_{tank} = 1.407 \times 10^{3}\, kilo \cdot gal$ $\quad vent_rate = 250.000\, cfm$ $\quad vent_rate_{bb} = 0.112\, cfm$

AN Tank Farm: Tank Data

$diam_{tank} = 75.000\, ft$ $\quad ht_{tank} = \begin{pmatrix} 413.944 \\ 9.592 \times 10^{-11} \\ 351.978 \\ 61.966 \end{pmatrix} in$ $\quad$ estimation Of Waste Depth

Dome-Space Compositions

$[CH_4] = 1.444 \times 10^{-4}\%$ $\quad [N2O] = 1.000 \times 10^{-3}\%$ $\quad [NH_3] = 4.290 \times 10^{-4}\%$

+

End Of Input Data

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Output Data

Waste Properties (1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

Hydrogen Generation Rate Due To Thermolysis, Radiolysis, And Corrosion...

$$HGR_{thermv} = \begin{pmatrix} 1.104 \times 10^{-4} \\ 9.805 \times 10^{-17} \\ 4.707 \times 10^{-5} \\ 6.334 \times 10^{-5} \end{pmatrix} cfm \qquad HGR_{radv} = \begin{pmatrix} 0.025 \\ 1.121 \times 10^{-29} \\ 4.292 \times 10^{-5} \\ 0.025 \end{pmatrix} cfm \qquad HGR_{corr} = \begin{pmatrix} 8.003 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 4.408 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} cfm$$

Overall Hydrogen Generation Rate...

at The Headspace Conditions...

$$HGR = \begin{pmatrix} 0.026 \\ 2.182 \times 10^{-16} \\ 5.308 \times 10^{-4} \\ 0.026 \end{pmatrix} cfm \qquad HGR = \begin{pmatrix} 37.930 \\ 3.142 \times 10^{-13} \\ 0.764 \\ 37.165 \end{pmatrix} \frac{ft^3}{day}$$

at Standard Conditions (273°K)...

$$HGR_{stp} = \begin{pmatrix} 0.023 \\ 1.882 \times 10^{-16} \\ 4.577 \times 10^{-4} \\ 0.022 \end{pmatrix} cfm \qquad HGR_{stp} = \begin{pmatrix} 32.708 \\ 2.709 \times 10^{-13} \\ 0.659 \\ 32.048 \end{pmatrix} \frac{ft^3}{day}$$

Steady-State Compositions

Hydrogen At Normal Ventilation Rate...

$[H2_{ss}] = 0.263\%LFL_{H2}$

At Barometric Breathing Ventilation Rate

$[H2_{ss_bb}] = 477.591\%LFL_{H2}$

Ammonia At Normal Ventilation Rate...

$[NH3_{ss}] = 2.860 \times 10^{-3}\%LFL_{NH3}$

At Barometric Breathing Ventilation Rate

$[NH3_{ss_bb}] = 0.063\%LFL_{NH3}$

Methane At Normal Ventilation Rate...

$[CH4_{ss}] = 2.889 \times 10^{-3}\%LFL_{CH4}$

At Barometric Breathing Ventilation Rate

$[CH4_{ss_bb}] = 6.454\%LFL_{CH4}$

Nitrous Oxide At Normal Ventilation Rate...

$[N2O_{ss}] = 1.000 \times 10^{-3}\%$

At Barometric Breathing Ventilation Rate

$[N2O_{ss_bb}] = 2.192\%$

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Flammable Gas Concentrations After Loss Of Ventilation At Selected Time Periods

$conc_{mix}(0 \cdot day) = 0.269\ \%LFL$ $conc_{mix}(10 \cdot day) = 26.441\ \%LFL$

$conc_{mix}(100 \cdot day) = 206.328\ \%LFL$ $conc_{mix}(10^9 \cdot day) = 484.109\ \%LFL$

Time To Reach Various LFL Levels At Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_{1_25\%LFL} = 9.433\ day$ $Time_{1_75\%LFL} = 30.215\ day$

$Time_{1_50\%LFL} = 19.525\ day$ $Time_{1_100\%LFL} = 41.580\ day$

Time To Reach Various LFL Levels At Zero Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_zb_{2_25\%LFL} = 9.089\ day$

$Time_zb_{2_50\%LFL} = 18.386\ day$ $Time_zb_{2_100\%LFL} = 37.252\ day$

Minimum Ventilation Rates To Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL} = 2.644\ cfm$ $vent_rate_{1_75\%LFL} = 0.863\ cfm$

$vent_rate_{1_50\%LFL} = 1.308\ cfm$ $vent_rate_{1_100\%LFL} = 0.641\ cfm$

Gas Concentrations At Time To Reach 25% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{25}] = 0.987\%$	$[H2_{25}] = 24.665\ \%LFL_{H2}$
NH3	$[NH3_{25}] = 9.395 \times 10^{-3}\%$	$[NH3_{25}] = 0.063\ \%LFL_{NH3}$
CH4	$[CH4_{25}] = 0.014\%$	$[CH4_{25}] = 0.272\ \%LFL_{CH4}$

Gas Concentrations At Time To Reach 50% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{50}] = 1.976\%$	$[H2_{50}] = 49.389\ \%LFL_{H2}$
NH3	$[NH3_{50}] = 9.495 \times 10^{-3}\%$	$[NH3_{50}] = 0.063\ \%LFL_{NH3}$
CH4	$[CH4_{50}] = 0.027\%$	$[CH4_{50}] = 0.547\ \%LFL_{CH4}$

Gas Concentrations At Time To Reach 100% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{100}] = 3.953\%$	$[H2_{100}] = 98.830\ \%LFL_{H2}$
NH3	$[NH3_{100}] = 9.496 \times 10^{-3}\%$	$[NH3_{100}] = 0.063\ \%LFL_{NH3}$
CH4	$[CH4_{100}] = 0.055\%$	$[CH4_{100}] = 1.107\ \%LFL_{CH4}$

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G.7. RPP-5926 Rev. 2: 07 Calculation of Mass Transport Coefficient "h" for Soluble Gas -- 241-AY-102 Filled With Waste

CH2MHILL
Hanford Group, Inc.

SA Barker

Calculation of Mass Transport Coefficient "h" for Soluble Gas

241-AY-102 Filled With Waste +

References

Hu, T. A., S. A. Barker, D. C. Hedengren, M.A. Kufahl, 2001, "*Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*", RPP-5926, Rev. 1, CH2MHILL Hanford Group, Inc., Richland, WA.

Input Data

Constants

$\rho_g := 1.17 \cdot \frac{kg}{m^3}$	Density of gas
$D_g := 2.50 \times 10^{-5} \cdot \frac{m^2}{s}$	Diffusion coefficient in gas phase
$\mu_g := 2.0 \cdot 10^{-5} \cdot \frac{kg}{m \cdot s}$	Viscosity of gas
$g = 9.807 \frac{m}{s^2}$	gravitational number
$\Delta T := 1 \cdot K$	Temperature difference between waste surface and gas
$\beta_g := 3.30 \cdot 10^{-3} \cdot \frac{1}{K}$	Thermal expansion coefficient of Gas
$L_c := 5.7825 \cdot m$	Characteristic Length (1/4 of Diameter)
$D_L := 2.8 \cdot 10^{-9} \cdot \frac{m^2}{s}$	Diffusion Coefficient in Liquid Phase
$\rho_L := 1300 \cdot \frac{kg}{m^3}$	Density of Liquid

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$\mu_L := 6.82 \cdot 10^{-4} \cdot \frac{kg}{m \cdot s}$ Viscosity of Liquid

$\beta_L := 3.02 \cdot 10^{-4} \cdot \frac{1}{K}$ Thermal expansion coefficient of Liquid

$MW_{NH3} := 17.0307 \cdot \frac{gm}{mol}$ Molecular Weight of Ammonia

$h_{g_Schumpe_model} := -0.0481 \cdot \frac{L}{mol}$ Schumpe Model Coefficient

Read Waste Information From "NH3CALInputData010829-07.xls"

IData :=

C:\..\NH3CALInputData010829-07.xls

Read Tank Information From "TankInfo.xls"

TData :=

C:\..\TankInfo.xls

Find Waste Properties

Tank_id := "241-AY-102"

TFI1 := search(Tank_id,"-",1) TFI1 = 3.000

TankFarm := substr(Tank_id,TFI1 + 1,2) TankFarm = "AY"

j1 := 1..177

TankNames3 := stack(TankNames1,TankNames2)

$na1_{j1} := j1$

vent_rate := 250·cfm From (Bingham 2000)

Find The Appropriate Tank Specific Information:

fi1 := FindIndex(TankNames6,Tank_id)

$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$

$tank_{idx} := fi1_1 + 1$ $tank_{idx} = 24.000$

$class_{waste} := if[(fi1_1 < 29), "dst", "sst"]$

$class_{waste} = "dst"$

fi2 := FindIndex(Farms,TankFarm)

$fi2 = \begin{pmatrix} 6.000 \\ 1.000 \end{pmatrix}$

$farm_{idx} := fi2_1 + 5$ $farm_{idx} = 11.000$

$vol_{tank} := TData_{farm_{idx},4} \cdot ft^3$

$vol_{tank} = 1.881 \times 10^5 \, ft^3$

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$$comp: \begin{pmatrix} \text{"Na+"} \\ \text{"AL+3"} \\ \text{"Fe+3"} \\ \text{"Cr+3"} \\ \text{"Ni+2"} \\ \text{"K+"} \\ \text{"OH-"} \\ \text{"NO3-"} \\ \text{"NO2-"} \\ \text{"CO3-2"} \\ \text{"PO4-3"} \\ \text{"SO4-2"} \\ \text{"F-"} \\ \text{"Cl-"} \end{pmatrix} \quad Co := \begin{pmatrix} IData_{tank_{idx},2} \\ IData_{tank_{idx},3} \\ IData_{tank_{idx},4} \\ IData_{tank_{idx},5} \\ IData_{tank_{idx},6} \\ IData_{tank_{idx},7} \\ IData_{tank_{idx},8} \\ IData_{tank_{idx},9} \\ IData_{tank_{idx},10} \\ IData_{tank_{idx},11} \\ IData_{tank_{idx},12} \\ IData_{tank_{idx},13} \\ IData_{tank_{idx},14} \\ IData_{tank_{idx},15} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \quad mw := \begin{pmatrix} 22.99 \\ 26.98 \\ 55.85 \\ 52 \\ 58.71 \\ 39.09 \\ 17.0074 \\ 62.0049 \\ 46.0055 \\ 60.0092 \\ 94.9676 \\ 96.0576 \\ 19 \\ 35.453 \end{pmatrix} \cdot \frac{gm}{mol} \quad H := \begin{pmatrix} .1143 \\ .2174 \\ .1161 \\ .0648 \\ .1654 \\ .0922 \\ .0839 \\ .0128 \\ .0795 \\ .1423 \\ .2119 \\ .1117 \\ .092 \\ .0318 \end{pmatrix}$$

$$\frac{Co}{\frac{\mu \cdot gm}{mL}} =$$

	1
1	$5.400 \cdot 10^4$
2	$1.970 \cdot 10^3$
3	10.100
4	29.100
5	4.020
6	388.000
7	$1.439 \cdot 10^3$
8	486.000
9	$7.290 \cdot 10^3$
10	$4.865 \cdot 10^4$
11	$3.010 \cdot 10^3$
12	$2.320 \cdot 10^3$
13	91.050
14	197.343
15	
16	

Component Concentration Molecular Weigh

$[NH_3_SS_dome] := IData_{tank_{idx},16} \cdot ppm$ $[NH_3_SS_dome] = 4.286\ pp$

$[NH3_L] := IData_{tank_{idx},17} \cdot \frac{\mu \cdot gm}{mL}$ $[NH3_L] = 35.293 \frac{\mu \cdot gm}{mL}$

$[H2O_{wt\%}] := IData_{tank_{idx},18}\ \%$ $[H2O_{wt\%}] = 87.000\ \%$

$\rho_{liq} := IData_{tank_{idx},19} \cdot \frac{gm}{mL}$ $\rho_{liq} = 1.150 \frac{gm}{mL}$

$vol_{waste} := IData_{tank_{idx},20} \cdot kilo \cdot L$ $vol_{waste} = 4.315 \times 10^3\ kilo$

$vol_{headspace} := vol_{tank} - vol_{waste}$

$vol_{headspace} = 35693\ ft^3$ .... .Al

$Q_{normal_vent} := vent_rate$ .....AH

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$T_{headspace_c} := IData_{tank_{idx},21} \cdot C$ $\quad T_{headspace} := (T_{headspace_c} + 273.15) \cdot K$ $\quad T_{headspace} = 316.761\,K$

$T_{waste_c} := IData_{tank_{idx},22} \cdot C$ $\quad T_{waste} := (T_{waste_c} + 273.15) \cdot K$ $\quad T_{waste} = 325.150\,K$

$K_{H_soln_corr_fact} := IData_{tank_{idx},23}$ .....AA

$K_{H_soln_corr_fact} = 1.100$

$P := 1 \cdot atm$

$t := 35 \cdot day$ time of interest

Calculations

Schmidt Number

$$S_c := \frac{\mu_g}{D_g \cdot \rho_g}$$

$$S_c = 0.683761$$

Grashoff Number

$$G_r := \frac{g \cdot \beta_g \cdot \rho_g^2 \cdot L_c^3 \cdot \Delta T}{\mu_g^2}$$

$$G_r = 2.141 \times 10^{10}$$

Film Coefficient - Vapor

$$h_g := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$ Vapor Film Coefficient

$$h_g = 1.587 \times 10^{-3} \frac{m}{s}$$

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Film Coefficient - Liquid

$$h_L := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_L}\right)^{\frac{1}{3}} \cdot \left(\frac{g \cdot \beta_L \cdot \rho_L^{2} \cdot \Delta T}{\mu_L^{2}}\right)^{\frac{1}{3}}$$ Liquid Film Coefficient

$$h_L = 5.306 \times 10^{-6} \frac{m}{s}$$

Sum C_i

$$C_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i}}{1000}$$

$$C_{sum} = 3.555 \frac{mol}{m^3}$$ X

Sum C_i x H_i

$$CH_{sum} := \frac{\sum_{i=1}^{13} \frac{Co_i}{mw_i} \cdot H_i}{1000}$$

$$CH_{sum} = 0.430 \frac{mol}{m^3}$$ .....Y

K_H^o In Water

=EXP(-8.0964+3917.5/(273.15+W3)-0.003-14*(273.15+W3))

$$K_{H_o} := \exp\left(-8.0964 + \frac{3917.5 \cdot K}{T_{waste}} - .00314 \cdot \frac{T_{waste}}{K}\right)$$

$$K_{H_o} = 18.745$$ .....Z

KHo In Solution

=Z3/POWER(10,Y3+X3*I60)*AA3

$$K_H := \frac{K_{H_o} \cdot K_{H_soln_corr_fact}}{10^{\left[\left[\frac{C_{sum}}{\left(\frac{mol}{m^3}\right)}\right]\left[\frac{h_{g_Schumpe_model}}{\left(\frac{L}{mol}\right)}\right]+\left[\frac{CH_{sum}}{\left(\frac{mol}{m^3}\right)}\right]\right]}} \cdot \frac{mol}{L \cdot atm}$$

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$K_H = 11.348 \frac{mol}{L \cdot atm}$ .....AB

Ammonia Concentration

$Output_3 := \frac{K_H}{\frac{mol}{L \cdot atm}}$

$[NH3_L] = 0.035 \frac{kg}{m^3}$

$[NH3_{liq}] := \frac{[NH3_L]}{MW_{NH3}}$

$[NH3_{liq}] = 2.072 \times 10^{-3} \frac{mol}{L}$ .....AD

Ammonia Partial Pressure

$Output_5 := \frac{[NH3_{liq}]}{\frac{mol}{L}}$

$P_{NH3} := \frac{[NH3_{liq}]}{K_H}$

$P_{NH3} = 1.826 \times 10^{-4} atm$ .....AE

Molar Volume

$V_m := 22.4 \cdot \frac{L}{mol} \cdot \frac{T_{headspace}}{273.15 \cdot K}$

$Output_4 := \frac{V_m}{\frac{L}{mol}}$

$V_m = 25.976383 \frac{L}{mol}$ .....AG

Steady-State Ammonia Concentration

$[NH3_{ss}] := \frac{[NH3_SS_dome]}{V_m}$

$[NH3_{ss}] = 1.64985 \times 10^{-7} \frac{mol}{L}$ .....AF

Equivalent Steady-State Ammonia Concentration In Liquid Phase

$[NH3_{ss_liq_eq}] := K_H \cdot V_m \cdot [NH3_{ss}] \cdot P$

$[NH3_{ss_liq_eq}] = 4.863 \times 10^{-5} \frac{mol}{L}$ .....AJ

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Mass Transport Properties

$$h_A := Q_{normal_vent} \cdot \left(\frac{[NH3_{ss}]}{[NH3_{liq}] - [NH3_{ss_liq_eq}]} \right)$$

$$Output_2 := \frac{h_A}{cfm}$$

$h_A = 0.020382\ cfm$ ..... AK

Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_SS_dome] \cdot P \right) \cdot V_m$$

$vr_{ss_norm} = 1.071 \times 10^{-3}\ cfm$ ..... AL

Off-Normal Barometric Vent Rate

$$Q_{off_normal_vent} := .45 \cdot \frac{\%}{day} \cdot vol_{headspace}$$

$Q_{off_normal_vent} = 0.112\ cfm$ ..... AM

Off-Normal Constant, k_1 And k_2

$$k_1 := \frac{Q_{off_normal_vent} + \left(h_A \cdot K_H \cdot P \cdot V_m \right)}{vol_{headspace}}$$

$k_1 = 1.715 \times 10^{-4}\ \frac{1}{min}$ ..... AN

$$k_2 := \frac{h_A \cdot [NH3_{liq}]}{vol_{headspace}}$$

$$Output_1 := \frac{k_2}{\frac{mol}{L \cdot min}}$$

$k_2 = 1.183 \times 10^{-9}\ \frac{mol}{L \cdot min}$ ..... AO

Off-Normal Ammonia Partial Pressure

$$P_{NH3_on} := \frac{k_2}{k_1} \cdot V_m \cdot P$$

$P_{NH3_on} = 1.79289 \times 10^{-4}\ atm$ ..... AP

$\frac{P_{NH3_on}}{atm} = 179.289\ ppm$ ..... AQ

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Steady-State Release Rate At Normal Ventilation Conditions

$$vr_{ss_off_norm} := h_A \cdot \left([NH3_{liq}] - K_H \cdot \frac{P_{NH3_on}}{atm} \cdot P \right) \cdot V_m$$

$vr_{ss_off_norm} = 2.000 \times 10^{-5}\ cfm$ .....AR

Ammonia Concentration At Time, t

$$[NH3_t] := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1} \right) \cdot \exp(-1 \cdot k_1 \cdot t) \right] \cdot V_m \cdot 10^6 \cdot ppm$$

$[NH3_t] = 179.259\ ppm$ .....AU

Ammonia Diffusion Rate At Time, t

$$\delta_{NH3_t} := h_A \cdot \left([NH3_{liq}] - K_H \cdot [NH3_t] \cdot P \right) \cdot V_m$$

$\delta_{NH3_t} = 2.018 \times 10^{-5}\ cfm$ .....AV

KRT

$$KRT := T_{waste} \cdot K_H \cdot 0.082 \cdot \frac{(L \cdot atm)}{mol \cdot K}$$

$KRT = 302.561$ .....AW

Film Coefficient - Liquid At Time t

$$h_{Lt} := 0.15 \cdot D_L \cdot \left(\frac{\mu_L}{D_L \cdot \rho_{liq}} \right)^{\frac{1}{3}} \cdot \left[\frac{g \cdot \beta_L \cdot (\rho_{liq})^2 \cdot \Delta T}{(\mu_L)^2} \right]^{\frac{1}{3}}$$

Liquid Film Coefficient

$h_{Lt} = 5.093 \times 10^{-6}\ \frac{m}{s}$ .....AX

Film Coefficient - Vapor At Time t

$$h_{gt} := 0.15 \cdot \frac{D_g}{L_c} \cdot (S_c \cdot G_r)^{\frac{1}{3}}$$

Vapor Film Coefficient

$h_{gt} = 1.587 \times 10^{-3}\ \frac{m}{s}$ .....AY

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Film Coefficient - Overall At Time t

Overall Film Coefficient

$$h := \frac{1}{\frac{1}{h_{Lt}} + \frac{KRT}{h_{gt}}}$$

$h = 2.584 \times 10^{-6} \frac{m}{s}$ .....AZ

Surface Area

$area := \pi \cdot (37.5 \cdot ft)^2$

$area = 4.418 \times 10^3 ft^2$ .....BA

$hxA := h \cdot area$

$hxA = 2.247\ cfm$ .....BB

Effective Surface Area (Percent)

$$eff_{SA} := \frac{h_A}{hxA}$$

$eff_{SA} = 0.907\ \%$ .....BC

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Ammonia Concentrations As A Function Of Time

$$time := \begin{pmatrix} -30 \\ -20 \\ -10 \\ .0001 \\ .5 \\ 3 \\ 5 \\ 10 \\ 15 \\ 30 \\ 35 \\ 50 \\ 70 \\ 90 \\ 110 \\ 120 \\ 125 \\ 127 \\ 130 \\ 135 \\ 140 \\ 145 \end{pmatrix} \cdot day$$

$i := 1..22$

$$NH3_i := \left[\frac{k_2}{k_1} + \left([NH3_{ss}] - \frac{k_2}{k_1}\right)\exp\left(-1 \cdot \frac{k_1}{\frac{1}{day}} \cdot \frac{time_i}{day}\right)\right] \cdot V_m$$

$h_A = 0.020\ cfm$

$[NH3_{liq}] = 2.072 \times 10^{-3} \frac{mol}{L}$

$K_H = 11.348 \frac{mol}{L \cdot atm}$

$V_m = 25.976 \frac{L}{mol}$

$RR_{NH3_i} := h_A \cdot \left([NH3_{liq}] - K_H \cdot P \cdot NH3_i\right) \cdot V_m$

$RR_{NH3_1} := h_A$ $\quad NH3_1 := [NH3_SS_dome]$

$RR_{NH3_2} := h_A$ $\quad NH3_2 := [NH3_SS_dome]$

$NH3_3 := [NH3_SS_dome]$

$RR_{NH3_3} := h_A$

$RR_{NH3_4} := h_A$

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$time_i$ = day	$NH3_i$ = ppm	RR_{NH3_i} = cfm
-30	4.286	0.020
-20	4.286	0.020
-10	4.286	0.020
$1 \cdot 10^{-4}$	4.290	0.020
1	24.609	$9.493 \cdot 10^{-4}$
3	95.849	$5.213 \cdot 10^{-4}$
5	128.365	$3.260 \cdot 10^{-4}$
10	164.471	$1.090 \cdot 10^{-4}$
15	174.977	$4.591 \cdot 10^{-5}$
30	179.183	$2.064 \cdot 10^{-5}$
35	179.259	$2.018 \cdot 10^{-5}$
50	179.289	$2.000 \cdot 10^{-5}$
70	179.289	$2.000 \cdot 10^{-5}$
90	179.289	$2.000 \cdot 10^{-5}$
110	179.289	$2.000 \cdot 10^{-5}$
120	179.289	$2.000 \cdot 10^{-5}$
125	179.289	$2.000 \cdot 10^{-5}$
127	179.289	$2.000 \cdot 10^{-5}$
130	179.289	$2.000 \cdot 10^{-5}$
135	179.289	$2.000 \cdot 10^{-5}$
140	179.289	$2.000 \cdot 10^{-5}$
145	179.289	$2.000 \cdot 10^{-5}$

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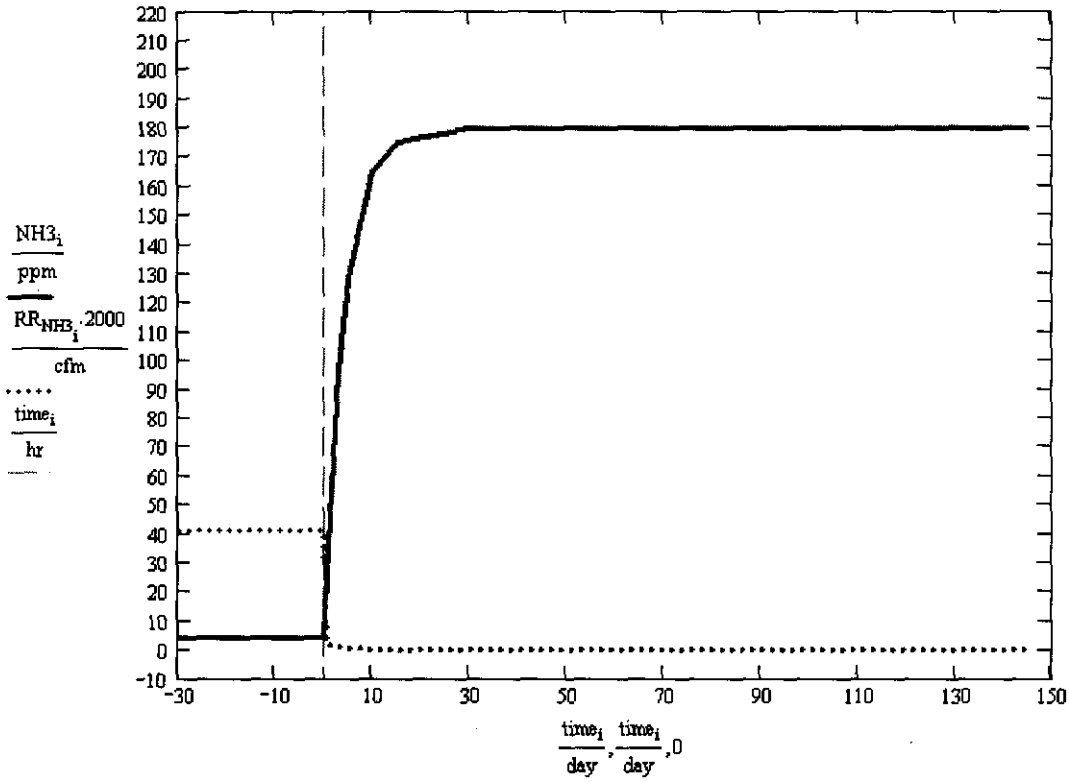

Output Results To Datafile "rpp5926_r2_07_NH3CALOutputData0020203.xls"

C:\..\rpp5926_r2_07_NH3CALOutputData0020203.xls

Output

$$\text{Output} = \begin{pmatrix} 1.183 \times 10^{-9} \\ 0.020 \\ 11.348 \\ 25.976 \\ 2.072 \times 10^{-3} \end{pmatrix}$$

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G.8. RPP-5926 Rev. 2: 08 Decay Heat Generation Rate -- Based on Radionuclide Data, 241-AY-102

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Decay Heat Generation Rate

Based On Radionuclide Data SA Barker

Reference:

Ref: Kirkpatrick, T. D., and Brown, R. C., 1984, Basis and Values for Specific Activity and Decay Heat Generation Rates for Selected Radionuclides, RHO-SD-RE-TI-131, Rockwell Hanford Operations, Richland, Washington.

Bring In The Radionuclide Data From SD-RE-TI-131

M := READPRN("sd-re-ti-131.prn")

key VVVVVVVVVVVVVVVVVVVVVVV
0==> half-life (days); **1==> half-life multiplier 10x (days);**
2==> Atomic weight (gm/gm_mol);
3==> Specific Activity (dpm/gm); **4==> Specific Activity multiplier 10x (dpm/gm);**
5==> Decay Heat Generation Rate (Watt/Ci) 6==> Decay Heat Generation Rate multiplier 10x (Watt/Ci)

M =

	0	1	2	3	4	5	6
0	0	0	0	0	0	0	0
1	$1.925 \cdot 10^3$	0	60	2.51	15	1.54	-2
2	$3.915 \cdot 10^3$	0	85	8.71	14	1.5	-3
3	50.55	0	89	6.44	16	3.45	-3
4	$1.045 \cdot 10^4$	0	90	3.08	14	1.16	-3
5	2.671	0	90	1.21	18	5.53	-3
6	$1.045 \cdot 10^4$	0	90	6.17	14	6.69	-3
7	58.51	0	91	5.44	16	3.58	-3
8	64.02	0	95	4.77	16	5.04	-3
9	3.608	0	95	8.46	17	1.32	-3
10	35.06	0	95	8.7	16	4.79	-3
11	64.02	0	95	1.53	17	1.56	-2
12	7.78	7	99	3.76	10	5.01	-4
13	39.35	0	103	7.15	16	3.27	-3
14	0.039	0	103	7.22	19	2.3	-4
15	39.35	0	103	1.43	17	3.5	-3

Author: SA Barker Date: 6/12/02

$j := 0, 1 .. 61$

$na_j := j$ name := augment(na, me)

$k := 0 .. 3$

$kk := 0 .. 3$

excel := C:\..\FGS Input 020203 .xls File Name is "FGS Input 020203 .xls"

excel =

	0	1	2	3	4	5	6
0	1	2	3	4	5	6	7
1	0	0	0	0	0	0	0
2	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
3	0	$1.166 \cdot 10^3$	$4.16 \cdot 10^4$	$7.305 \cdot 10^4$	$1.123 \cdot 10^4$	0.04	82.911
4	0	0	0	0	0	0	0
5	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	67.467	220.193
6	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	59.727	214.404
7	0	$2.581 \cdot 10^4$	$9.444 \cdot 10^4$	$2.368 \cdot 10^5$	$1.604 \cdot 10^4$	144.373	277.714
8	0	$2.597 \cdot 10^3$	$1.641 \cdot 10^5$	$1.673 \cdot 10^5$	$2.995 \cdot 10^4$	1.371	351.899

Tank_id := "241-AY-102"

The following data is from Hu 2001b, except where noted

$tank_{idxT} := 68$

>>>> Compensate for Origin = 0 <<<<

$tank_{idxL} := tank_{idxT} + 1$

$tank_{idxS} := tank_{idxT} + 2$ $idcol := 33 - 1$

$$[137Cs] := \begin{pmatrix} excel_{tank_{idxT}, idcol} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL}, idcol} \\ excel_{tank_{idxS}, idcol} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 74.368 \\ 1 \times 10^{-12} \\ 27.418 \\ 179.452 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

Author: _____ Date: 6/12/02

$$[90Sr] := \begin{bmatrix} excel_{tank_{idxT},(idcol-1)} \\ 1\cdot 10^{-12} \\ excel_{tank_{idxL},(idcol-1)} \\ excel_{tank_{idxS},(idcol-1)} \end{bmatrix} \cdot \frac{\mu\cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.808\times 10^{3} \\ 1\times 10^{-12} \\ 1.524 \\ 5.85\times 10^{3} \end{pmatrix} \frac{\mu\cdot Ci}{gm}$$

$$\rho_{waste} := \begin{bmatrix} excel_{tank_{idxT},(idcol+1)} \\ excel_{tank_{idxS},(idcol+1)} \\ excel_{tank_{idxL},(idcol+1)} \\ excel_{tank_{idxS},(idcol+1)} \end{bmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.217 \\ 1.397 \\ 1.15 \\ 1.397 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{bmatrix} excel_{tank_{idxT},(idcol+2)} \\ 1\cdot 10^{-9} \\ excel_{tank_{idxL},(idcol+2)} \\ excel_{tank_{idxS},(idcol+2)} \end{bmatrix} \cdot kilo\cdot L \qquad vol_{waste} = \begin{pmatrix} 4177 \\ 0 \\ 3155 \\ 1022 \end{pmatrix} kilo\cdot L$$

$$name_{isotope} := \begin{pmatrix} "137Cs" \\ "137Ba" \\ "90Sr" \\ "90Y" \end{pmatrix}$$

$$[137Ba] := \overrightarrow{[137Cs]}\cdot 0.946 \qquad [90Y] := \overrightarrow{[90Sr]}\cdot 1.000$$

Author: _____ Date: 6/12/02

Find the appropriate radio-isotope specific information:

```
FindIndex(M, key) := | r ← rows(M) − 1
                     | c ← cols(M) − 1
                     | i ← 0
                     | j ← 0
                     | while (j ≤ c)·(M_{i,j} ≠ key)
                     |     | i ← i + 1  if i < r
                     |     | otherwise
                     |     |     | i ← 1
                     |     |     | j ← j + 1
                     | (i, j)  if j ≤ c
                     | 0  otherwise
```

$$name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$fi_{kk} := FindIndex(name, name_{isotope_{kk}})$$

$$fi = \begin{pmatrix} \{2,1\} \\ \{2,1\} \\ \{2,1\} \\ \{2,1\} \end{pmatrix}$$

$$ii := \overrightarrow{fi} \qquad ii_0 = \begin{pmatrix} 31 \\ 1 \end{pmatrix} \quad ii_1 = \begin{pmatrix} 32 \\ 1 \end{pmatrix} \quad ii_2 = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad ii_3 = \begin{pmatrix} 5 \\ 1 \end{pmatrix}$$

$$in_{kk} := (ii_{kk})_0$$

$$in = \begin{pmatrix} 31 \\ 32 \\ 4 \\ 5 \end{pmatrix}$$

Author: _____ Date: 6/12/02

$$half_life_{kk} := M_{in_{kk},0} \cdot 10^{M_{in_{kk},1}} \cdot day \qquad half_life = \begin{pmatrix} 30.171 \\ 4.795 \times 10^{-6} \\ 28.601 \\ 0.007 \end{pmatrix} yr \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$wt_{atomic_{kk}} := M_{in_{kk},2} \cdot \frac{gm}{g_mol} \qquad wt_{atomic} = \begin{pmatrix} 137 \\ 137 \\ 90 \\ 90 \end{pmatrix} \frac{gm}{g_mol} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA_{kk} := M_{in_{kk},3} \cdot 10^{M_{in_{kk},4}} \cdot \frac{dpm}{gm} \qquad SA = \begin{pmatrix} 1.92 \times 10^{14} \\ 1.21 \times 10^{21} \\ 3.08 \times 10^{14} \\ 1.21 \times 10^{18} \end{pmatrix} \frac{dpm}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$SA = \begin{pmatrix} 86.486 \\ 5.45 \times 10^{8} \\ 138.739 \\ 5.45 \times 10^{5} \end{pmatrix} \frac{Ci}{gm} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope_{kk}} := M_{in_{kk},5} \cdot 10^{M_{in_{kk},6}} \cdot \frac{watt}{Ci} \qquad q_{isotope} = \begin{pmatrix} 1.01 \times 10^{-3} \\ 3.92 \times 10^{-3} \\ 1.16 \times 10^{-3} \\ 5.53 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$q_{isotope} = \begin{pmatrix} 3.444 \times 10^{-3} \\ 0.013 \\ 3.955 \times 10^{-3} \\ 0.019 \end{pmatrix} \frac{mBTU}{Ci \cdot hr} \qquad name_{isotope} = \begin{pmatrix} \text{"137Cs"} \\ \text{"137Ba"} \\ \text{"90Sr"} \\ \text{"90Y"} \end{pmatrix}$$

$$heat_load_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[\begin{array}{l} ([137Cs])_k \cdot q_{isotope_0} + ([137Ba])_k \cdot q_{isotope_1} \cdots \\ + ([90Sr])_k \cdot q_{isotope_2} + ([90Y])_k \cdot q_{isotope_3} \end{array} \right]$$

$$heat_load = \begin{pmatrix} 6.324 \times 10^{4} \\ 0 \\ 506.423 \\ 5.71 \times 10^{4} \end{pmatrix} watt$$

Author: SA Baker Date: 6/14/02

Check answer #1

$z := 1$

$$heat_load2 := vol_{waste_z} \cdot \rho_{waste_z} \cdot \left[\begin{array}{l} ([137Cs])_z \cdot q_{isotope_0} + ([137Ba])_z \cdot q_{isotope_1} \cdots \\ +([90Sr])_z \cdot q_{isotope_2} + ([90Y])_z \cdot q_{isotope_3} \end{array} \right]$$

$heat_load2 = 0\,watt$

Check answer #2 (alternate calculation)

$$[137Cs] = \begin{pmatrix} 74.368 \\ 1 \times 10^{-12} \\ 27.418 \\ 179.452 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.808 \times 10^{3} \\ 1 \times 10^{-12} \\ 1.524 \\ 5.85 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 1.475 \times 10^{5} \\ 3.531 \times 10^{-8} \\ 1.114 \times 10^{5} \\ 3.609 \times 10^{4} \end{pmatrix} ft^3 \qquad \rho_{waste} = \begin{pmatrix} 1.217 \\ 1.397 \\ 1.15 \\ 1.397 \end{pmatrix} \frac{gm}{mL}$$

$$name_{isotope} := \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$[137Cs137Ba] := \overrightarrow{[137Cs]} \cdot 1.000 \qquad [90Sr90Y] := \overrightarrow{[90Sr]} \cdot 1.000$$

$jk := 0..1$

$$name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$fi2_{jk} := FindIndex(name, name_{isotope_{jk}})$

$$fi2 = \begin{bmatrix} \begin{pmatrix} 33 \\ 1 \end{pmatrix} \\ \begin{pmatrix} 6 \\ 1 \end{pmatrix} \end{bmatrix}$$

$$ii := \overrightarrow{fi2} \qquad ii_0 = \begin{pmatrix} 33 \\ 1 \end{pmatrix} \qquad ii_1 = \begin{pmatrix} 6 \\ 1 \end{pmatrix}$$

$in2_{jk} := (ii_{jk})_0$

$$in2 = \begin{pmatrix} 33 \\ 6 \end{pmatrix}$$

Author: _____ Date: 6/12/02

$$half_life2_{jk} := M_{in2_{jk},0} \cdot 10^{M_{in2_{jk},1}} \cdot day \quad half_life2 = \begin{pmatrix} 11019.593 \\ 10446.150 \end{pmatrix} day \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$wt2_{atomic_{jk}} := M_{in2_{jk},2} \cdot \frac{gm}{g_mol} \quad wt2_{atomic} = \begin{pmatrix} 137 \\ 90 \end{pmatrix} \frac{gm}{g_mol} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$SA2_{jk} := M_{in2_{jk},3} \cdot 10^{M_{in2_{jk},4}} \cdot \frac{dpm}{gm} \quad SA2 = \begin{pmatrix} 3.74 \times 10^{14} \\ 6.17 \times 10^{14} \end{pmatrix} \frac{dpm}{gm} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$SA2 = \begin{pmatrix} 168.468 \\ 277.928 \end{pmatrix} \frac{Ci}{gm} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$q2_{isotope_{jk}} := M_{in2_{jk},5} \cdot 10^{M_{in2_{jk},6}} \cdot \frac{watt}{Ci} \quad q2_{isotope} = \begin{pmatrix} 4.72 \times 10^{-3} \\ 6.69 \times 10^{-3} \end{pmatrix} \frac{watt}{Ci} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$q2_{isotope} = \begin{pmatrix} 0.016 \\ 0.023 \end{pmatrix} \frac{mBTU}{Ci \cdot hr} \quad name_{isotope} = \begin{pmatrix} \text{"137Cs137Ba"} \\ \text{"90Sr90Y"} \end{pmatrix}$$

$$heat_load2_k := vol_{waste_k} \cdot \rho_{waste_k} \cdot \left[([137Cs137Ba])_k \cdot q2_{isotope_0} + ([90Sr90Y])_k \cdot q2_{isotope_1} \right]$$

$$heat_load2 = \begin{pmatrix} 6.324 \times 10^4 \\ 0 \\ 506.59 \\ 5.71 \times 10^4 \end{pmatrix} watt \quad \text{compares to ==>} \quad heat_load = \begin{pmatrix} 6.324 \times 10^4 \\ 0 \\ 506.423 \\ 5.71 \times 10^4 \end{pmatrix} watt$$

$$heat_load2 = \begin{pmatrix} 2.158 \times 10^5 \\ 0 \\ 1.729 \times 10^3 \\ 1.948 \times 10^5 \end{pmatrix} \frac{BTU}{hr} \quad heat_load = \begin{pmatrix} 2.156 \times 10^5 \\ 0 \\ 1.727 \times 10^3 \\ 1.947 \times 10^5 \end{pmatrix} \frac{mBTU}{hr}$$

a1 :=

63235.48	
1.59E-23	
506.4231	
57098.92	

Write results to excel file
"rpp5926_r2_08_DecayHeatGRInput020203 .xls"

$$\left(\frac{heat_load}{watt} \right)$$

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G.9. RPP-5926 Rev. 2: 09 Hydrogen Generation Rate Calculations -- Single-Point Calculation – Calc. Note RPP-5926, Rev. 2: Fill tank to 1,140 kgal With Same Waste Addition, 241-AY-102

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Hydrogen Generation Rate Calculations

Single-Point Calculation - Calculation Note RPP-5926, Rev 2 -- Tank 241-AY-102 with Water Fill:

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Author: SA Barker Date: 6/12/02

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Read Waste Information From "FGS Input 020203 .xls"

excel :=

C:\..\FGS Input 020203 .xls

Datafile Name Is "FGS Input 020203 .xls"

excel =

	1	2	3	4	5	6	7
1	1.000	2.000	3.000	4.000	5.000	6.000	7.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	$1.166 \cdot 10^{3}$	$4.160 \cdot 10^{4}$	$7.305 \cdot 10^{4}$	$1.123 \cdot 10^{4}$	0.040	82.911
4	0.000	$1.166 \cdot 10^{3}$	$4.160 \cdot 10^{4}$	$7.305 \cdot 10^{4}$	$1.123 \cdot 10^{4}$	0.040	82.911
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	67.467	220.193
7	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	59.727	214.404
8	0.000	$2.581 \cdot 10^{4}$	$9.444 \cdot 10^{4}$	$2.368 \cdot 10^{5}$	$1.604 \cdot 10^{4}$	144.373	277.714
9	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	1.371	351.899
10	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	0.011	434.834
11	0.000	$2.597 \cdot 10^{3}$	$1.641 \cdot 10^{5}$	$1.673 \cdot 10^{5}$	$2.995 \cdot 10^{4}$	2.845	262.084
12	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	15.096	351.079
13	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	0.062	374.528
14	0.000	$3.140 \cdot 10^{3}$	$1.123 \cdot 10^{5}$	$1.719 \cdot 10^{5}$	$3.898 \cdot 10^{4}$	31.297	325.809
15	0.000	$3.556 \cdot 10^{3}$	$1.209 \cdot 10^{5}$	$1.616 \cdot 10^{5}$	$4.113 \cdot 10^{4}$	7.631	223.898
16	0.000	$3.556 \cdot 10^{3}$	$1.209 \cdot 10^{5}$	$1.616 \cdot 10^{5}$	$4.113 \cdot 10^{4}$	0.026	220.893

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Input Data

Waste Properties (Crust Layer Volume Is Included In Solids Layer In This Example)
(1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

$Tank_id := \text{"241-AY-102"}$ $\quad TFI1 := search(Tank_id, \text{"-"}, 1)$ $\quad TFI1 = 3\,000$

$TankFarm := substr(Tank_id, TFI1 + 1, 2)$ $\quad TankFarm = \text{"AY"}$

$TankNames3 := stack(TankNames1, TankNames2)$

$j1 = 1..177$

$na1_{j1} := j1$

$vent_rate := 250 \cdot cfm$ From (Bingham 2000)

Find The Appropriate Tank Specific Information:

$fi1 := FindIndex(TankNames3, Tank_id)$

$fi1 = \begin{pmatrix} 23.000 \\ 1.000 \end{pmatrix}$

$tank_{idxT} := \left[\left(fi1_1 - 1\right) \cdot 3\right] + 3$ $\quad tank_{idxT} = 69.000$ $\quad Col_{idx} := 28$

$tank_{idxL} := tank_{idxT} \bullet 1$

$tank_{idxS} := tank_{idxT} + 2$

$class_{waste} := if\left[\left(fi1_1 < 29\right), \text{"dst"}, \text{"sst"}\right]$

$class_{waste} = \text{"dst"}$

.The Following Data Is From Hu 2001b, Except Where Noted

$$[TOC] := \begin{vmatrix} tank_{idxT}, Col_{idx} \\ excel_{tank_{idxS}, Col_{idx}} \\ excel_{tank_{idxL}, Col_{idx}} \\ excel \end{vmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [TOC] = \begin{vmatrix} 1.769 \times 10 \\ 2.124 \times 10^3 \\ 1.639 \times 10^3 \\ 3 \end{vmatrix} \frac{\mu \cdot gm}{mL} \qquad Ci := 1.61 \cdot 10^{-2} \cdot \frac{BTU}{hr}$$

$$[NO_2] := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+1} \\ excel_{tank_{idxS}, Col_{idx}+1} \\ excel_{tank_{idxL}, Col_{idx}+1} \\ excel_{tank_{idxS}, Col_{idx}+1} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad \begin{vmatrix} \\ \\ \\ \\ \end{vmatrix} \frac{\mu \cdot gm}{mL}$$

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$$[NO_3] := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+2} \\ excel_{tank_{idxS},Col_{idx}+2} \\ excel_{tank_{idxL},Col_{idx}+2} \\ excel_{tank_{idxS},Col_{idx}+2} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 378.889 \\ 294.845 \\ 409.789 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+3} \\ excel_{tank_{idxS},Col_{idx}+3} \\ excel_{tank_{idxL},Col_{idx}+3} \\ excel_{tank_{idxS},Col_{idx}+3} \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \\ 1.480 \times 10^{3} \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[90Sr] := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+4} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},Col_{idx}+4} \\ excel_{tank_{idxS},Col_{idx}+4} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[137Cs] := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+5} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},Col_{idx}+5} \\ excel_{tank_{idxS},Col_{idx}+5} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs] = \begin{pmatrix} 74.771 \\ 1.000 \times 10^{-12} \\ 27.904 \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$\rho_{waste} := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+6} \\ excel_{tank_{idxS},Col_{idx}+6} \\ excel_{tank_{idxL},Col_{idx}+6} \\ excel_{tank_{idxS},Col_{idx}+6} \end{pmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste} = \begin{pmatrix} 1.210 \\ 1.427 \\ 1.130 \\ 1.427 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste} := \begin{pmatrix} excel_{tank_{idxT},Col_{idx}+7} \\ 1 \cdot 10^{-9} \\ excel_{tank_{idxL},Col_{idx}+7} \\ excel_{tank_{idxS},Col_{idx}+7} \end{pmatrix} \cdot kilo \cdot L \qquad vol_{waste} = \begin{pmatrix} 4315 \\ 0 \\ 3669 \\ 646 \end{pmatrix} kilo \cdot L$$

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$$F_{H2O} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+8} \\ excel_{tank_{idxS}, Col_{idx}+8} \\ excel_{tank_{idxL}, Col_{idx}+8} \\ excel_{tank_{idxS}, Col_{idx}+8} \end{pmatrix} \qquad F_{H2O} = \begin{pmatrix} 79.7 \\ 38.0 \\ 87.0 \\ 38.0 \end{pmatrix} \%$$

$$F_{liquid_2} := \left(\frac{F_{H2O_2}}{F_{H2O_3}}\right) \qquad F_{liquid_3} := \left(\frac{F_{H2O_3}}{F_{H2O_3}}\right) \qquad F_{liquid_4} := \left(\frac{F_{H2O_4}}{F_{H2O_3}}\right)$$

$$F_{liquid_1} := \left[\frac{F_{liquid_2}\cdot\left(vol_{waste_2}\cdot\rho_{waste_2}\right) + F_{liquid_3}\cdot\left(vol_{waste_3}\cdot\rho_{waste_3}\right) + F_{liquid_4}\cdot\left(vol_{waste_4}\cdot\rho_{waste_4}\right)}{vol_{waste_4}\cdot\rho_{waste_4} + vol_{waste_3}\cdot\rho_{waste_3} + vol_{waste_2}\cdot\rho_{waste_2}}\right]$$

$$F_{liquid} = \begin{pmatrix} 89.753 \\ 43.678 \\ 100.000 \\ 43.678 \end{pmatrix} \%$$

$$Temp_{waste} := \begin{pmatrix} excel_{tank_{idxT}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxS}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxL}, Col_{idx}+9} + 273.15 \\ excel_{tank_{idxS}, Col_{idx}+9} + 273.15 \end{pmatrix} \cdot K \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

From (Bingham 2000)

$$Temp_{vap} := \left(excel_{tank_{idxL}, Col_{idx}+10} + 273.15\right)\cdot K \qquad Temp_{vap} = 316.761\,K$$

From (Bingham 2000)

Make Sure You Run The File "Decay Heat Generation Rate 011129 .MCD"

excel2 :=

C:\..\rpp5926_r2_08_DecayHeatGRInput020203 .xls

Read Results From Excel File "rpp5926_r2_08_DecayHeatGRInput020203 .xls"

$$HeatLoad_{137Cs_90Sr} := excel2\cdot watt$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 6.533\times10^{4} \\ 1.594\times10^{-23} \\ 506.423 \\ 6.482\times10^{4} \end{pmatrix} watt$$

Calculated By Barker In "Decay Heat Generation Rate .MCD"

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TankInfo :=

C:\..\TankInfo_post-1999.xls

Read Waste properties From Excel File "TankInfo_post-1999.xls"

$j := 1..27$

$na_j := j$ name := augment(na,TankId)

TankFarm = "AY"

fi := FindIndex(name,TankFarm)

$fi = \begin{pmatrix} 11.000 \\ 2.000 \end{pmatrix}$

$vol_{tank} := TankInfo_{fi_1,4} \cdot ft^3$

$vol_{tank} = 1407\,kilo \cdot gal$ $vol_{tank} = 188089\,ft^3$

vent_rate = 250.000 cfm

$vent_rate_{bb} := .0045 \cdot \left(vol_{tank} - vol_{waste_1}\right) \cdot \frac{1}{day}$

$vent_rate_{bb} = 0.112\,cfm$

$diam_{tank} := 2 \cdot TankInfo_{(fi_1,2)} \cdot ft$ $diam_{tank} = 75.000\,ft$

$ht_{tank} := \frac{vol_{waste}}{TankInfo_{(fi_1,8)} \cdot \frac{gal}{in}}$ estimation Of Waste Depth

$ht_{tank} = \begin{pmatrix} 413.944 \\ 9.592 \times 10^{-11} \\ 351.978 \\ 61.966 \end{pmatrix} in$ estimation Of Waste Depth

$vol_{head} := vol_{tank} - vol_{waste_1}$ $vol_{head} = 3.569 \times 10^4\,ft^3$

Dome-Space Methane Nitrous Oxide And Ammonia Concentrations (Bingham 2000)

$[H_2] = .0022 \cdot \%$ $[CH_4] = 1.4445 \cdot ppm$ $[N2O] = .0010 \cdot \%$ $[NH_3] = 4.29 \cdot ppm$

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Ammonia Diffusion Information (see Rpp5926 R1 - Calculation Of Mass Transport Coefficient H For Soluble Gas AY-102 .mcd (from File "rpp5929_r2_04_NH3CALOutputData0020203.xls"

NH3In :=

C:\..\rpp5926_r2_07_NH3CALOutputData0020203.xls

$k_{2_NH3} := NH3In_1 \cdot \frac{mol}{L \cdot min}$ $\qquad k_{2_NH3} = 1.183 \times 10^{-9} \frac{mol}{L \cdot min}$

$h_{A_NH3} := NH3In_2 \cdot cfm$ $\qquad h_{A_NH3} = 2.038 \times 10^{-2}\, cfm$

$K_H := NH3In_3 \cdot \frac{mol}{L \cdot atm}$ $\qquad K_H = 11.348 \frac{mol}{L \cdot atm}$

$V_m := NH3In_4 \cdot \frac{L}{mol}$ $\qquad V_m = 25.976 \frac{L}{mol}$

$[NH3_{liq}] := NH3In_5 \cdot \frac{mol}{L}$ $\qquad [NH3_{liq}] = 2.072 \times 10^{-5} \frac{mol}{L}$

$P := 1 \cdot atm$

$k_{1_NH3} := \frac{vent_rate_{bb} + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}$ $\qquad k_{1_NH3} = 1.715 \times 10^{-4}\, min^{-1}$

Gas Concentrations At LFL

$LFL_{H2} := 4 \cdot \%$ $\qquad \%LFL_{H2} := \frac{.04}{100}$

$LFL_{NH3} := 15 \cdot \%$ $\qquad \%LFL_{NH3} := \frac{.15}{100}$

$LFL_{CH4} := 5 \cdot \%$ $\qquad \%LFL_{CH4} := \frac{.05}{100}$

End Of Input Data

Calculations

$i := 1..4$

Hydrogen Generation Due To Thermolysis (Hu, 2000 - Eqn 4-8)

Define Constants (Based On Hu (2000) Eqn 4-8)

$a_{thm} := 2.76 \cdot 10^9 \frac{g_mol}{kg \cdot day}$ Thermolysis pre-exponential Factor (Hu, 2000 - Eqn 4-8)

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$E_{thm} = 89.33 \cdot \frac{kilo \cdot J}{g_mol}$ activation Energy (Hu, 2000 - Eqn 4-8)

$R_{const} = 8.3144739 \frac{J}{g_mol \cdot K}$ Gas Constant

$$r_f := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-8)

$r_f = 0.700$

Calculate The Weight Fraction Of Liquid In The Waste

$W_{H2O_i} := vol_{waste_i} \cdot \rho_{waste_i} \cdot F_{H2O_i}$

$$W_{H2O} = \begin{pmatrix} 4.160 \times 10^{6} \\ 5.424 \times 10^{-7} \\ 3.607 \times 10^{6} \\ 3.504 \times 10^{5} \end{pmatrix} kg$$

Check Units On Input Data

$$[TOC] = \begin{pmatrix} 1.769 \times 10^{3} \\ 2.124 \times 10^{3} \\ 1.639 \times 10^{3} \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$([TOC_{wt\%}])_i := \frac{([TOC])_3}{\rho_{waste_3}} \cdot 100$$

$$[TOC_{wt\%}] = \begin{pmatrix} 0.145 \\ 0.145 \\ 0.145 \\ 0.145 \end{pmatrix}$$

$$[Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \times 10^{0} \\ 1.480 \times 10^{3} \\ 100.206 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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$$\left([Al_{wt\%}]\right)_i := \frac{([Al])_3}{Pwaste_3} \cdot 100$$

$$[Al_{wt\%}] = \begin{pmatrix} 0.131 \\ 0.131 \\ 0.131 \\ 0.131 \end{pmatrix}$$

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Calculate The Hydrogen Generation Rate Due To Thermolysis (HGR_{therm})

$$HGR_{therm_scf_i} := \frac{a_{thm}}{\left(\frac{g_mol}{kg \cdot day}\right)} \cdot rf \cdot \left(\left[TOC_{wt\%}\right]\right)_i \cdot \left[\left(\left[Al_{wt\%}\right]\right)_i\right]^4 \cdot e^{-\left[\frac{\frac{E_{thm}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)}\right] \cdot \left(\frac{Temp_{waste_i}}{K}\right)}\right]} \cdot F_{liquid_i} \cdot \frac{g_mol}{kg \cdot day}$$

$$HGR_{therm_i} := HGR_{therm_scf_i}$$

$$HGR_{therm} = \begin{pmatrix} 3.378 \times 10^{-6} \\ 1.644 \times 10^{-6} \\ 2.681 \times 10^{-7} \\ 1.644 \times 10^{-6} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{thermv_i} := HGR_{therm_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right) \cdot \frac{Temp_{vap}}{273.15 \cdot K}$$

$$HGR_{thermv_1} := \sum_{i=2}^{4} HGR_{thermv_i}$$

$$HGR_{thermv} = \begin{pmatrix} 2.412 \\ 2.154 \times 10^{-12} \\ 1.020 \\ 1.391 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv} = \begin{pmatrix} 1.675 \times 10^{-3} \\ 1.496 \times 10^{-15} \\ 7.086 \times 10^{-4} \\ 9.662 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{thermv_scf_i} := HGR_{thermv_i} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 2.080 \\ 1.857 \times 10^{-12} \\ 0.880 \\ 1.200 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.444 \times 10^{-3} \\ 1.290 \times 10^{-15} \\ 6.110 \times 10^{-4} \\ 8.332 \times 10^{-4} \end{pmatrix} cfm$$

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Hydrogen Generation Due To Radiolysis (Hu, 2000 - Eqn 4-16)

Constant Definition (Based On Hu (2000) Eqn 4-16)

$E_{rad} := 44.32 \cdot \frac{kilo \cdot J}{g_mol}$ Activation Energy Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$s_{rad} := 2.49 \cdot 10^{6} \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential Factor Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$$rf := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient Of TOC (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-16)

$G_{H2O_sat} := 0.005 \cdot \frac{molecules}{100 \cdot eV}$ default Water Radiolysis G-value

$$[NO_3] = \begin{vmatrix} 294.845 \times 10^{0} \\ 409.789 \times 10^{0} \end{vmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{3_molar}] := \frac{[NO_3]}{mw_{NO3}}$$

$$[NO_{3_molar}] = \begin{vmatrix} 6.111 \times 10^{-3} \\ 4.755 \times 10^{-3} \\ 6.609 \times 10^{-3} \\ 4.755 \times 10^{-3} \end{vmatrix} \frac{g_mol}{liter}$$

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$$[NO_2] = \begin{pmatrix} 4.431 \times 10^{3} \\ 228.866 \times 10^{0} \\ 5.976 \times 10^{3} \\ 228.866 \times 10^{0} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_{2_molar}] := \frac{[NO_2]}{mw_{NO2}}$$

$$[NO_{2_molar}] = \begin{pmatrix} 0.096 \\ 4.975 \times 10^{-3} \\ 0.130 \\ 4.975 \times 10^{-3} \end{pmatrix} \frac{g_mol}{liter}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 1.385 \times 10^{13} \\ 3.379 \times 10^{-15} \\ 1.073 \times 10^{11} \\ 1.374 \times 10^{13} \end{pmatrix} \mu \cdot Ci$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 2.229 \times 10^{5} \\ 5.440 \times 10^{-23} \\ 1.728 \times 10^{3} \\ 2.212 \times 10^{5} \end{pmatrix} \frac{BTU}{hr}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 6.533 \times 10^{4} \\ 1.594 \times 10^{-23} \\ 506.423 \\ 6.482 \times 10^{4} \end{pmatrix} watt$$

$$H_{load} := \overrightarrow{\left(\frac{HeatLoad_{137Cs_90Sr}}{vol_{waste} \cdot \rho_{waste}} \right)}$$

$$H_{load} = \begin{pmatrix} 0.013 \\ 1.117 \times 10^{-17} \\ 1.221 \times 10^{-4} \\ 0.070 \end{pmatrix} \frac{watt}{kg}$$

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Calculate The Hydrogen Generation Rate Due To Radiolysis (HGR_{rad})

$$G_{org_i} := \frac{a_{rad}}{\left(\frac{molecules}{100 \cdot eV}\right)} \cdot e^{\left[-\left[\frac{\frac{E_{rad}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)} \cdot \frac{Temp_{waste_i}}{K}\right]}\right]\right]} \cdot f_f \cdot \left([TOC_{wt\%}]\right)_i \cdot \frac{molecules}{100 \cdot eV}$$

$$G_{org} = \begin{pmatrix} 0.050 \\ 0.050 \\ 0.013 \\ 0.050 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \overrightarrow{\left[\left[0.45 - 0.56 \cdot \left[\frac{[NO3_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO2_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}}\right] \cdot \frac{molecules}{100 \cdot eV}\right]}$$

$$G_{H2O} = \begin{pmatrix} 0.151 \\ 0.282 \\ 0.127 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O_i} := \begin{cases} G_{H2O_i} & \text{if } G_{H2O_i} > G_{H2O_sat} \\ G_{H2O_sat} & \text{otherwise} \end{cases}$$

$$G_{H2O} = \begin{pmatrix} 0.151 \\ 0.282 \\ 0.127 \\ 0.282 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$HGR_{rad_i} := \left(G_{H2O_i} + G_{org_i}\right) \cdot H_{load_i} \cdot F_{liquid_i} \cdot \frac{g_mol}{6.02 \cdot 10^{23} \cdot molecules}$$

$$HGR_{rad} = \begin{pmatrix} 1.594 \times 10^{-5} \\ 1.149 \times 10^{-20} \\ 1.217 \times 10^{-7} \\ 7.230 \times 10^{-5} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad} = \begin{pmatrix} 2.013 \times 10^{-5} \\ 1.451 \times 10^{-20} \\ 1.538 \times 10^{-7} \\ 9.134 \times 10^{-5} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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$$HGR_{radv} := \overrightarrow{\left[HGR_{rad} \cdot \left(vol_{waste} \cdot \rho_{waste}\right)\right]} \cdot \frac{Temp_{vap}}{273.15 \cdot K}$$

$$HGR_{radv_1} := \sum_{i=2}^{4} HGR_{radv_i}$$

$$HGR_{radv} = \begin{pmatrix} 77.8958 \\ 1.9014 \times 10^{-26} \\ 0.5852 \\ 77.3106 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 0.054 \\ 1.320 \times 10^{-29} \\ 4.064 \times 10^{-4} \\ 0.054 \end{pmatrix} cfm$$

$$HGR_{radv_scf} := HGR_{radv} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{radv_scf} = \begin{pmatrix} 67.171 \\ 1.640 \times 10^{-26} \\ 0.505 \\ 66.667 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_scf} = \begin{pmatrix} 0.047 \\ 1.139 \times 10^{-29} \\ 3.504 \times 10^{-4} \\ 0.046 \end{pmatrix} cfm$$

Hydrogen Generation Due To Corrosion (Hu, 2000 - Eqn 4-17)

Constant Definition (Based On Hu (2000) Eqn 4-17)

$$R_{corr} := \begin{cases} 3.6 \cdot 10^{-8} \cdot \frac{m^3}{m^2 \cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 3.6 \cdot 10^{-8} \cdot \frac{m^3}{m^2 \cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 1.83 \cdot 10^{-8} \cdot \frac{m^3}{m^2 \cdot min} & \text{otherwise} \end{cases}$$

Corrosion Coefficient (1.83E-08 For DSTs, 3.6E-08 For SSts) ($m^3/min/m^2$) Reference Temperature Is 25°C (Hu, 2001B - Eqn 2-1)

$$R_{corr} = 1.830 \times 10^{-8} \frac{m^3}{m^2 \cdot min}$$

Calculate The Wetted Area Of Steel (vertical Waste Storage Tank, Assuming A Flat Bottom)

$$\left[\pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank}\right] = \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank}$$

$$Awet_1 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_1}$$

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$$Awet_2 := \pi \cdot diam_{tank} \cdot ht_{tank_2}$$

$$Awet_3 := \pi \cdot diam_{tank} \cdot ht_{tank_3}$$

$$Awet_4 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_4}$$

$$Awet = \begin{pmatrix} 1.255 \times 10^4 \\ 1.883 \times 10^{-9} \\ 6.911 \times 10^3 \\ 5.635 \times 10^3 \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due To Corrosion

$$HGR_{corr_mol} := \overrightarrow{\frac{R_{corr} \cdot Awet}{(vol_{waste} \cdot \rho_{waste})}} \cdot \frac{273.15 \cdot K}{298.15 \cdot K} \qquad HGR_{corr_mol_i} = \begin{pmatrix} 2.404 \times 10^{-7} \\ 1.320 \times 10^{-7} \\ 1.668 \times 10^{-7} \\ 6.114 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{corr} := \overline{\left[HGR_{corr_mol} \cdot (vol_{waste} \cdot \rho_{waste}) \cdot \frac{Temp_{vap}}{273.15 \cdot K}\right]}$$

$$HGR_{corr} = \begin{pmatrix} 8.003 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 4.408 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr} = \begin{pmatrix} 1.152 \\ 1.730 \times 10^{-13} \\ 0.635 \\ 0.518 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_scf} := HGR_{corr} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{corr_scf} = \begin{pmatrix} 6.901 \times 10^{-4} \\ 1.036 \times 10^{-16} \\ 3.801 \times 10^{-4} \\ 3.099 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr_scf} = \begin{pmatrix} 0.994 \\ 1.492 \times 10^{-13} \\ 0.547 \\ 0.446 \end{pmatrix} \frac{ft^3}{day}$$

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Total Hydrogen Generation Rate

$$mass_{waste} = \begin{pmatrix} 5.221 \times 10^{6} \\ 1.427 \times 10^{-6} \\ 4.146 \times 10^{6} \\ 9.221 \times 10^{5} \end{pmatrix} kg$$

$$HGR_{thermv} = \begin{pmatrix} 2.412 \\ 2.154 \times 10^{-12} \\ 1.020 \\ 1.391 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 77.896 \\ 1.901 \times 10^{-26} \\ 0.585 \\ 77.311 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr} = \begin{pmatrix} 1.152 \\ 1.730 \times 10^{-13} \\ 0.635 \\ 0.518 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR := \overrightarrow{\left(HGR_{thermv} + HGR_{radv} + HGR_{corr}\right)}$$

$$HGR = \begin{pmatrix} 0.05657 \\ 1.61582 \times 10^{-15} \\ 1.55582 \times 10^{-3} \\ 0.05501 \end{pmatrix} cfm$$

$$HGR = \begin{pmatrix} 2.307 \times 10^{3} \\ 6.589 \times 10^{-11} \\ 63.441 \\ 2.243 \times 10^{3} \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

$$HGR_{stp} := HGR \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

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$$HGR_{stp} = \begin{pmatrix} 0.049 \\ 1.393 \times 10^{-15} \\ 1.342 \times 10^{-3} \\ 0.047 \end{pmatrix} cfm$$

$$HGR_{stp} = \begin{pmatrix} 70.245 \\ 2.006 \times 10^{-12} \\ 1.932 \\ 68.313 \end{pmatrix} \frac{ft^3}{day}$$

At Standard Conditions...

Steady-State Hydrogen Concentration (Assuming Normal Ventilation Rate)

$$[H2_{ss}] := \frac{HGR_1}{HGR_1 + vent_rate}$$

$[H2_{ss}] = 226.226\ ppmv$

$[H2_{ss}] = 0.023\ \%$

Steady-State Hydrogen Concentration (Assuming Barometric Breathing Ventilation Rate)

$$[H2_{ss_bb}] := \frac{HGR_1}{HGR_1 + vent_rate_{bb}}$$

$[H2_{ss_bb}] = 3.365 \times 10^5\ ppmv$

$[H2_{ss_bb}] = 33.650\ \%$

$[H2_{ss_bb}] = 841.260\ \%LFL_{H2}$

Gas Release Rate (Independent Of Ventilation Rate)

$$rate_{H2_rel} := [H2_{ss}] \cdot \frac{vent_rate}{1 - [H2_{ss}]}$$

$rate_{H2_rel} = 0.0566\ cfm$

$$rate_{H2_rel_bb} := [H2_{ss_bb}] \cdot \frac{vent_rate_{bb}}{1 - [H2_{ss_bb}]}$$

$rate_{H2_rel_bb} = 0.057\ cfm$

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Calculate Generation Rates Of Ammonia, Methane, And Nitrous Oxide (Assuming No Gas Retention)

$$GR_{NH3} := \frac{[NH_3] \cdot vent_rate}{1 - [NH_3]} \qquad GR_{NH3} = 1.07250 \times 10^{-3}\ cfm$$

$$GR_{CH4} := \frac{[CH_4] \cdot vent_rate}{1 - [CH_4]} \qquad GR_{CH4} = 3.611 \times 10^{-4}\ cfm$$

$$GR_{N2O} := \frac{[N2O] \cdot vent_rate}{1 - [N2O]} \qquad GR_{N2O} = 2.500 \times 10^{-3}\ cfm$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Normal Ventilation Rate)(Just A Check Of Methodology)

$$[NH3_{ss}] := \frac{GR_{NH3}}{GR_{NH3} + vent_rate} \qquad [NH3_{ss}] = 4.290 \times 10^{-4}\%$$

$$[CH4_{ss}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate} \qquad [CH4_{ss}] = 1.444 \times 10^{-4}\%$$

$$[N2O_{ss}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate} \qquad [N2O_{ss}] = 1.000 \times 10^{-3}\%$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Barometric Breathing Ventilation Rate)

$$NH3_1000_day := \left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1 \cdot \frac{k1_NH3}{\frac{1}{day}} \cdot 1000\right)\right] \cdot V_m$$

$$NH3_1000_day = 179.289\ ppm$$

$$[NH3_{ss_bb}] := NH3_1000_day \qquad [NH3_{ss_bb}] = 0.018\%$$

$$[NH3_{ss_bb}] = 0.120\%LFL_{NH3}$$

$$[CH4_{ss_bb}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate_{bb}} \qquad [CH4_{ss_bb}] = 0.323\%$$

$$[CH4_{ss_bb}] = 6.454\%LFL_{CH4}$$

$$[N2O_{ss_bb}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate_{bb}} \qquad [N2O_{ss_bb}] = 2.192\%$$

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Determine The Overall Steady-State Flammable Gas Concentration With Loss Of Ventilation

$$[Conc_mix_{ss_bb}] := \frac{[H2_{ss_bb}]}{LFL_{H2}} + \frac{[NH3_{ss_bb}]}{LFL_{NH3}} + \frac{[CH4_{ss_bb}]}{LFL_{CH4}}$$

$$[Conc_mix_{ss_bb}] = 847.834\%LFL$$

Set Variables Into Array, Where 1 => H2, 2 => NH3, 3 => CH4, And 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} 0.057 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Generation Rate

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} 0.057 \\ 1.073 \times 10^{-3} \\ 3.611 \times 10^{-4} \\ 2.500 \times 10^{-3} \end{pmatrix} cfm$$

Release Rate (Assume No Retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss}] \\ [NH3_{ss}] \\ [CH4_{ss}] \\ [N2O_{ss}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 0.023 \\ 4.290 \times 10^{-4} \\ 1.444 \times 10^{-4} \\ 1.000 \times 10^{-3} \end{pmatrix} \%$$

Initial Concentration Rate (Assume At Steady-State With Normal Ops)

Calculate The Composition Of All Components At Time 't'

Special Calculation For Ammonia (Soluble Gas)

$$\lambda_i := \frac{vent_rate_{bb} + Rate_{rel_i}}{vol_{head}}$$

$$Conc_{in_i} := \frac{Rate_{rel_i} \cdot 100\%}{Rate_{rel_i} + vent_rate_{bb}}$$

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$$conc(t,i) := \begin{cases} Conc_{in_i}\left[1 - e^{\left(-\lambda_i \cdot t\right)}\right] + Conc_{init_i}\left[e^{\left(-\lambda_i \cdot t\right)}\right] & \text{if } i < 2 \\ Conc_{in_i}\left[1 - e^{\left(-\lambda_i \cdot t\right)}\right] + Conc_{init_i}\left[e^{\left(-\lambda_i \cdot t\right)}\right] & \text{if } i > 2 \\ \left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1 \cdot \frac{k1_NH3}{\frac{1}{day}} \cdot \frac{t}{day}\right)\right] \cdot V_m & \text{otherwise} \end{cases}$$

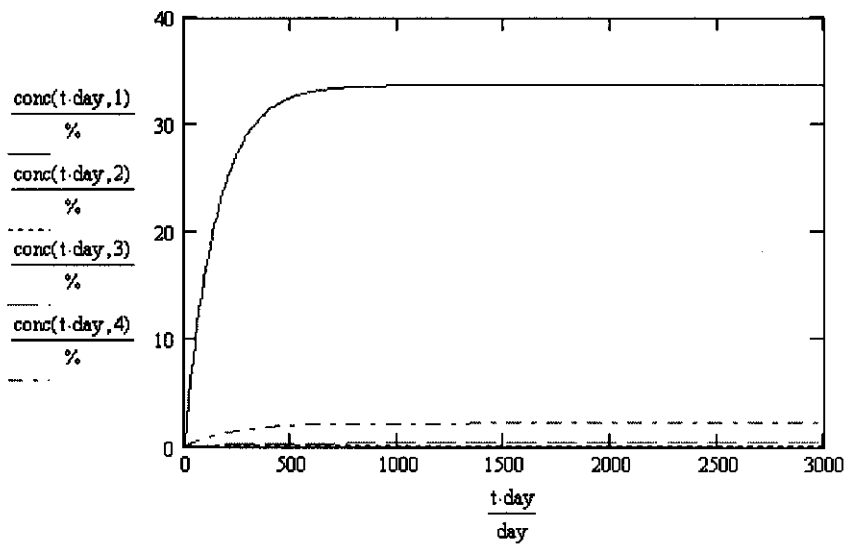
$conc(0 \cdot sec,1) = 0.023\%$ $\quad conc(1000 \cdot day,1) = 33.612\%$ $\quad conc(1000 \cdot day,1) = 840.307\%LFL_{H2}$

$conc(0 \cdot sec,2) = 4.290 \times 10^{-4}\%$ $\quad conc(1000 \cdot day,2) = 0.018\%$ $\quad conc(1000 \cdot day,2) = 0.120\%LFL_{NH3}$

$conc(0 \cdot sec,3) = 1.444 \times 10^{-4}\%$ $\quad conc(1000 \cdot day,3) = 0.319\%$ $\quad conc(1000 \cdot day,3) = 6.384\%LFL_{CH4}$

$conc(0 \cdot sec,4) = 1.000 \times 10^{-3}\%$ $\quad conc(1000 \cdot day,4) = 2.170\%$

$t := 0, 10 .. 3000$



Calculate Steady-State Flammable Gas Concentration At Normal Operating Conditions

$$LFL_{mix}(z) := \frac{1}{\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}}$$

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$LFL_{mix}(0 \cdot day) = 1.750 \times 10^{4}\%$

$LFL_{mix}(100 \cdot day) = 23.977\%$

Calculate The Time To Reach Various Fractions Of The LFL

Time To Reach 25 %LFL

TOL := .00001

$$f(z, tlfl) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - tlfl$$

tlfl := 25

z := 10·day Initial Guess

temp25 := −5·day Initial Value In Case Solution Cannot Be Found

temp25 := Re(root(f(z, tlfl), z))

temp25 = 4.312 day

$Time_{1_25\%LFL} := if\left([Conc_mix_{ss_bb}] > 25\%, if\left(temp_{25} < 0 \cdot day, 0 \cdot day, temp_{25}\right), 10^{9} \cdot day\right)$

$Time_{1_25\%LFL} = 4.312\ day$

Time To Reach 50 %LFL

tlfl := 50

z := 10·day Initial Guess

temp50 := −5·day Initial Value In Case Solution Cannot Be Found

temp50 := Re(root(f(z, tlfl), z))

temp50 = 8.868 day

$Time_{1_50\%LFL} := if\left([Conc_mix_{ss_bb}] > 50\%, if\left(temp_{50} < 0 \cdot day, 0 \cdot day, temp_{50}\right), 10^{9} \cdot day\right)$

$Time_{1_50\%LFL} = 8.868\ day$

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Time To Reach 75 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 75$$

$z := 10 \cdot day$ Initial Guess

$temp_{75} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := Re(root(f(z), z))$

$temp_{75} = 13.572\ day$

$Time_{1_75\%LFL} := if\left([Conc_mix_{ss_bb}] > 75\%, if\left(temp_{75} < 0 \cdot day, 0 \cdot day, temp_{75}\right), 10^9 \cdot day\right)$

$Time_{1_75\%LFL} = 13.572\ day$

Time To Reach 100 %LFL

$$f(z) := \frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 100$$

$z := 10 \cdot day$ Initial Guess

$temp_{100} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := Re(root(f(z), z))$

$temp_{100} = 18.433\ day$

$Time_{1_100\%LFL} := if\left([Conc_mix_{ss_bb}] > 100\%, if\left(temp_{100} < 0 \cdot day, 0 \cdot day, temp_{100}\right), 10^9 \cdot day\right)$

$Time_{1_100\%LFL} = 18.433\ day$

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Minimum Ventilation Rates Need To Prevent Headspace Concentrations From Reaching Various Levels

$$Conc_vr(V,i) := \begin{cases} \dfrac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right] & \text{if } i<2 \\ \dfrac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right] & \text{if } i>2 \\ \left[\dfrac{k2_NH3}{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{vol_{head}}}+\left(\dfrac{[NH3_{ss}]}{V_m}-\dfrac{k2_NH3}{k1_NH3}\right)\exp\left[-1\cdot\dfrac{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{vol_{head}}}{\frac{1}{day}}\cdot 10^9\right]\right]\cdot V_m & \text{otherwise} \end{cases}$$

Ventilation Rate To Keep Concentration Less Than 25 %LFL

$$f2_25(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL}-24.999$$

$z := .001\cdot cfm$ Initial Guess

$temp_{25} := -5\cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{25} := root(f2_25(z),z)$

$temp_{25} = 5.644076\ cfm$

$vent_rate_{1_25\%LFL} := if(temp_{25} < 0\cdot cfm, 0\cdot cfm, temp_{25}+0.001\cdot cfm)$

$vent_rate_{1_25\%LFL} = 5.645\ cfm$

Ventilation Rate To Keep Concentration Less Than 50 %LFL

$$f2_50(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL}-49.999$$

$z := .001\cdot cfm$ Initial Guess

$temp_{50} := -5\cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := root(f2_50(z),z)$

$temp_{50} = 2.791426\ cfm$

$vent_rate_{1_50\%LFL} := if(temp_{50} < 0\cdot cfm, 0\cdot cfm, temp_{50}+0.001\cdot cfm)$

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$vent_rate_{1_50\%LFL} = 2.792\ cfm$

Ventilation Rate To Keep Concentration Less Than 75 %LFL

$$f2_75(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 74.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{75} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := root(f2_75(z), z)$

$temp_{75} = 1.841383\ cfm$

$vent_rate_{1_75\%LFL} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, temp_{75} + 0.001 \cdot cfm)$

$vent_rate_{1_75\%LFL} = 1.842\ cfm$

Ventilation Rate To Keep Concentration Less Than 100 %LFL

$$f2_100(z) := \frac{\left(\frac{Conc_vr(z,1)}{LFL_{H2}} + \frac{Conc_vr(z,2)}{LFL_{NH3}} + \frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}{\%LFL} - 99.999$$

$z := .001 \cdot cfm$ Initial Guess

$temp_{1000} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := root(f2_100(z), z)$

$temp_{100} = 1.366605\ cfm$

$vent_rate_{1_100\%LFL} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, temp_{100} + 0.001 \cdot cfm)$

$vent_rate_{1_100\%LFL} = 1.368\ cfm$

Additional Calculations -- Estimated Time To LFL With Zero Ventilation

Tank Headspace Hydrogen Concentration :

$vent_rate_{zb} := 1 \cdot 10^{-6} \cdot cfm$

$\%H_{2lim} := 100 \cdot [H2_{ss_bb}]$ $\%H_{2lim} = 33.650$ volume % Hydrogen

$\%LFL_{lim} := 100 \cdot [H2_{ss_bb}] \cdot \frac{100}{4}$ $\%LFL_{lim} = 841.260$ % LFL Based On Hydrogen

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Final H2 Concentration To Meet 25% (NH3 And CH4 Included) Estimate Gas Concentrations At Final Conditions:

$$H2_25\% := 0.0004\cdot\left(25 - \frac{conc(23.2\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(23.2\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_25\% = 0.969\,\%$$

Final H2 Concentration To Meet 50% (NH3 And CH4 Included):

$$H2_50\% := 0.0004\cdot\left(50 - \frac{conc(50\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(50\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_50\% = 1.943\,\%$$

Final H2 Concentration To Meet 100% (NH3 And CH4 Included):

$$H2_100\% := 0.0004\cdot\left(100 - \frac{conc(117\cdot day,2)}{\%LFL_{NH3}} - \frac{conc(117\cdot day,3)}{\%LFL_{CH4}}\right) \qquad H2_100\% = 3.889\,\%$$

Maximum %LFL With Loss Of Ventilation (Assume Gas Conc. ~ Equal To Barometric Breathing At 100% LFL :

$$LFL_{nat_breathing} := \frac{HGR_1}{\left(HGR_1 + vent_rate_{bb}\right)\cdot .04} + \frac{[NH3_{ss_bb}]}{\%LFL_{NH3}\cdot 100} + \frac{[CH4_{ss_bb}]}{\%LFL_{CH4}\cdot 100} \qquad LFL_{nat_breathing} = 847.834\,\%$$

Time To Reach 25% LFL With Zero Ventilation:

$$tempz_{25} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot \ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_25\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{25} = 4.211\ day$$

$$Time_zb2_25\%LFL := if\left(LFL_{nat_breathing} > 25\%, if\left(tempz_{25} < 0\cdot day, 0\cdot day, tempz_{25}\right), 999999999\cdot day\right)$$

$$Time_zb2_25\%LFL = 4.169\ day$$

Time To Reach 50% LFL With Zero Ventilation:

$$tempz_{50} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot \ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_50\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{50} = 8.670\ day$$

$$Time_zb2_50\%LFL := if\left(LFL_{nat_breathing} > 50\%, if\left(tempz_{50} < 0\cdot day, 0\cdot day, tempz_{50}\right), 999999999\cdot day\right)$$

$$Time_zb2_50\%LFL = 8.498\ day$$

Time To Reach 100% LFL With Zero Ventilation:

$$tempz_{100} := \frac{-vol_{head}}{\left(HGR_1 + vent_rate_{zb}\right)}\cdot \ln\left[\frac{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_100\%}{HGR_1 - \left(HGR_1 + vent_rate_{zb}\right)\cdot H2_init}\right] \qquad temp2_{100} = 18.010\ day$$

$$Time_zb2_100\%LFL := if\left(LFL_{nat_breathing} > 100\%, if\left(tempz_{100} < 0\cdot day, 0\cdot day, tempz_{100}\right), 999999999\cdot day\right)$$

$$Time_zb2_100\%LFL = 17.282\ day$$

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Summary Section

Input Data

Waste Properties (1 ==> Total Waste, 2 ==> Liquid Waste, 3 ==> Solid Waste)

Tank_id = "241-AY-102" $class_{waste}$ = "dst"

$$[TOC] = \begin{pmatrix} 1.769 \times 10^{3} \\ 2.124 \times 10^{3} \\ 1.639 \times 10^{3} \\ 2.124 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 378.889 \\ 294.845 \\ 409.789 \\ 294.845 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 4.431 \times 10^{3} \\ 228.866 \\ 5.976 \times 10^{3} \\ 228.866 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[Al] = \begin{pmatrix} 1.109 \times 10^{3} \\ 100.206 \\ 1.480 \times 10^{3} \\ 100.206 \end{pmatrix} \frac{\mu \cdot gm}{mL} \qquad [137Cs] = \begin{pmatrix} 74.771 \\ 1.000 \times 10^{-12} \\ 27.904 \\ 175.680 \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 1.818 \times 10^{3} \\ 1.000 \times 10^{-12} \\ 1.551 \\ 5.729 \times 10^{3} \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 1.140 \times 10^{3} \\ 2.642 \times 10^{-10} \\ 969.345 \\ 170.655 \end{pmatrix} kilo \cdot gal \qquad \rho_{waste} = \begin{pmatrix} 1.210 \\ 1.427 \\ 1.130 \\ 1.427 \end{pmatrix} \frac{gm}{mL} \qquad Temp_{waste} = \begin{pmatrix} 345.150 \\ 345.150 \\ 318.150 \\ 345.150 \end{pmatrix} K$$

$$F_{H2O} = \begin{pmatrix} 79.665 \\ 38.000 \\ 87.000 \\ 38.000 \end{pmatrix} \% \qquad HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 6.533 \times 10^{4} \\ 1.594 \times 10^{-23} \\ 506.423 \\ 6.482 \times 10^{4} \end{pmatrix} watt \qquad Temp_{vap} = 316.761\,K$$

$vol_{tank} = 1.407 \times 10^{3}$ kilo·gal vent_rate = 250.000 cfm $vent_rate_{bb} = 0.112$ cfm

AN Tank Farm: Tank Data

$diam_{tank} = 75.000$ ft $$ht_{tank} = \begin{pmatrix} 413.944 \\ 9.592 \times 10^{-11} \\ 351.978 \\ 61.966 \end{pmatrix} in$$ estimation Of Waste Depth

Dome-Space Compositions

$[CH_4] = 1.444 \times 10^{-4}\%$ $[N2O] = 1.000 \times 10^{-3}\%$ $[NH_3] = 4.290 \times 10^{-4}\%$

End Of Input Data

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Output Data

Waste Properties (1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

Hydrogen Generation Rate Due To Thermolysis, Radiolysis, And Corrosion...

$$HGR_{thermv} = \begin{pmatrix} 1.675 \times 10^{-3} \\ 1.496 \times 10^{-15} \\ 7.086 \times 10^{-4} \\ 9.662 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv} = \begin{pmatrix} 0.054 \\ 1.320 \times 10^{-29} \\ 4.064 \times 10^{-4} \\ 0.054 \end{pmatrix} cfm \qquad HGR_{corr} = \begin{pmatrix} 8.003 \times 10^{-4} \\ 1.201 \times 10^{-16} \\ 4.408 \times 10^{-4} \\ 3.594 \times 10^{-4} \end{pmatrix} cfm$$

Overall Hydrogen Generation Rate...

at The Headspace Conditions...

$$HGR = \begin{pmatrix} 0.057 \\ 1.616 \times 10^{-15} \\ 1.556 \times 10^{-3} \\ 0.055 \end{pmatrix} cfm \qquad HGR = \begin{pmatrix} 81.460 \\ 2.327 \times 10^{-12} \\ 2.240 \\ 79.220 \end{pmatrix} \frac{ft^3}{day}$$

at Standard Conditions (273°K)...

$$HGR_{stp} = \begin{pmatrix} 0.049 \\ 1.393 \times 10^{-15} \\ 1.342 \times 10^{-3} \\ 0.047 \end{pmatrix} cfm \qquad HGR_{stp} = \begin{pmatrix} 70.245 \\ 2.006 \times 10^{-12} \\ 1.932 \\ 68.313 \end{pmatrix} \frac{ft^3}{day}$$

Steady-State Compositions

Hydrogen At Normal Ventilation Rate...

$[H2_{ss}] = 0.566\,\%LFL_{H2}$

At Barometric Breathing Ventilation Rate

$[H2_{ss_bb}] = 841.260\,\%LFL_{H2}$

Ammonia At Normal Ventilation Rate...

$[NH3_{ss}] = 2.860 \times 10^{-3}\,\%LFL_{NH3}$

At Barometric Breathing Ventilation Rate

$[NH3_{ss_bb}] = 0.120\,\%LFL_{NH3}$

Methane At Normal Ventilation Rate...

$[CH4_{ss}] = 2.889 \times 10^{-3}\,\%LFL_{CH4}$

At Barometric Breathing Ventilation Rate

$[CH4_{ss_bb}] = 6.454\,\%LFL_{CH4}$

Nitrous Oxide At Normal Ventilation Rate...

$[N2O_{ss}] = 1.000 \times 10^{-3}\,\%$

At Barometric Breathing Ventilation Rate

$[N2O_{ss_bb}] = 2.192\,\%$

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Flammable Gas Concentrations After Loss Of Ventilation At Selected Time Periods

$conc_{mix}(0 \cdot day) = 0.571\,\%LFL$ $conc_{mix}(10 \cdot day) = 56.090\,\%LFL$

$conc_{mix}(100 \cdot day) = 417.060\,\%LFL$ $conc_{mix}(10^9 \cdot day) = 847.834\,\%LFL$

Time To Reach Various LFL Levels At Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_{1_25\%LFL} = 4.312$ day $Time_{1_75\%LFL} = 13.572$ day

$Time_{1_50\%LFL} = 8.868$ day $Time_{1_100\%LFL} = 18.433$ day

Time To Reach Various LFL Levels At Zero Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

$Time_zb_{2_25\%LFL} = 4.169$ day

$Time_zb_{2_50\%LFL} = 8.498$ day $Time_zb_{2_100\%LFL} = 17.282$ day

Minimum Ventilation Rates To Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL} = 5.645$ cfm $vent_rate_{1_75\%LFL} = 1.842$ cfm

$vent_rate_{1_50\%LFL} = 2.792$ cfm $vent_rate_{1_100\%LFL} = 1.368$ cfm

Gas Concentrations At Time To Reach 25% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{25}] = 0.992\,\%$	$[H2_{25}] = 24.793\,\%LFL_{H2}$
NH3	$[NH3_{25}] = 0.012\,\%$	$[NH3_{25}] = 0.079\,\%LFL_{NH3}$
CH4	$[CH4_{25}] = 6.363 \times 10^{-3}\,\%$	$[CH4_{25}] = 0.127\,\%LFL_{CH4}$

Gas Concentrations At Time To Reach 50% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{50}] = 1.985\,\%$	$[H2_{50}] = 49.637\,\%LFL_{H2}$
NH3	$[NH3_{50}] = 0.016\,\%$	$[NH3_{50}] = 0.106\,\%LFL_{NH3}$
CH4	$[CH4_{50}] = 0.013\,\%$	$[CH4_{50}] = 0.256\,\%LFL_{CH4}$

Gas Concentrations At Time To Reach 100% LFL After Loss Of Ventilation (Values = 1.000x10⁹ Indicates Condition Does Not Occur)

H2	$[H2_{100}] = 3.975\,\%$	$[H2_{100}] = 99.364\,\%LFL_{H2}$
NH3	$[NH3_{100}] = 0.018\,\%$	$[NH3_{100}] = 0.118\,\%LFL_{NH3}$
CH4	$[CH4_{100}] = 0.026\,\%$	$[CH4_{100}] = 0.518\,\%LFL_{CH4}$

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G.10. RPP-5926 Rev. 2: 10 Hydrogen Generation Rate Calculations -- Monte Carlo Calculation – Calculation Note RPP-5926, Revision 2 Tank 241-AN-104

CH2MHILL
Hanford Group, Inc.

SA Barker

Hydrogen Generation Rate Calculations

Monte Carlo Analysis - 241-AN-104

This Calculation Allows The User To Assign Uncertainty Information And Perform A Monte Carlo Analysis To Determine Uncertainty Bound For An Answer.

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Read Waste Information From "FGS Input 020203 .xls"

excel :=

C:\..\FGS Input 020203 mc.xls

Datafile Name Is "FGS Input 020203 mc .xls"

excel =

	1	2	3	4	5	6	7
1	1.000	2.000	3.000	4.000	5.000	6.000	7.000
2	0.000	0.000	0.000	0.000	0.000	0.000	0.000
3	0.000	$1.166 \cdot 10^3$	116.578	$4.160 \cdot 10^4$	$4.160 \cdot 10^3$	$7.305 \cdot 10^4$	$7.305 \cdot 10^3$
4	0.000	$1.166 \cdot 10^3$	116.578	$4.160 \cdot 10^4$	$4.160 \cdot 10^3$	$7.305 \cdot 10^4$	$7.305 \cdot 10^3$
5	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6	0.000	$2.581 \cdot 10^4$	$2.581 \cdot 10^3$	$9.444 \cdot 10^4$	$9.444 \cdot 10^3$	$2.368 \cdot 10^5$	$2.368 \cdot 10^4$
7	0.000	$2.581 \cdot 10^4$	$2.581 \cdot 10^3$	$9.444 \cdot 10^4$	$9.444 \cdot 10^3$	$2.368 \cdot 10^5$	$2.368 \cdot 10^4$
8	0.000	$2.581 \cdot 10^4$	$2.581 \cdot 10^3$	$9.444 \cdot 10^4$	$9.444 \cdot 10^3$	$2.368 \cdot 10^5$	$2.368 \cdot 10^4$
9	0.000	$2.597 \cdot 10^3$	259.692	$1.641 \cdot 10^5$	$1.641 \cdot 10^4$	$1.673 \cdot 10^5$	$1.673 \cdot 10^4$
10	0.000	$2.597 \cdot 10^3$	259.692	$1.641 \cdot 10^5$	$1.641 \cdot 10^4$	$1.673 \cdot 10^5$	$1.673 \cdot 10^4$
11	0.000	$2.597 \cdot 10^3$	259.692	$1.641 \cdot 10^5$	$1.641 \cdot 10^4$	$1.673 \cdot 10^5$	$1.673 \cdot 10^4$
12	0.000	$3.140 \cdot 10^3$	313.970	$1.123 \cdot 10^5$	$1.123 \cdot 10^4$	$1.719 \cdot 10^5$	$1.719 \cdot 10^4$
13	0.000	$3.140 \cdot 10^3$	313.970	$1.123 \cdot 10^5$	$1.123 \cdot 10^4$	$1.719 \cdot 10^5$	$1.719 \cdot 10^4$
14	0.000	$3.140 \cdot 10^3$	313.970	$1.123 \cdot 10^5$	$1.123 \cdot 10^4$	$1.719 \cdot 10^5$	$1.719 \cdot 10^4$
15	0.000	$3.556 \cdot 10^3$	355.629	$1.209 \cdot 10^5$	$1.209 \cdot 10^4$	$1.616 \cdot 10^5$	$1.616 \cdot 10^4$
16	0.000	$3.556 \cdot 10^3$	355.629	$1.209 \cdot 10^5$	$1.209 \cdot 10^4$	$1.616 \cdot 10^5$	$1.616 \cdot 10^4$

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Input Data

Waste Properties
(1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

Tank_id := "241-AN-104" TFI1 := search(Tank_id,"-" ,1) TFI1 = 3.000

TankFarm := substr(Tank_id,TFI1 + 1,2) TankFarm = "AN"

TankNames3 := stack(TankNames1,TankNames2)

j1 := 1 .. 177

$na1_{j1} := j1$

vent_rate := 100·cfm From (Bingham 2000)

Set Monte Carlo Sampling Parameters:

NSamples := 500 number Of Individual Samples To Collect

SSize := 100 number Of Data Points In Each Sample

Find The Appropriate Tank Specific Information:

fi1 := FindIndex(TankNames3,Tank_id)

$$fi1 = \begin{pmatrix} 4.000 \\ 1.000 \end{pmatrix}$$

$tank_{idxT} := \left[\left(fi1_1 - 1\right)\cdot 3\right] + 3$ $tank_{idxT} = 12.000$

$tank_{idxL} := tank_{idxT} + 1$

$tank_{idxS} := tank_{idxT} + 2$

$class_{waste} := if\left[\left(fi1_1 < 29\right), "dst", "sst"\right]$

$class_{waste} = "dst"$ $Ci := 1.61\cdot 10^{-2}\cdot \frac{BTU}{hr}$

..The Following Data Is From Hu 2002, Except Where Noted

For The Following Parameters Use Liquid Data Only...

$[TOC_m] := excel_{tank_{idxL},2}\cdot \frac{\mu\cdot gm}{mL}$ $[TOC_m] = 3.140\times 10^{3}\ \frac{\mu\cdot gm}{mL}$

$[TOC_{sd}] := excel_{tank_{idxL},3}\cdot \frac{\mu\cdot gm}{mL}$ $[TOC_{sd}] = 3.140\times 10^{2}\ \frac{\mu\cdot gm}{mL}$

$[NO2_m] := excel_{tank_{idxL},4}\cdot \frac{\mu\cdot gm}{mL}$ $[NO2_m] = 1.123\times 10^{5}\ \frac{\mu\cdot gm}{mL}$

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$[NO2_sd] := excel_{tank_{idxL},5} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [NO2_sd] = 1.123 \times 10^{4} \frac{\mu \cdot gm}{mL}$

$[NO3_m] := excel_{tank_{idxL},6} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [NO3_m] = 1.719 \times 10^{5} \frac{\mu \cdot gm}{mL}$

$[NO3_sd] := excel_{tank_{idxL},7} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [NO3_sd] = 1.719 \times 10^{4} \frac{\mu \cdot gm}{mL}$

$[Al_m] := excel_{tank_{idxL},8} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [Al_m] = 3.898 \times 10^{4} \frac{\mu \cdot gm}{mL}$

$[Al_{sd}] := excel_{tank_{idxL},9} \cdot \frac{\mu \cdot gm}{mL}$ $\quad [Al_{sd}] = 3.898 \times 10^{3} \frac{\mu \cdot gm}{mL}$

For The Following Parameters Use Layer Specific Data...

$$[90Sr_m] := \begin{pmatrix} excel_{tank_{idxT},10} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},10} \\ excel_{tank_{idxS},10} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr_m] = \begin{pmatrix} 15.096 \\ 1.000 \times 10^{-12} \\ 0.062 \\ 31.297 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[90Sr_{sd}] := \begin{pmatrix} excel_{tank_{idxT},11} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},11} \\ excel_{tank_{idxS},11} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr_{sd}] = \begin{pmatrix} 1.510 \\ 1.000 \times 10^{-12} \\ 6.231 \times 10^{-3} \\ 3.130 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[137Cs_m] := \begin{pmatrix} excel_{tank_{idxT},12} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},12} \\ excel_{tank_{idxS},12} \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs_m] = \begin{pmatrix} 351.079 \\ 1.000 \times 10^{-12} \\ 374.528 \\ 325.809 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[137Cs_{sd}] := \begin{pmatrix} excel_{tank_{idxT},13} \\ 1 \cdot 10^{-12} \\ excel_{tank_{idxL},13} \\ excel_{tank_{idxS},13} \end{pmatrix} \frac{\mu \cdot Ci}{gm} \qquad [137Cs_{sd}] = \begin{pmatrix} 35.108 \\ 1.000 \times 10^{-12} \\ 37.453 \\ 32.581 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

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$$\rho_{waste_m} := \begin{pmatrix} excel_{tank_{idxT},14} \\ excel_{tank_{idxL},14} \cdot 0.95 \\ excel_{tank_{idxL},14} \\ excel_{tank_{idxS},14} \end{pmatrix} \cdot \frac{gm}{mL} \quad \rho_{waste_m} = \begin{pmatrix} 1.483 \\ 1.339 \\ 1.410 \\ 1.579 \end{pmatrix} \frac{gm}{mL}$$

$$\rho_{waste_sd} := \begin{pmatrix} excel_{tank_{idxT},15} \\ excel_{tank_{idxS},15} \\ excel_{tank_{idxL},15} \\ excel_{tank_{idxS},15} \end{pmatrix} \cdot \frac{gm}{mL} \quad \rho_{waste_sd} = \begin{pmatrix} 0.050 \\ 0.050 \\ 0.054 \\ 0.050 \end{pmatrix} \frac{gm}{mL}$$

$$vol_{waste_m} := \begin{pmatrix} excel_{tank_{idxT},16} \\ 1 \cdot 10^{-9} \\ excel_{tank_{idxL},16} \\ excel_{tank_{idxS},16} \end{pmatrix} \cdot kilo \cdot L \quad vol_{waste_m} = \begin{pmatrix} 3819 \\ 0 \\ 2083 \\ 1736 \end{pmatrix} kilo \cdot L$$

$$vol_{waste_sd} := \begin{pmatrix} excel_{tank_{idxT},17} \\ 1 \cdot 10^{-10} \\ excel_{tank_{idxL},17} \\ excel_{tank_{idxS},17} \end{pmatrix} \cdot kilo \cdot L \quad vol_{waste_sd} = \begin{pmatrix} 161 \\ 0 \\ 162 \\ 171 \end{pmatrix} kilo \cdot L$$

$$F_{H2O_m} := \begin{pmatrix} excel_{tank_{idxT},18} \\ excel_{tank_{idxS},18} \\ excel_{tank_{idxL},18} \\ excel_{tank_{idxS},18} \end{pmatrix} \quad F_{H2O_m} = \begin{pmatrix} 48.6 \\ 45.8 \\ 50.9 \\ 45.8 \end{pmatrix} \%$$

$$F_{H2O_sd} := \begin{pmatrix} excel_{tank_{idxT},19} \\ excel_{tank_{idxS},19} \\ excel_{tank_{idxL},19} \\ excel_{tank_{idxS},19} \end{pmatrix} \quad F_{H2O_sd} = \begin{pmatrix} 4.9 \\ 4.6 \\ 5.1 \\ 4.6 \end{pmatrix} \%$$

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$$Fliquid_m_2 := \left(\frac{FH2O_m_2}{FH2O_m_3}\right) \qquad Fliquid_m_3 := \left(\frac{FH2O_m_3}{FH2O_m_3}\right) \qquad Fliquid_m_4 := \left(\frac{FH2O_m_4}{FH2O_m_3}\right)$$

$$Fliquid_m_1 := \left[\frac{Fliquid_m_2 \cdot \left(vol_{waste_m_2} \cdot \rho waste_m_2\right) + Fliquid_m_3 \cdot \left(vol_{waste_m_3} \cdot \rho waste_m_3\right) + Fliquid_m_4 \cdot \left(vol_{waste_m_4} \cdot \rho waste_m_4\right)}{vol_{waste_m_4} \cdot \rho waste_m_4 + vol_{waste_m_3} \cdot \rho waste_m_3 + vol_{waste_m_2} \cdot \rho waste_m_2}\right]$$

$$Fliquid_m = \begin{pmatrix} 95.174 \\ 90.002 \\ 100.000 \\ 90.002 \end{pmatrix} \% \qquad Fliquid_sd := Fliquid_m \cdot .1 \qquad Fliquid_sd = \begin{pmatrix} 9.517 \\ 9.000 \\ 10.000 \\ 9.000 \end{pmatrix} \%$$

$$Temp_{vap_m} := \left(excel_{tank_{idxS},22} + 275.15\right) \cdot K \qquad Temp_{vap_sd} := excel_{tank_{idxS},23} \cdot K$$

$$Temp_{vap_m} = 307.650\,K \qquad Temp_{vap_sd} = 4K$$

$$Temp_{waste_m} := \begin{pmatrix} excel_{tank_{idxT},20} + 273.15 \\ excel_{tank_{idxS},20} + 273.15 \\ excel_{tank_{idxL},20} + 273.15 \\ excel_{tank_{idxS},20} + 273.15 \end{pmatrix} K \qquad Temp_{waste_sd} := \begin{pmatrix} excel_{tank_{idxT},21} \\ excel_{tank_{idxT},21} \\ excel_{tank_{idxT},21} \\ excel_{tank_{idxT},21} \end{pmatrix}$$

$$Temp_{waste_m} = \begin{pmatrix} 314.150 \\ 314.150 \\ 314.150 \\ 314.150 \end{pmatrix} K \qquad Temp_{waste_sd} = \begin{pmatrix} 5 \\ 5 \\ 5 \\ 5 \end{pmatrix} K$$

$class_{waste}$ = "dst"

Heat Load Calculated By Barker In
"Decay Heat Generation Rate AN-104.MCD"

Make Sure You Run The File "Decay Heat Generation Rate 011129 .MCD"

Read Results From Excel File "rpp5926_r2_01_NH3CALOutputData0020203_AN-102.xls"

excel2 :=

C:\..\rpp5926_r2_02_DecayHeatGRInput020203_AN-104 .xls

$HeatLoad_{137Cs_90Sr_m} := excel2 \cdot watt$

Calculated By Barker In
"Decay Heat Generation Rate .MCD"

$$HeatLoad_{137Cs_90Sr_m} = \begin{pmatrix} 9.952 \times 10^{3} \\ 1.791 \times 10^{-23} \\ 5.191 \times 10^{3} \\ 4.761 \times 10^{3} \end{pmatrix} watt$$

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$HeatLoad_{137Cs_90Sr_sd} := HeatLoad_{137Cs_90Sr_m} \cdot 0.1$

$TankInfo :=$

C:\..\TankInfo.xls

Read Waste Properties From Excel File "TankInfo.xls"

$j := 1..27$

$na_j := j$ $\quad$ $name := augment(na, TankId)$

$TankFarm = \text{"AN"}$

$fi := FindIndex(name, TankFarm)$

$fi = \begin{pmatrix} 7.000 \\ 2.000 \end{pmatrix}$

$vol_{tank} := TankInfo_{fi_1,4} \cdot ft^3$

$vol_{tank} = 1407\,kilo \cdot gal$ $\quad$ $vol_{tank} = 188089\,ft^3$

$vent_rate = 100.000\,cfm$

$vent_rate_{nb} := .0045 \cdot \left(vol_{tank} - vol_{waste_m_1}\right) \cdot \frac{1}{day}$

$vent_rate_{nb} = 0.166\,cfm$

$diam_{tank} := 2 \cdot TankInfo_{(fi_1,2)} \cdot ft$ $\quad$ $diam_{tank} = 75.000\,ft$

$ht_{tank} := \frac{vol_{waste_m}}{TankInfo_{(fi_1,8)} \cdot \frac{gal}{in}}$ estimation Of Waste Depth

$vol_{head} := vol_{tank} - vol_{waste_m_1}$

$ht_{tank} = \begin{pmatrix} 366.331 \\ 9.592 \times 10^{-11} \\ 199.808 \\ 166.523 \end{pmatrix} in$ estimation Of Waste Depth

$vol_{head} = 5.322 \times 10^4\,ft^3$

$i := 1..4$ $\quad$ $k := 1..NSamples$

$vol_{waste_i} := \left(rnorm\left(NSamples, \frac{vol_{waste_m_i}}{kilo \cdot gal}, \frac{vol_{waste_sd_i}}{kilo \cdot gal}\right)\right) \cdot kilo \cdot gal$

$vol_{head} := vol_{tank} - vol_{waste_1}$

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$vol_{head_m} := mean(vol_{head})$ $\qquad$ $vol_{head_sd} := Stdev(vol_{head})$

$vol_{head_m} = 5.387 \times 10^{4}\,ft^{3}$ $\qquad$ $vol_{head_sd} = 5.654 \times 10^{3}\,ft^{3}$

$$\rho_{waste_i} := \left(rnorm\left(NSamples, \frac{\rho_{waste_m_i}}{\frac{gm}{mL}}, \frac{\rho_{waste_sd_i}}{\frac{gm}{mL}}\right)\right)\cdot\frac{gm}{mL}$$

$$mass_{waste_i} := \overline{\left(vol_{waste_i}\cdot\rho_{waste_i}\right)}$$

$mass_{waste_m_i} := mean(mass_{waste_i})$ $\qquad$ $mass_{waste_sd_i} := Stdev(mass_{waste_i})$

$$mass_{waste_m_i} = \begin{pmatrix} 5.646 \times 10^{6} \\ 1.340 \times 10^{-6} \\ 2.949 \times 10^{6} \\ 2.749 \times 10^{6} \end{pmatrix} kg \qquad mass_{waste_sd_i} = \begin{pmatrix} 3.027 \times 10^{5} \\ 1.424 \times 10^{-} \\ 2.440 \times 10^{5} \\ 2.835 \times 10^{5} \end{pmatrix} kg$$

Dome-Space Methane Nitrous Oxide And Ammonia Concentrations (Bingham 2000)

$[H2_m] := .0021\cdot\%$ $\qquad$ $[CH4_m] := .0002\cdot\%$ $\qquad$ $[N2O_m] := .0007\cdot\%$ $\qquad$ $[NH3_m] := .0021\cdot\%$

$[H2_sd] := .00021\cdot\%$ $\qquad$ $[CH4_sd] := .00002\cdot\%$ $\qquad$ $[N2O_{sd}] := .00007\cdot\%$ $\qquad$ $[NH3_sd] := .00021\cdot\%$

Ammonia Diffusion Information (see Rpp5926 R1 - Calculation Of Mass Transport Coefficient H For Soluble Gas AY-102 .mcd (from File "rpp5929_r2_01_NH3CALOutputData0020203.xls"

NH3In :=

C:\..\rpp5926_r2_01_NH3CALOutputData0020203_AN-104.xls

$k2_NH3 := NH3In_1\cdot\frac{mol}{L\cdot min}$ $\qquad$ $k2_NH3 = 1.806 \times 10^{-9}\,\frac{mol}{L\cdot min}$

$hA_NH3 := NH3In_2\cdot cfm$ $\qquad$ $hA_NH3 = 5.916 \times 10^{-3}\,cfm$

$K_H := NH3In_3\cdot\frac{mol}{L\cdot atm}$ $\qquad$ $K_H = 6.123\,\frac{mol}{L\cdot atm}$

$V_m := NH3In_4\cdot\frac{L}{mol}$ $\qquad$ $V_m = 24.794\,\frac{L}{mol}$

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$[NH3_{liq}] := NH3In_5 \cdot \frac{mol}{L}$ $\qquad [NH3_{liq}] = 0.014 \frac{mol}{L}$

$P := 1 \cdot atm$

$k1_NH3 := \frac{vent_rate_{nb} + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}$ $\qquad k1_NH3_m := mean(k1_NH3)$

$k1_NH3_m = 1.998 \times 10^{-5} min^{-1}$

$k1_NH3_med := median(k1_NH3)$ $\qquad k1_NH3_sd := Stdev(k1_NH3)$

$k1_NH3_med = 1.983 \times 10^{-5} min^{-1}$ $\qquad k1_NH3_sd = 2.141 \times 10^{-6} min^{-1}$

Gas Concentrations At LFL

$LFL_{H2} := 4 \cdot \%$ $\qquad \%LFL_{H2} := \frac{.04}{100}$

$LFL_{NH3} := 15 \cdot \%$ $\qquad \%LFL_{NH3} := \frac{.15}{100}$

$LFL_{CH4} := 5 \cdot \%$ $\qquad \%LFL_{CH4} := \frac{.05}{100}$

End Of Input Data

Author: _____ Date: 6/17/02

Calculations

Hydrogen Generation Due To Thermolysis (Hu, 2000 - Eqn 4-8)

Define Constants (Based On Hu (2000) Eqn 4-8)

$a_{thm} := 2.76 \cdot 10^9 \frac{g_mol}{kg \cdot day}$ Thermolysis Pre-exponential Factor (Hu, 2000 - Eqn 4-8)

$E_{thm} := 89.33 \cdot \frac{kilo \cdot J}{g_mol}$ activation Energy (Hu, 2000 - Eqn 4-8)

$R_{const} = 8.3144739 \frac{J}{g_mol \cdot K}$ Gas Constant

$r_f := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$ Reactivity Coefficient (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-8)

$r_f = 0.700$

Calculate The Weight Fraction Of Liquid In The Waste

$F_{H2O_i} := \left(rnorm\left(NSamples, F_{H2O_m_i}, F_{H2O_sd_i}\right)\right)$

$W_{H2O_i} := \overrightarrow{\left(mass_{waste_i} \cdot F_{H2O_i}\right)}$

$W_{H2O_m_i} := mean\left(W_{H2O_i}\right)$ $W_{H2O_sd_i} := Stdev\left(W_{H2O_i}\right)$

$$W_{H2O_m_i} = \begin{pmatrix} 1.379 \times 10^9 \\ 3.068 \times 10^{-4} \\ 7.532 \times 10^8 \\ 6.338 \times 10^8 \end{pmatrix} kg \qquad W_{H2O_sd_i} = \begin{pmatrix} 1.346 \times 10^8 \\ 3.070 \times 10^{-5} \\ 7.293 \times 10^7 \\ 6.017 \times 10^7 \end{pmatrix} kg$$

Check Units On Input Data

$$[TOC] := \left(rnorm\left(NSamples, \frac{[TOC_m]}{\frac{\mu \cdot gm}{mL}}, \frac{[TOC_{sd}]}{\frac{\mu \cdot gm}{mL}}\right)\right) \cdot \frac{\mu \cdot gm}{mL}$$

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$$[TOC_{wt\%}] := \frac{\overrightarrow{[TOC]}}{\rho waste_3} \cdot 100$$

$[TOC_{wt\%_m}] := mean([TOC_{wt\%}])$ $\qquad$ $[TOC_{wt\%_sd}] := Stdev([TOC_{wt\%}])$

$[TOC_{wt\%_m}] = 0.221$ $\qquad$ $[TOC_{wt\%_sd}] = 0.023$

$$[Al] := \left(rnorm\left(NSamples, \frac{[Al_m]}{\frac{\mu \cdot gm}{mL}}, \frac{[Al_{sd}]}{\frac{\mu \cdot gm}{mL}}\right)\right) \cdot \frac{\mu \cdot gm}{mL}$$

$$[Al_{wt\%}] := \frac{\overrightarrow{[Al]}}{\rho waste_3} \cdot 100$$

$[Al_{wt\%_m}] := mean([Al_{wt\%}])$ $\qquad$ $[Al_{wt\%_sd}] := Stdev([Al_{wt\%}])$

$[Al_{wt\%_m}] = 2.755$ $\qquad$ $[Al_{wt\%_sd}] = 0.278$

Calculate The Hydrogen Generation Rate Due To Thermolysis (HGR_{therm})

$$Temp_{waste_i} := \left(rnorm\left(NSamples, \frac{Temp_{waste_m_i}}{K}, \frac{Temp_{waste_sd_i}}{K}\right)\right) \cdot K$$

$$Fliquid1 := \left(rnorm\left(NSamples, Fliquid_m_1, Fliquid_sd_1\right)\right)$$

$$Fliquid1_k := \begin{cases} Fliquid1_k & \text{if } Fliquid1_k \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$Fliquid2 := \left(rnorm\left(NSamples, Fliquid_m_2, Fliquid_sd_2\right)\right)$$

$$Fliquid2_k := \begin{cases} Fliquid2_k & \text{if } Fliquid2_k \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$Fliquid3 := \left(rnorm\left(NSamples, Fliquid_m_3, Fliquid_sd_3\right)\right)$$

$$Fliquid3_k := \begin{cases} Fliquid3_k & \text{if } Fliquid3_k \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$Fliquid4 := \left(rnorm\left(NSamples, Fliquid_m_4, Fliquid_sd_4\right)\right)$$

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$$Fliquid4_k := \begin{cases} Fliquid4_k & \text{if } Fliquid4_k \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$Fliquid_1 := \overrightarrow{Fliquid1} \qquad Fliquid_2 := \overrightarrow{Fliquid2}$$

$$Fliquid_3 := \overrightarrow{Fliquid3} \qquad Fliquid_4 := \overrightarrow{Fliquid4}$$

$$i := 1..4$$

$$HGR_{therm_scf_i} := \frac{a_{thm}}{\left(\frac{g_mol}{kg \cdot day}\right)} \cdot rf \cdot \overrightarrow{\left[[TOC_{wt\%}] \cdot ([Al_{wt\%}])^{.4} \cdot e^{-\left[\frac{\frac{E_{thm}}{\left(\frac{J}{g_mol}\right)}}{\left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)}\right] \cdot \left(\frac{Temp_{waste_i}}{K}\right)}\right]} \cdot Fliquid_i \right]} \cdot \frac{g_mol}{kg \cdot day}$$

$$HGR_{therm_i} := HGR_{therm_scf_i}$$

$$HGR_{therm_m_i} := mean(HGR_{therm_i}) \qquad HGR_{therm_sd_i} := Stdev(HGR_{therm_i})$$

$$HGR_{therm_m} = \begin{pmatrix} 9.600 \times 10^{-7} \\ 9.144 \times 10^{-7} \\ 9.928 \times 10^{-7} \\ 9.403 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day} \qquad HGR_{therm_sd} = \begin{pmatrix} 5.768 \times 10^{-7} \\ 5.205 \times 10^{-7} \\ 5.825 \times 10^{-7} \\ 6.229 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{thermv_i} := \overrightarrow{\left[HGR_{therm_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right)\right]} \cdot \frac{Temp_{vap_m}}{273.15 \cdot K}$$

$$HGR_{thermv_1} := \overrightarrow{\sum_{i=2}^{4} HGR_{thermv_i}} \qquad HGR_{thermv_median_i} := median(HGR_{thermv_i})$$

$$HGR_{thermv_m_i} := mean(HGR_{thermv_i}) \qquad HGR_{thermv_sd_i} := Stdev(HGR_{thermv_i})$$

$$HGR_{thermv_m} = \begin{pmatrix} 4.925 \\ 1.097 \times 10^{-12} \\ 2.618 \\ 2.307 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{thermv_scf_i} := HGR_{thermv_m_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

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$$HGR_{thermv_m} = \begin{pmatrix} 3.420 \times 10^{-3} \\ 7.617 \times 10^{-16} \\ \\ 1 \end{pmatrix} cfm \qquad HGR_{thermv_scf} = \begin{pmatrix} 4.372 \\ 9.738 \times 10^{-13} \\ 2.324 \\ 2.048 \end{pmatrix} \frac{ft^3}{day}$$

$1.584 \times 10^{-}$ | cfm $HGR_{thermv_scf} =$ $1.614 \times 10^{-}$

$E_{rad} := 44.32 \cdot \frac{kilo \cdot J}{g_mol}$ Activation Energy Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$a_{rad} := 2.49 \cdot 10^{6} \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential Factor Of G In Organic Radiolysis (Hu, 2000 - Eqn 4-16)

$$rf := \begin{cases} 0.4 & \text{if } class_{waste} = \text{"sst"} \\ 0.4 & \text{if } class_{waste} = \text{"SST"} \\ 0.7 & \text{otherwise} \end{cases}$$

Reactivity Coefficient Of TOC (0.7 For DSTs, 0.4 For SSts) (Hu, 2000 - Eqn 4-16)

$mw_{NO2} := (14.0067 + 2 \cdot 15.9994) \cdot \frac{gm}{g_mol}$

$mw_{NO3} := (14.0067 + 3 \cdot 15.9994) \cdot \frac{gm}{g_mol}$

$[NO3_m] = 171.867 \times 10^{3} \frac{\mu \cdot gm}{mL}$

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$$[NO_3] := \left(\mathrm{rnorm}\left(NSamples, \frac{[NO_3_m]}{\frac{\mu\cdot gm}{mL}}, \frac{[NO_3_sd]}{\frac{\mu\cdot gm}{mL}}\right)\right)\cdot\frac{\mu\cdot gm}{mL}$$

$$[NO_3_molar] := \frac{[NO_3]}{mw_{NO3}}$$

$$[NO_3_molar_m] := \mathrm{mean}([NO_3_molar]) \qquad [NO_3_molar_sd] := \mathrm{Stdev}([NO_3_molar])$$

$$[NO_3_molar_m] = 2.770\,\frac{g_mol}{L} \qquad [NO_3_molar_sd] = 0.282\,\frac{g_mol}{L}$$

$$[NO_2_m] = 112.338\times 10^{3}\,\frac{\mu\cdot gm}{mL}$$

$$[NO_2] := \left(\mathrm{rnorm}\left(NSamples, \frac{[NO_2_m]}{\frac{\mu\cdot gm}{mL}}, \frac{[NO_2_sd]}{\frac{\mu\cdot gm}{mL}}\right)\right)\cdot\frac{\mu\cdot gm}{mL}$$

$$[NO_2_molar] := \frac{[NO_2]}{mw_{NO2}}$$

$$[NO_2_molar_m] := \mathrm{mean}([NO_2_molar]) \qquad [NO_2_molar_sd] := \mathrm{Stdev}([NO_2_molar])$$

$$[NO_2_molar_m] = 2.428\,\frac{g_mol}{L} \qquad [NO_2_molar_sd] = 0.244\,\frac{g_mol}{L}$$

$$HeatLoad_{137Cs_90Sr_i} := \left[\mathrm{rnorm}\left[NSamples, \frac{HeatLoad_{137Cs_90Sr_m_i}}{\mu\cdot Ci}, \frac{HeatLoad_{137Cs_90Sr_sd_i}}{(\mu\cdot Ci)}\right]\right]\cdot\mu\cdot Ci$$

$$HeatLoad_{137Cs_90Sr_md_i} := \mathrm{mean}(HeatLoad_{137Cs_90Sr_i})$$

$$HeatLoad_{137Cs_90Sr_md_i} = \begin{pmatrix} 2.105\times 10^{12} \\ 3.784\times 10^{-15} \\ 1.101\times 10^{12} \\ 1.002\times 10^{12} \end{pmatrix}\mu\cdot Ci$$

$$HeatLoad_{137Cs_90Sr_sdd_i} := \mathrm{Stdev}(HeatLoad_{137Cs_90Sr_i})$$

$$HeatLoad_{137Cs_90Sr_sdd_i} = \begin{pmatrix} 2.044\times 10^{11} \\ 0.000 \\ 1.139\times 10^{11} \\ 9.512\times 10^{10} \end{pmatrix}\mu\cdot Ci$$

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$$HeatLoad_{m_i} = \begin{pmatrix} 3.519 \times 10^{-6} \\ 2.665 \times 10^{-20} \\ 3.522 \times 10^{-6} \end{pmatrix} \frac{watt}{kg}$$

$$G_{org_i} := \frac{a_{rad}}{\left(\frac{molecules}{100 \cdot eV}\right)} \cdot \left[e^{-\left[\frac{E_{rad}}{\left(\frac{J}{g_mol}\right)}\right]} \Big/ \left[\frac{R_{const}}{\left(\frac{J}{g_mol \cdot K}\right)} \cdot \frac{Temp_{waste_i}}{K}\right] \right]$$

$$G_{org_m_i} := mean(G_{org_i}) \qquad G_{org_sd_i} := Stdev(G_{org_i})$$

$$G_{org_m_i} = \begin{pmatrix} 0.017 \\ 0.017 \\ 0.017 \\ 0.017 \end{pmatrix} \frac{molecules}{100 \cdot eV} \qquad G_{org_sd_i} = \begin{pmatrix} 4.912 \times 10^{-3} \\ 4.762 \times 10^{-3} \\ 4.942 \times 10^{-3} \\ 5.506 \times 10^{-3} \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \left[0.45 - 0.56 \cdot \left[\frac{[NO3_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO2_molar]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} \right] \cdot \frac{molecules}{100 \cdot eV}$$

$$G_{H2O_k} := \begin{cases} G_{H2O_k} & \text{if } G_{H2O_k} > G_{H2O_sat} \\ G_{H2O_sat} & \text{otherwise} \end{cases}$$

$$G_{H2O_m} := mean(G_{H2O}) \qquad G_{H2O_sd} := Stdev(G_{H2O})$$

$$G_{H2O_m} = 5.000 \times 10^{-3} \frac{molecules}{100 \cdot eV} \qquad G_{H2O_sd} = 0.000 \frac{molecules}{100 \cdot eV}$$

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$$HGR_{rad_i} := \left(G_{H2O_i} + G_{org_i}\right) \cdot H_{load_i} \cdot F_{liquid_i} \cdot \frac{g_mol}{6.02 \cdot 10^{23} \cdot molecules}$$

$$HGR_{rad_m_i} := mean\left(HGR_{rad_i}\right) \qquad HGR_{rad_sd_i} := Stdev\left(HGR_{rad_i}\right)$$

$$HGR_{rad_m} = \begin{pmatrix} 2.562 \times 10^{-7} \\ 1.854 \times 10^{-21} \\ 2.632 \times 10^{-7} \\ 2.399 \times 10^{-7} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad_sd} = \begin{pmatrix} 2.535 \times 10^{-8} \\ 0.000 \\ 2.098 \times 10^{-8} \\ 2.832 \times 10^{-8} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{radv_i} := \overrightarrow{\left[HGR_{rad_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right)\right]} \cdot \frac{Temp_{vap_m}}{273.15 \cdot K} \qquad HGR_{radv_median_i} := median\left(HGR_{radv_i}\right)$$

$$HGR_{radv_m_i} := mean\left(HGR_{radv_i}\right) \qquad HGR_{radv_sd_i} := Stdev\left(HGR_{radv_i}\right)$$

$$HGR_{radv_m} = \begin{pmatrix} 1.6286 \\ 2.7979 \times 10^{-27} \\ 0.8744 \\ 0.7428 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_sd} = \begin{pmatrix} 0.1493 \\ 0.0000 \\ 0.0925 \\ 0.1034 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.131 \times 10^{-3} \\ 1.943 \times 10^{-30} \\ 6.072 \times 10^{-4} \\ 5.158 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv_median} = \begin{pmatrix} 1.146 \times 10^{-3} \\ 1.934 \times 10^{-30} \\ 6.124 \times 10^{-4} \\ 5.149 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{radv_scf_i} := HGR_{radv_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}} \qquad HGR_{radv_scf_median_i} := median\left(HGR_{radv_scf_i}\right)$$

$$HGR_{radv_scf_m_i} := mean\left(HGR_{radv_scf_i}\right) \qquad HGR_{radv_scf_sd_i} := Stdev\left(HGR_{radv_scf_i}\right)$$

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.446 \\ 2.484 \times 10^{-27} \\ 0.776 \\ 0.659 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_scf_sd} = \begin{pmatrix} 0.133 \\ 0.000 \\ 0.082 \\ 0.092 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.004 \times 10^{-3} \\ 1.725 \times 10^{-30} \\ 5.391 \times 10^{-4} \\ 4.580 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv_scf_median} = \begin{pmatrix} 1.017 \times 10^{-3} \\ 1.717 \times 10^{-30} \\ 5.437 \times 10^{-4} \\ 4.572 \times 10^{-4} \end{pmatrix} cfm$$

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$$R_{corr} := \begin{cases} 1.2 \cdot 10^{-7} \cdot \dfrac{ft^3}{ft^2 \cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 1.2 \cdot 10^{-7} \cdot \dfrac{ft^3}{ft^2 \cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 6.0 \cdot 10^{-8} \cdot \dfrac{ft^3}{ft^2 \cdot min} & \text{otherwise} \end{cases}$$

Corrosion Coefficient (6.0E-08 For DSTs, 1.2E-07 For SSts) ($ft^3/min/ft^2$) (Hu, 2000 - Eqn 4-xx)

$$\left[\pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank}\right] = \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank}$$

$$Awet_1 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_1}$$

$$Awet_2 := \pi \cdot diam_{tank} \cdot ht_{tank_2}$$

$$Awet_3 := \pi \cdot diam_{tank} \cdot ht_{tank_3}$$

$$Awet_4 := \pi \cdot \left(\frac{diam_{tank}}{2}\right)^2 + \pi \cdot diam_{tank} \cdot ht_{tank_4}$$

$$Awet = \begin{pmatrix} 1.161 \times 10^4 \\ 1.883 \times 10^{-9} \\ 3.923 \times 10^3 \\ 7.688 \times 10^3 \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due To Corrosion

$$HGR_{corr_i} := R_{corr} \cdot Awet_i \cdot \frac{Temp_{waste_i}}{273.15 \cdot K}$$

$$HGR_{corr_median_i} := median\left(HGR_{corr_i}\right)$$

$$HGR_{corr_m_i} := mean\left(HGR_{corr_i}\right)$$

$$HGR_{corr_sd_i} := Stdev\left(HGR_{corr_i}\right)$$

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$$HGR_{corr_m} = \begin{pmatrix} 1.1535 \\ 1.8714 \times 10^{-13} \\ 0.3899 \\ 0.7640 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_sd} = \begin{pmatrix} 0.0186 \\ 0.0000 \\ 6.3391 \times 10^{-3} \\ 0.0128 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_m} = \begin{pmatrix} 8.011 \times 10^{-4} \\ 1.300 \times 10^{-16} \\ 2.708 \times 10^{-4} \\ 5.306 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{corr_median} = \begin{pmatrix} 8.011 \times 10^{-4} \\ 1.300 \times 10^{-16} \\ 2.708 \times 10^{-4} \\ 5.305 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{corr_scf_i} := HGR_{corr_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}} \qquad HGR_{corr_scf_median_i} := median\left(HGR_{corr_scf_i}\right)$$

$$HGR_{corr_scf_m_i} := mean\left(HGR_{corr_scf_i}\right) \qquad HGR_{corr_scf_sd_i} := Stdev\left(HGR_{corr_scf_i}\right)$$

$$HGR_{corr_scf_m} = \begin{pmatrix} 1.024 \\ 1.662 \times 10^{-13} \\ 0.346 \\ 0.678 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_scf_sd} = \begin{pmatrix} 0.017 \\ 0.000 \\ 5.628 \times 10^{-3} \\ 0.011 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_scf_m} = \begin{pmatrix} 7.112 \times 10^{-4} \\ 1.154 \times 10^{-16} \\ 2.404 \times 10^{-4} \\ 4.711 \times \end{pmatrix} cfm \qquad HGR_{corr_scf_median} = \begin{pmatrix} 7.112 \times 10^{-4} \\ 1.154 \times 10^{-16} \\ 2.404 \times 10^{-4} \\ 4.710 \times 10^{-4} \end{pmatrix} cfm$$

Total Hydrogen Generation Rate

$$mass_{waste_m} = \begin{pmatrix} 5.646 \times 10^{6} \\ 1.340 \times 10^{-6} \\ 2.949 \times 10^{6} \\ 2.749 \times 10^{6} \end{pmatrix} kg$$

$$HGR_{thermv_m} = \begin{pmatrix} 4.925 \\ 1.097 \times 10^{-12} \\ 2.618 \\ 2.307 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{thermv_median} = \begin{pmatrix} 4.413 \\ 9.709 \times 10^{-13} \\ 2.282 \\ 1.866 \end{pmatrix} \frac{ft^3}{day}$$

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$$HGR_{radv_m} = \begin{pmatrix} 1.629 \\ 2.798 \times 10^{-27} \\ 0.874 \\ 0.743 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_median} = \begin{pmatrix} 1.650 \\ 2.785 \times 10^{-27} \\ 0.882 \\ 0.742 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_m} = \begin{pmatrix} 1.154 \\ 1.871 \times 10^{-13} \\ 0.390 \\ 0.764 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_median} = \begin{pmatrix} 1.154 \\ 1.872 \times 10^{-13} \\ 0.390 \\ 0.764 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_i := \overline{\left(HGR_{thermv_i} + HGR_{radv_i} + HGR_{corr_i}\right)} \qquad HGR_{median_i} := median\left(HGR_i\right)$$

$$HGR_{m_i} := mean\left(HGR_i\right) \qquad HGR_{sd_i} := Stdev\left(HGR_i\right)$$

$$HGR_m = \begin{pmatrix} 5.352 \times 10^{-3} \\ 8.916 \times \\ 2.696 \\ 2.648 \times 10^{-} \end{pmatrix} cfm \qquad HGR_{sd} = \begin{pmatrix} 1.590 \times 10^{-3} \\ 0.000 \\ 1.112 \times 10^{-3} \\ 1.098 \times \end{pmatrix} cfm$$

$$HGR_m = \begin{pmatrix} 218.230 \\ 3.636 \times 10^{-11} \\ 109.935 \\ 107.985 \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

$$HGR_{median} = \begin{pmatrix} 5.010 \times 10^{-} \\ 8.045 \times 10^{-16} \\ 2.463 \\ 2.336 \times 10^{-3} \end{pmatrix} cfm$$

$$HGR_{stp_i} := HGR_i \cdot \frac{273.15 \cdot K}{Temp_{vap_m}} \qquad HGR_{stp_median_i} := median\left(HGR_{stp_i}\right)$$

$$HGR_{stp_m_i} := mean\left(HGR_{stp_i}\right) \qquad HGR_{stp_sd_i} := Stdev\left(HGR_{stp_i}\right)$$

$$HGR_{stp_m} = \begin{pmatrix} 4.752 \times 10^{-3} \\ 7.916 \times 10^{-16} \\ 2.394 \times 10^{-3} \\ 2.351 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{stp_sd} = \begin{pmatrix} 1.412 \times 10^{-3} \\ 0.000 \\ 9.875 \times 10^{-4} \\ 9.751 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{stp_m} = \begin{pmatrix} 6.842 \\ 1.140 \times 10^{-12} \\ 3.447 \\ 3.386 \end{pmatrix} \frac{ft^3}{day}$$

At Standard Conditions...

$$HGR_{stp_median} = \begin{pmatrix} 4.448 \times 10^{-3} \\ 7.143 \times 10^{-16} \\ 2.187 \times 10^{-3} \\ 2.074 \times 10^{-3} \end{pmatrix} cfm$$

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Steady-State Hydrogen Concentration (Assuming Normal Ventilation Rate)

$$[H2_{ss}] := \overrightarrow{\frac{HGR_1}{HGR_1 + vent_rate}}$$

$[H2_{ss_m}] := mean([H2_{ss}])$ $\qquad$ $[H2_{ss_sd}] := Stdev([H2_{ss}])$

$[H2_{ss_m}] = 5.352 \times 10^{-3}\%$ $\qquad$ $[H2_{ss_sd}] = 1.590 \times 10^{-3}\%$

$[H2_{ss_m}] = 0.134\%LFL_{H2}$ $\qquad$ $[H2_{ss_sd}] = 0.040\%LFL_{H2}$

Steady-State Hydrogen Concentration (Assuming Natural Breathing Ventilation Rate)

$$[H2_{ss_nb}] := \overline{\frac{HGR_1}{HGR_1 + vent_rate_{nb}}}$$

$[H2_{ss_nb_median}] := median([H2_{ss_nb}])$

$[H2_{ss_nb_m}] := mean([H2_{ss_nb}])$ $\qquad$ $[H2_{ss_nb_sd}] := Stdev([H2_{ss_nb}])$

$[H2_{ss_nb_m}] = 3.109\%$ $\qquad$ $[H2_{ss_nb_sd}] = 0.887\%$

$[H2_{ss_nb_m}] = 77.734\%LFL_{H2}$ $\qquad$ $[H2_{ss_nb_sd}] = 22.168\%LFL_{H2}$

$[H2_{ss_nb_median}] = 73.098\%LFL_{H2}$

Gas Release Rate (Independent Of Ventilation Rate)

$rate_{H2_rel} := [H2_{ss_m}] \cdot \frac{vent_rate}{1 - [H2_{ss_m}]}$ $\qquad$ $rate_{H2_rel_nb} := [H2_{ss_nb_median}] \cdot \frac{vent_rate_{nb}}{1 - [H2_{ss_nb_median}]}$

$rate_{H2_rel} = 5.352 \times 10^{-3}\ cfm$ $\qquad$ $rate_{H2_rel_nb} = 5.010 \times 10^{-3}\ cfm$

Calculate Release Rates Of Ammonia, Methane, And Nitrous Oxide (Assuming No Gas Retention)

$[NH_3] := (rnorm(NSamples, [NH_{3_m}], [NH_{3_sd}]))$

$$RR_{NH3} := \overrightarrow{\left(\frac{[NH_3] \cdot vent_rate}{1 - [NH_3]}\right)}$$

$RR_{NH3_m} := mean(RR_{NH3})$ $\qquad$ $RR_{NH3_sd} := Stdev(RR_{NH3})$

$RR_{NH3_m} = 2.097 \times 10^{-3}\ cfm$ $\qquad$ $RR_{NH3_sd} = 2.073 \times 10^{-4}\ cfm$

$[CH_4] := (rnorm(NSamples, [CH_{4_m}], [CH_{4_sd}]))$

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$$RR_{CH4} := \overrightarrow{\left(\frac{[CH_4]\cdot vent_rate}{1-[CH_4]}\right)}$$

$RR_{CH4_m} := mean(RR_{CH4})$ $\qquad$ $RR_{CH4_sd} := Stdev(RR_{CH4})$

$RR_{CH4_m} = 2.007 \times 10^{-4}\,cfm$ $\qquad$ $RR_{CH4_sd} = 1.956 \times 10^{-5}\,cfm$

$[N2O] := (rnorm(NSamples, [N2O_m], [N2O_{sd}]))$

$$RR_{N2O} := \overrightarrow{\left(\frac{[N2O]\cdot vent_rate}{1-[N2O]}\right)}$$

$RR_{N2O_m} := mean(RR_{N2O})$ $\qquad$ $RR_{N2O_sd} := Stdev(RR_{N2O})$

$RR_{N2O_m} = 7.022 \times 10^{-4}\,cfm$ $\qquad$ $RR_{N2O_sd} = 7.151 \times 10^{-5}\,cfm$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Normal Ventilation Rate)(just A Check Of Methodology)

$$[NH3_{ss_m}] := \frac{RR_{NH3_m}}{RR_{NH3_m} + vent_rate} \qquad [NH3_{ss_m}] = 2.097 \times 10^{-3}\%$$

$$[NH3_{ss}] := \overrightarrow{\frac{RR_{NH3}}{RR_{NH3} + vent_rate}} \qquad [NH3_{ss_m}] = 0.014\%LFL_{NH3}$$

$$[CH4_{ss_m}] := \frac{RR_{CH4_m}}{RR_{CH4_m} + vent_rate} \qquad [CH4_{ss_m}] = 2.007 \times 10^{-4}\%$$

$$[CH4_{ss_m}] = 4.014 \times 10^{-3}\%LFL_{CH4}$$

$$[N2O_{ss_m}] := \frac{RR_{N2O_m}}{RR_{N2O_m} + vent_rate} \qquad [N2O_{ss_m}] = 7.022 \times 10^{-4}\%$$

Steady-State Ammonia, Methane, And Nitrous Oxide Concentration (Assuming Natural Breathing Ventilation Rate)

$$NH3_1000_day := \overrightarrow{\left[\left[\frac{k2_NH3}{k1_NH3} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k2_NH3}{k1_NH3}\right)\exp\left(-1\cdot\frac{k1_NH3}{\frac{1}{day}}\cdot 1000\right)\right]\cdot V_m\right]}$$

$[NH3_{ss_nb}] := NH3_1000_day$

$[NH3_{ss_nb_m}] := mean([NH3_{ss_nb}])$ $\qquad$ $[NH3_{ss_nb_median}] := median([NH3_{ss_nb}])$

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$[NH3_{ss_nb_m}] = 0.227\%$

$[NH3_{ss_nb_m}] = 1.511\%LFL_{NH3}$

$[NH3_{ss_nb_median}] = 0.226\%$

$[NH3_{ss_nb_median}] = 1.506\%LFL_{NH3}$

$[NH3_{ss_nb_sd}] := Stdev([NH3_{ss_nb}])$

$[NH3_{ss_nb_sd}] = 0.024\%$

$[NH3_{ss_nb_sd}] = 0.159\%LFL_{NH3}$

$$[CH4_{ss_nb}] := \overrightarrow{\frac{RR_{CH4}}{RR_{CH4} + vent_rate_{nb}}}$$

$[CH4_{ss_nb_m}] := mean([CH4_{ss_nb}])$

$[CH4_{ss_nb_m}] = 0.121\%$

$[CH4_{ss_nb_m}] = 2.410\%LFL_{CH4}$

$[CH4_{ss_nb_median}] := median([CH4_{ss_nb}])$

$[CH4_{ss_nb_sd}] := Stdev([CH4_{ss_nb}])$

$[CH4_{ss_nb_sd}] = 0.012\%$

$[CH4_{ss_nb_median}] = 0.121\%$

$$[N2O_{ss_nb}] := \overline{\frac{RR_{N2O}}{RR_{N2O} + vent_rate_{nb}}}$$

$[N2O_{ss_nb_m}] := mean([N2O_{ss_nb}])$

$[N2O_{ss_nb_m}] = 0.420\%$

$[N2O_{ss_nb_median}] = 0.422\%$

$[N2O_{ss_nb_median}] := median([N2O_{ss_nb}])$

$[N2O_{ss_nb_sd}] := Stdev([N2O_{ss_nb}])$

$[N2O_{ss_nb_sd}] = 0.043\%$

$[N2O_{ss_nb_sd}] = 0.853\%LFL_{CH4}$

Determine The Overall Steady-State Flammable Gas Concentration With Loss Of Ventilation

$$[Conc_mix_{ss_nb}] := \frac{[H2_{ss_nb}]}{LFL_{H2}} + \frac{[NH3_{ss_nb}]}{LFL_{NH3}} + \frac{[CH4_{ss_nb}]}{LFL_{CH4}}$$

$[Conc_mix_{ss_nb_m}] := mean([Conc_mix_{ss_nb}])$

$[Conc_mix_{ss_nb_m}] = 81.655\%LFL$

$[Conc_mix_{ss_nb_sd}] := Stdev([Conc_mix_{ss_nb}])$

$[Conc_mix_{ss_nb_sd}] = 22.186\%LFL$

$[Conc_mix_{ss_nb_median}] := median([Conc_mix_{ss_nb}])$

$[Conc_mix_{ss_nb_median}] = 77.013\%LFL$

Set Variables Into Array, Where 1 => H2, 2 => NH3, 3 => CH4, And 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} \{500,1\} \\ \{500,1\} \\ \{500,1\} \\ \{500,1\} \end{pmatrix} cfm$$

Generation Rate

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$$GR_m := \begin{pmatrix} HGR_{m_1} \\ RR_{NH3_m} \\ RR_{CH4_m} \\ RR_{N2O_m} \end{pmatrix} \qquad GR_m = \begin{pmatrix} 5.352 \times 10^{-3} \\ 2.097 \times 10^{-} \\ 2.007 \times \\ 7.022 \times 10^{-4} \end{pmatrix} \text{:fm}$$

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} \{500,1\} \\ \{500,1\} \\ \{500,1\} \\ \{500,1\} \end{pmatrix} \text{cfm}$$

Release Rate
(Assume No Retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss_m}] \\ [NH3_{ss_m}] \\ [CH4_{ss_m}] \\ [N2O_{ss_m}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 5.352 \times 10^{-} \\ 2.097 \times 10^{-} \\ 2.007 \times 10^{-} \\ 7.022 \times 10^{-4} \end{pmatrix} \%$$

Initial Concentration Rate
(Assume At Steady-
State With Normal Ops)

Calculate The Composition Of All Components At Time 't'

$$\lambda_i := \frac{\overrightarrow{vent_rate_{nb} + Rate_{rel}}}{vol_{head}}$$

$$Conc_{in_i} := \frac{\overrightarrow{Rate_{rel_i} \cdot 100\%}}{Rate_{rel_i} + vent_rate_{nb}}$$

$$conc(t,i) := \overrightarrow{\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]}$$

$$conc_m(t,i) := \overrightarrow{mean\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]}$$

$$concm(t,i) := mean(conc(t,i)) \qquad concmed(t,i) := median(conc(t,i))$$

$$conc_median(t,i) := \overrightarrow{median\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]}$$

$conc_m(0 \cdot sec,1) = 5.352 \times 10^{-3}\%$ $\quad$ $conc_m(1000 \cdot day,1) = 3.076\%$ $\quad$ $conc_m(1000 \cdot day,1) = 76.902\%LFL_{H2}$

$conc_m(0 \cdot sec,2) = 2.097 \times 10^{-3}\%$ $\quad$ $conc_m(1000 \cdot day,2) = 1.231\%$ $\quad$ $conc_m(1000 \cdot day,2) = 8.204\%LFL_{NH3}$

$conc_m(0 \cdot sec,3) = 2.007 \times 10^{-4}\%$ $\quad$ $conc_m(1000 \cdot day,3) = 0.119\%$ $\quad$ $conc_m(1000 \cdot day,3) = 2.381\%LFL_{CH4}$

$conc_m(0 \cdot sec,4) = 7.022 \times 10^{-4}\%$ $\quad$ $conc_m(1000 \cdot day,4) = 0.415\%$

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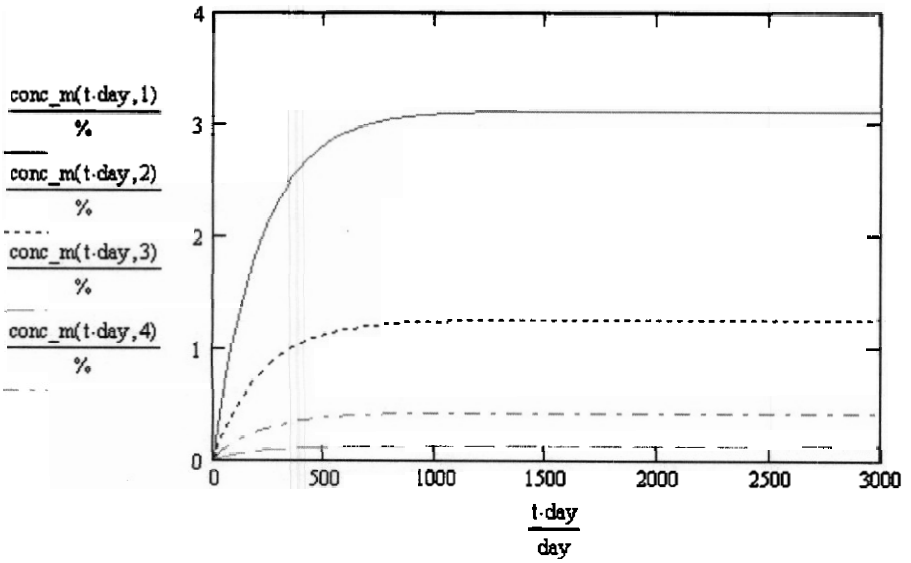
$t := 0, 30 .. 3000$



Calculate Steady-State Flammable Gas Concentration At Normal Operating Conditions

$$LFL_{mix}(z) := \frac{1}{\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}}$$

$LFL_{mix_m}(z) := mean(LFL_{mix}(z))$ $\qquad$ $LFL_{mix_sd}(z) := Stdev(LFL_{mix}(z))$

$LFL_{mix_m}(0 \cdot day) = 6.588 \times 10^{4}\%$ $\qquad$ $LFL_{mix_sd}(0 \cdot day) = 0.000\%$

$LFL_{mix_m}(1000000 \cdot day) = 119.344\%$ $\qquad$ $LFL_{mix_sd}(1000000 \cdot day) = 26.362\%$

$LFL_{mix_median}(z) := median(LFL_{mix}(z))$ $\qquad$ $LFL_{mix_median}(1000000 \cdot day) = 119.656\%$

Calculate The Time To Reach Various Fractions Of The LFL

Time To Reach 25 %LFL

$TOL := .00001$

$$fm(z,ll) := \frac{\left(\frac{1}{LFL_{mix_m}(z)}\right)}{\%LFL} - ll \qquad fmd(z,ll) := \frac{\left(\frac{1}{LFL_{mix_median}(z)}\right)}{\%LFL} - ll$$

$$f(z,ll) := mean\left(\frac{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}{\%LFL} - ll\right)$$

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$$f_sd(z,lfl) := \mathrm{Stdev}\left(\frac{\overrightarrow{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}}{\%LFL} - lfl\right)\cdot\%$$

$$f_md(z,lfl) := \mathrm{median}\left(\frac{\overrightarrow{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)}}{\%LFL} - lfl\right)$$

$lfl := 25$

$z := 10\cdot day$ Initial Guess

$temp_{25} := -5\cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{25} := \mathrm{Re}(\mathrm{root}(f(z,lfl),z))$

$temp_{25} = 71.437\ day$

The "Re" Function Will Keep The Real Portion Of A Complex Number. This Function Is Used To Allow The "IF" Statements Below To Fuction Properly. Caution, The Answer Given May Be Complex. Without The "IF" Statement The User May Be Unaware Of This!

$zm := 10\cdot day$ Initial Guess

$temp_{25_m} := -5\cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{25_m} := \mathrm{Re}(\mathrm{root}(fm(zm,lfl),zm))$

$temp_{25_m} = 77.092\ day$

$zm := 10\cdot day$ Initial Guess

$temp_{25_md} := -5\cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{25_md} := \mathrm{Re}(\mathrm{root}(f_md(zm,lfl),zm))$

$temp_{25_md} = 76.942\ day$

$Time_{1_25\%LFL_m} := \mathrm{if}\left([Conc_mix_{ss_nb_m}] > 25\%, \mathrm{if}(temp_{25_m} < 0\cdot day, 0\cdot day, temp_{25_m}), 10^9\cdot day\right)$

$Time_{1_25\%LFL_m} = 77.092\ day$

$Time_{1_25\%LFL_sd} := \mathrm{if}\left([Conc_mix_{ss_nb_m}] > 25\%, \mathrm{if}(temp_{25} < 0\cdot day, 0\cdot day, f_sd(temp_{25}, lfl)\cdot temp_{25}), 10^9\cdot day\right)$

$Time_{1_25\%LFL_sd} = 4.851\ day$

$Time_{1_25\%LFL_md} := \mathrm{if}\left([Conc_mix_{ss_nb_m}] > 25\%, \mathrm{if}(temp_{25_md} < 0\cdot day, 0\cdot day, temp_{25_md}), 10^9\cdot day\right)$

$Time_{1_25\%LFL_md} = 76.942\ day$

Time To Reach 50 %LFL

$lfl := 50$

$z := 10\cdot day$ Initial Guess

$temp_{50} := -5\cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := \mathrm{Re}(\mathrm{root}(f(z,lfl),z))$

$temp_{50} = 180.222\ day$

The "Re" Function Will Keep The Real Portion Of A Complex Number. This Function Is Used To Allow The "IF" Statements Below To Fuction Properly. Caution, The Answer Given May Be Complex. Without The "IF" Statement The User May Be Unaware Of This!

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$zm := 10 \cdot day$ Initial Guess $temp50_m := -5 \cdot day$ Initial Value In Case Solution **Cannot Be Found**

$temp50_m := Re(root(fm(zm, tlfl), zm))$

$temp50_m = 198.368\ day$

$zm := 10 \cdot day$ Initial Guess **$temp50_md := -5 \cdot day$** **Initial Value In Case Solution Cannot Be Found**

$temp50_md := Re(root(f_md(zm, tlfl), zm))$

$temp50_md = 199.583\ day$

$Time_{1_50\%LFL_m} := if\left([Conc_mix_{ss_nb_m}] > 50\%, if\left(temp50_m < 0 \cdot day, 0 \cdot day, temp50_m\right), 10^9 \cdot day\right)$

$Time_{1_50\%LFL_m} = 198.368\ day$

$Time_{1_50\%LFL_sd} := if\left([Conc_mix_{ss_nb_m}] > 50\%, if\left(temp50 < 0 \cdot day, 0 \cdot day, f_sd(temp50, tlfl) \cdot temp50\right), 10^9 \cdot day\right)$

$Time_{1_50\%LFL_sd} = 23.838\ day$

$Time_{1_50\%LFL_md} := if\left([Conc_mix_{ss_nb_m}] > 50\%, if\left(temp50_md < 0 \cdot day, 0 \cdot day, temp50_md\right), 10^9 \cdot day\right)$

$Time_{1_50\%LFL_md} = 199.583\ day$

Time To Reach 75 %LFL

$tlfl := 75$

$z := 10 \cdot day$ Initial Guess $temp75 := -5 \cdot day$ Initial Value In Case Solution **Cannot Be Found**

$temp75 := Re(root(f(z, tlfl), z))$

$temp75 = 410.319\ day$

The "Re" Function Will Keep The Real Portion Of A Complex Number
This Function Is Used To Allow The "IF" Statements Below To Fuction Properly. Caution, The Answer Given May Be Complex. Without The "IF" Statement The User May Be Unaware Of This!

$zm := 10 \cdot day$ Initial Guess $temp75_m := -5 \cdot day$ Initial Value In Case Solution **Cannot Be Found**

$temp75_m := Re(root(fm(zm, tlfl), zm))$

$temp75_m = 494.911\ day$

$zm := 10 \cdot day$ Initial Guess **$temp75_md := -5 \cdot day$** **Initial Value In Case Solution Cannot Be Found**

$temp75_md := Re(root(f_md(zm, tlfl), zm))$

$temp75_md = 486.845\ day$

$Time_{1_75\%LFL_m} := if\left([Conc_mix_{ss_nb_m}] > 75\%, if\left(temp75_m < 0 \cdot day, 0 \cdot day, temp75_m\right), 10^9 \cdot day\right)$

$Time_{1_75\%LFL_m} = 494.911\ day$

$Time_{1_75\%LFL_sd} := if\left([Conc_mix_{ss_nb_m}] > 75\%, if\left(temp75 < 0 \cdot day, 0 \cdot day, f_sd(temp75, tlfl) \cdot temp75\right), 10^9 \cdot day\right)$

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$Time_{1_75\%LFL_sd} = 78.812\ day$

$Time_{1_75\%LFL_md} := if\left([Conc_mix_{ss_nb_m}] > 75\%, if\left(temp_{75_md} < 0 \cdot day, 0 \cdot day, temp_{75_md}\right), 10^9 \cdot day\right)$

$Time_{1_75\%LFL_md} = 486.845\ day$

Time To Reach 100 %LFL

$tlfl := 100$

$z := 10 \cdot day$ Initial Guess $temp_{100} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := Re(root(f(z, tlfl), z))$

$temp_{100} = 432.160\ day$

The "Re" Function Will Keep The Real Portion Of A Complex Number. This Function Is Used To Allow The "IF" Statements Below To Fuction Properly. Caution, The Answer Given May Be Complex. Without The "IF" Statement The User May Be Unaware Of This!

$zm := 10 \cdot day$ Initial Guess $temp_{100_m} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{100_m} = 348.779\ day$

$zm := 10 \cdot day$ Initial Guess $temp_{100_md} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100_md} := Re(root(f_md(zm, tlfl), zm))$

$temp_{100_md} = -5.000\ day$

$Time_{1_100\%LFL_m} := if\left([Conc_mix_{ss_nb_m}] > 100\%, if\left(temp_{100_m} < 0 \cdot day, 0 \cdot day, temp_{100_m}\right), 10^9 \cdot day\right)$

$Time_{1_100\%LFL_m} = 1.000 \times 10^9\ day$

$Time_{1_100\%LFL_sd} := if\left[[Conc_mix_{ss_nb_m}] > 100\%, if\left[temp_{100} < 0 \cdot day, 0 \cdot day, f_sd(temp_{100}, tlfl) \cdot (temp_{100})\right], 10^9 \cdot day\right]$

$Time_{1_100\%LFL_sd} = 1.000 \times 10^9\ day$

$Time_{1_100\%LFL_md} := if\left([Conc_mix_{ss_nb_m}] > 100\%, if\left(temp_{100_md} < 0 \cdot day, 0 \cdot day, temp_{100_md}\right), 10^9 \cdot day\right)$

$Time_{1_100\%LFL_md} = 1.000 \times 10^9\ day$

Minimum Ventilation Rates Needed To Prevent Headspace Concentrations From Reaching Various Levels

$$Conc_vr(V, i) := \left| \overrightarrow{\frac{Rate_{rel_i} \cdot 100 \cdot \%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right]} \right|$$

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$$Conc_vr_m(V,i) := mean\left(\overrightarrow{\left[\frac{Rate_{rel_i}\cdot 100\cdot \%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]\right]}\right)$$

Calculate Steady-State Flammable Gas Concentration At Normal Operating Conditions

$$LFL_{mix_vr}(v) := \frac{1}{\frac{Conc_vr(v,1)}{LFL_{H2}}+\frac{Conc_vr(v,2)}{LFL_{NH3}}+\frac{Conc_vr(v,3)}{LFL_{CH4}}}$$

$LFL_{mix_vr_m}(z) := mean(LFL_{mix_vr}(z))$ $\qquad$ $LFL_{mix_vr_sd}(z) := Stdev(LFL_{mix_vr}(z))$

$LFL_{mix_vr_m}(0.148\cdot cfm) = 106.553\,\%$ $\qquad$ $LFL_{mix_vr_sd}(0.148\cdot cfm) = 23.445\,\%$

$LFL_{mix_vr_m}(1\cdot cfm) = 701.470\,\%$ $\qquad$ $LFL_{mix_vr_sd}(1\cdot cfm) = 159.148\,\%$

Ventilation Rate To Keep Concentration Less Than 25 %LFL

$$f2m(z,lfl) := \frac{\left(\frac{1}{LFL_{mix_vr_m}(z)}\right)}{\%LFL}-lfl$$

$$f2(z,lfl) := mean\left(\frac{\overrightarrow{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}}{\%LFL}-lfl\right)$$

$$f2_sd(z,lfl) := Stdev\left(\frac{\overrightarrow{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}}{\%LFL}-lfl\right)\cdot\%$$

$$f2_md(z,lfl) := median\left(\frac{\overrightarrow{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}}{\%LFL}-lfl\right)$$

$lfl := 24.999$

$z := .001\cdot cfm$ Initial Guess

$temp_{25} := -5\cdot cfm$ Initial Value In Case Solution Cannot Be Found

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$temp_{25} := root(f2(z, tlfl), z)$

$temp_{25} = 0.601875\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{25_m} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{25_m} := root(f2(zm, tlfl), zm)$

$temp_{25_m} = 0.601875\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{25_md} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{25_md} := root(f2_md(zm, tlfl), zm)$

$temp_{25_md} = 0.566662\ cfm$

$vent_rate_{1_25\%LFL_m} := if(temp_{25_m} < 0 \cdot cfm, 0 \cdot cfm, temp_{25_m} + 0.001 \cdot cfm)$

$vent_rate_{1_25\%LFL_m} = 0.603\ cfm$

$vent_rate_{1_25\%LFL_sd} := if(temp_{25} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{25}, tlfl) \cdot temp_{25})$

$vent_rate_{1_25\%LFL_sd} = 0.039\ cfm$

$vent_rate_{1_25\%LFL_md} := if(temp_{25_md} < 0 \cdot cfm, 0 \cdot cfm, temp_{25_md} + 0.001 \cdot cfm)$

$vent_rate_{1_25\%LFL_md} = 0.568\ cfm$

Ventilation Rate To Keep Concentration Less Than 50 %LFL

$tlfl := 50 - .001$

$z := .001 \cdot cfm$ Initial Guess

$temp_{50} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{50} := root(f2(z, tlfl), z)$

$temp_{50} = 0.298278\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{50_m} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{50_m} := root(f2m(zm, tlfl), zm)$

$temp_{50_m} = 0.281831\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{50_md} := -5 \cdot cfm$ Initial Value In Case Solution **Cannot Be Found**

$temp_{50_md} := root(f2_md(zm, tlfl), zm)$

$temp_{50_md} = 0.281052\ cfm$

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$vent_rate_{1_50\%LFL_m} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, temp_{50_m} + 0.001 \cdot cfm)$

$vent_rate_{1_50\%LFL_m} = 0.283\ cfm$

$vent_rate_{1_50\%LFL_sd} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{50}, tlfl) \cdot temp_{50})$

$vent_rate_{1_50\%LFL_sd} = 0.038\ cfm$

$vent_rate_{1_50\%LFL_md} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, temp_{50_md} + 0.001 \cdot cfm)$

$vent_rate_{1_50\%LFL_md} = 0.282\ cfm$

Ventilation Rate To Keep Concentration Less Than 75 %LFL

$tlfl := 75 - .001$

$z := .001 \cdot cfm$ Initial Guess $temp_{75} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{75} := root(f2(z, tlfl), z)$

$temp_{75} = 0.197086\ cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{75_m} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{75_m} := root(f2m(zm, tlfl), zm)$

$temp_{75_m} = 0.186354\ cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{75_md} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{75_md} := root(f2_md(zm, tlfl), zm)$

$temp_{75_md} = 0.185852\ cfm$

$vent_rate_{1_75\%LFL_m} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, temp_{75_m} + 0.001 \cdot cfm)$

$vent_rate_{1_75\%LFL_m} = 0.187\ cfm$

$vent_rate_{1_75\%LFL_sd} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{75}, tlfl) \cdot temp_{75})$

$vent_rate_{1_75\%LFL_sd} = 0.037\ cfm$

$vent_rate_{1_75\%LFL_md} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, temp_{75_md} + 0.001 \cdot cfm)$

$vent_rate_{1_75\%LFL_md} = 0.187\ cfm$

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Ventilation Rate To Keep Concentration Less Than 100 %LFL

$tlfl := 100 - .001$

$z := .001 \cdot cfm$ Initial Guess

$temp_{100} := -5 \cdot cfm$ Initial Value In Case Solution Cannot Be Found

$temp_{100} := root(f2(z, tlfl), z)$

$temp_{100} = 0.146493\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{100_m} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100_m} := root(f2m(zm, tlfl), zm)$

$temp_{100_m} = 0.138616\ cfm$

$zm := .001 \cdot cfm$ Initial Guess

$temp_{100_md} := -5 \cdot day$ Initial Value In Case Solution Cannot Be Found

$temp_{100_md} := root(f2_md(zm, tlfl), zm)$

$temp_{100_md} = 0.138249\ cfm$

$vent_rate_{1_100\%LFL_m} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, temp_{100_m} + 0.001 \cdot cfm)$

$vent_rate_{1_100\%LFL_m} = 0.140\ cfm$

$vent_rate_{1_100\%LFL_sd} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{100}, tlfl) \cdot temp_{100})$

$vent_rate_{1_100\%LFL_sd} = 0.037\ cfm$

$vent_rate_{1_100\%LFL_md} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, temp_{100_md} + 0.001 \cdot cfm)$

$vent_rate_{1_100\%LFL_md} = 0.139\ cfm$

Author: _____ Date: 6/17/02

Summary Section

Input Data

Waste Properties (1 ==> Total Waste, 2 ==> Liquid Waste, 3 ==> Solid Waste)

$Tank_id = \text{"241-AN-104"}$ $\quad class_{waste} = \text{"dst"}$

$[TOC_m] = 3.140 \times 10^{3} \frac{\mu \cdot gm}{mL}$ $\quad [NO3_m] = 1.719 \times 10^{5} \frac{\mu \cdot gm}{mL}$ $\quad [NO2_m] = 1.123 \times 10^{5} \frac{\mu \cdot gm}{mL}$

$[Al_m] = 3.898 \times 10^{4} \frac{\mu \cdot gm}{mL}$ $\quad [137Cs_m] = \begin{pmatrix} 351.079 \\ 1.000 \times 10^{-12} \\ 374.528 \\ 325.809 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$ $\quad [90Sr_m] = \begin{pmatrix} 15.096 \\ 1.000 \times 10^{-12} \\ 0.062 \\ 31.297 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$

$vol_{waste_m} = \begin{pmatrix} \times \\ 3.531 \times 10^{-8} \\ 7.356 \times 10^{4} \end{pmatrix} ft^3$ $\quad \rho_{waste_m} = \begin{pmatrix} 1.483 \\ 1.339 \\ 1.410 \\ 1.579 \end{pmatrix} \frac{gm}{mL}$ $\quad Temp_{waste_m} = \begin{pmatrix} 314.088 \\ 314.127 \\ 314.208 \\ 314.209 \end{pmatrix} K$

$F_{H2O_m} = \begin{pmatrix} \text{[illegible]} \\ 45.813 \\ 50.902 \\ 45.813 \end{pmatrix} \%$ $\quad HeatLoad_{137Cs_90Sr_m} = \begin{pmatrix} 1.791 \times 10^{-23} \\ 5.191 \times 10^{3} \\ 4.761 \times 10^{3} \end{pmatrix} watt$ $\quad Temp_{vap_m} = 307.650\,K$

$vol_{tank} = 1.407 \times 10^{3}\, kilo \cdot gal$ $\quad vent_rate = 100.000\, cfm$ $\quad vent_rate_{nb} = 0.166\, cfm$

AN Tank Farm: Tank Data

$diam_{tank} = 75.000\, ft$ $\quad ht_{tank} = \begin{pmatrix} 366.331 \\ 9.592 \times 10^{-11} \\ 199.808 \\ 166.523 \end{pmatrix} in$ $\quad$ estimation Of Waste Depth

Dome-Space Compositions

$[CH4_m] = 2.000 \times 10^{-4}\%$ $\quad [N2O_m] = 7.000 \times 10^{-4}\%$ $\quad [NH3_m] = 2.100 \times 10^{-3}\%$

End Of Input Data

Author: SA Baker Date: 6/17/02

Output Data

Waste Properties (1 ==> Total Waste, 2 ==> Liquid Waste, 3 ==> Solid Waste)

Hydrogen Generation Rate Due To Thermolysis, Radiolysis, And Corrosion...

$$HGR_{thermv_m} = \begin{pmatrix} 3.420 \times 10^{-3} \\ 7.617 \times 10^{-16} \\ 1.818 \times 10^{-3} \\ 1.602 \times 10^{-3} \end{pmatrix} \text{cfm} \quad HGR_{thermv_median} = \begin{pmatrix} 3.064 \times 10^{-3} \\ 6.742 \times 10^{-16} \\ 1.584 \times 10^{-3} \\ 1.296 \times 10^{-3} \end{pmatrix} \text{cfm} \quad HGR_{thermv_sd} = \begin{pmatrix} 1.581 \times 10^{-3} \\ 0.000 \\ 1.092 \times 10^{-3} \\ 1.074 \times 10^{-3} \end{pmatrix}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.131 \times 10^{-3} \\ 1.943 \times 10^{-30} \\ 6.072 \times 10^{-4} \\ 5.158 \times 10^{-4} \end{pmatrix} \text{cfm} \quad HGR_{radv_median} \begin{pmatrix} 1.146 \times 10^{-3} \\ 1.934 \times 10^{-30} \\ 6.124 \times 10^{-4} \\ 5.149 \times 10^{-4} \end{pmatrix} \text{cfm} \quad HGR_{radv_sd} = \begin{pmatrix} 0.000 \\ 6.423 \times 10^{-5} \end{pmatrix} \text{cfm}$$

$$HGR_{corr_m} = \begin{pmatrix} 8.011 \times 10^{-4} \\ 1.300 \times 10^{-16} \\ 2.708 \times 10^{-4} \\ 5.306 \times 10^{-4} \end{pmatrix} \text{cfm} \quad HGR_{corr_median} = \begin{pmatrix} 8.011 \times 10^{-4} \\ 1.300 \times 10^{-16} \\ 2.708 \times 10^{-4} \\ 5.305 \times 10^{-4} \end{pmatrix} \text{cfm} \quad HGR_{corr_sd} = \begin{pmatrix} 1.293 \times 10^{-5} \\ 0.000 \\ 4.402 \times 10^{-6} \\ 8.871 \times 10^{-6} \end{pmatrix} \text{cfm}$$

Overall Hydrogen Generation Rate...

At The Headspace Conditions...

$$HGR_m = \begin{pmatrix} 5.352 \times 10^{-3} \\ 8.916 \times 10^{-16} \\ 2.696 \times 10^{-3} \\ 2.648 \times 10^{-3} \end{pmatrix} \text{cfm}$$

$$HGR_m = \begin{pmatrix} 7.707 \\ 1.284 \times 10^{-12} \\ 3.882 \\ 3.813 \end{pmatrix} \frac{ft^3}{day}$$

At Standard Conditions (273.15°K)...

$$HGR_{stp_m} = \begin{pmatrix} 4.752 \times 10^{-3} \\ 7.916 \times 10^{-16} \\ 2.394 \times 10^{-3} \\ 2.351 \times 10^{-3} \end{pmatrix} \text{cfm} \quad HGR_{stp_median} = \begin{pmatrix} 4.448 \times 10^{-3} \\ 7.143 \times 10^{-16} \\ 2.187 \times 10^{-3} \\ 2.074 \times 10^{-3} \end{pmatrix} \text{cfm}$$

$$HGR_{stp_m} = \begin{pmatrix} 6.842 \\ 1.140 \times 10^{-12} \\ 3.447 \\ 3.386 \end{pmatrix} \frac{ft^3}{day} \quad HGR_{stp_median} = \begin{pmatrix} 6.405 \\ 1.029 \times 10^{-12} \\ 3.149 \\ 2.987 \end{pmatrix} \frac{ft^3}{day}$$

Author: _____ Date: 6/17/02

Steady-State Compositions

Hydrogen At Normal Ventilation Rate...	**At Natural Breathing Ventilation Rate**
$[H2_{ss_m}] = 0.134\%LFL_{H2}$	$[H2_{ss_nb_m}] = 77.734\%LFL_{H2}$
Ammonia At Normal Ventilation Rate...	**At Natural Breathing Ventilation Rate**
$[NH3_{ss_m}] = 0.014\%LFL_{NH3}$	$[NH3_{ss_nb_m}] = 1.511\%LFL_{NH3}$
Methane At Normal Ventilation Rate...	**At Natural Breathing Ventilation Rate**
$[CH4_{ss_m}] = 4.014 \times 10^{-3}\%LFL_{CH4}$	$[CH4_{ss_nb_m}] = 2.410\%LFL_{CH4}$
Nitrous Oxide At Normal Ventilation Rate...	**At Natural Breathing Ventilation Rate**
$[N2O_{ss_m}] = 7.022 \times 10^{-4}\%$	$[N2O_{ss_nb_m}] = 0.420\%$

Flammable Gas Concentrations After Loss Of Ventilation At Selected Time Periods (Mean Values)

$conc_{mix_m}(0 \cdot day) = 0.152\%LFL$	$conc_{mix_m}(10 \cdot day) = 3.898\%LFL$
$conc_{mix_m}(100 \cdot day) = 30.843\%LFL$	$conc_{mix_m}(489.445 \cdot day) = 74.780\%LFL$
$conc_{mix_m}(10^9 \cdot day) = 83.791\%LFL$	

Flammable Gas Concentrations After Loss Of Ventilation At Selected Time Periods (Median Values)

$conc_{mix_median}(0 \cdot day) = 0.152\%LFL$	$conc_{mix_median}(10 \cdot day) = 3.898\%LFL$
$conc_{mix_median}(100 \cdot day) = 30.843\%LFL$	$conc_{mix_median}(489.445 \cdot day) = 74.780\%LFL$
$conc_{mix_median}(10^9 \cdot day) = 83.791\%LFL$	

Time To Reach Various LFL Levels (Mean)

$Time_{1_25\%LFL_m} = 77.092\ day$	$Time_{1_75\%LFL_m} = 494.911\ day$
$Time_{1_50\%LFL_m} = 198.368\ day$	$Time_{1_100\%LFL_m} = 1.000 \times 10^9\ day$

Time To Reach Various LFL Levels (Median)

$Time_{1_25\%LFL_md} = 76.942\ day$	$Time_{1_75\%LFL_md} = 486.845\ day$
$Time_{1_50\%LFL_md} = 199.583\ day$	$Time_{1_100\%LFL_md} = 1.000 \times 10^9\ day$

Author: _____ Date: 6/17/02

Minimum Ventilation Rates To Keep Headspace Composition Below Selected LFLs (Mean)

$vent_rate_{1_25\%LFL_m} = 0.603$ cfm

$vent_rate_{1_75\%LFL_m} = 0.187$ cfm

$vent_rate_{1_50\%LFL_m} = 0.283$ cfm

$vent_rate_{1_100\%LFL_m} = 0.140$ cfm

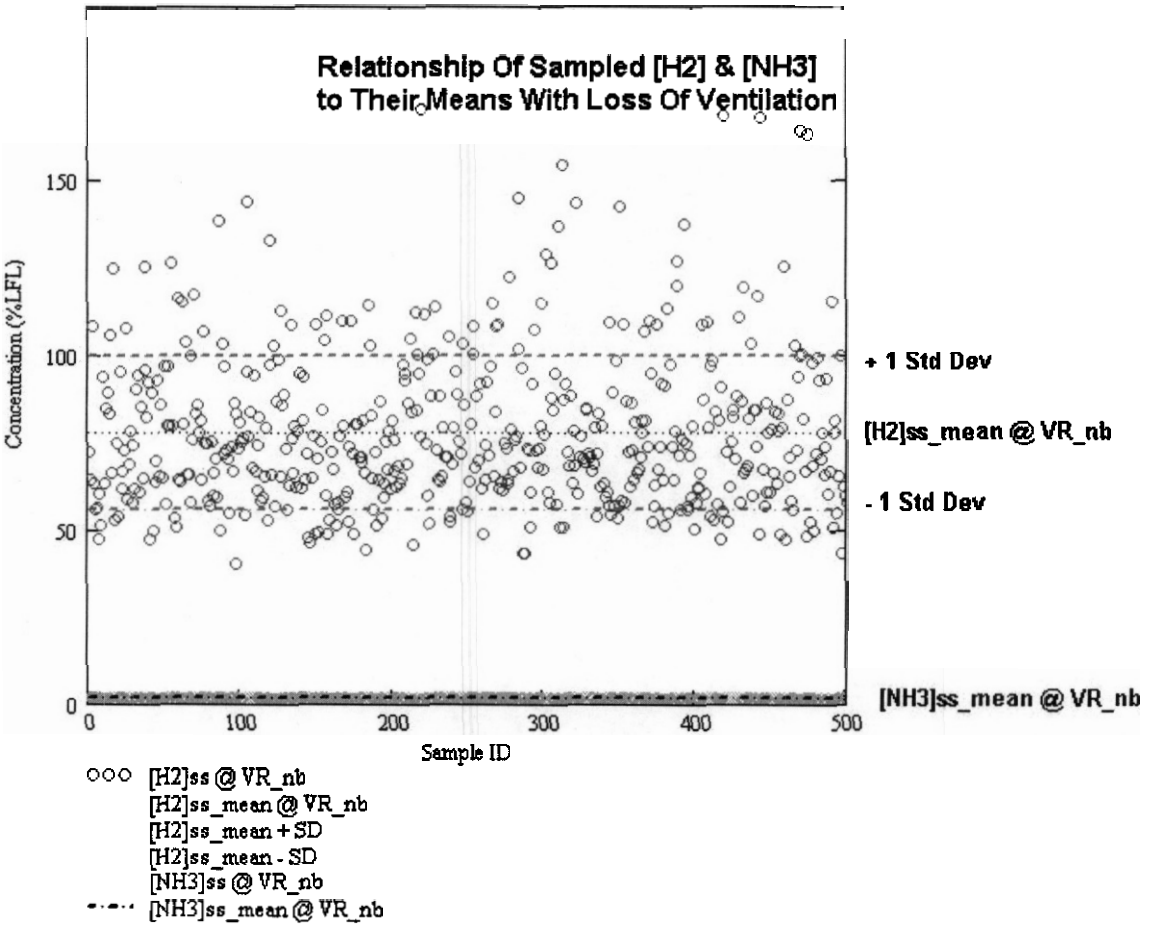
Minimum Ventilation Rates To Keep Headspace Composition Below Selected LFLs (Median)

$vent_rate_{1_25\%LFL_md} = 0.568$ cfm

$vent_rate_{1_75\%LFL_md} = 0.187$ cfm

$vent_rate_{1_50\%LFL_md} = 0.282$ cfm

$vent_rate_{1_100\%LFL_md} = 0.139$ cfm



Author: _____ Date: 6/17/02

Appendix H

CHECKLIST FOR TECHNICAL PEER REVIEW

Document Reviewed:

RPP5926, Rev. 2, *Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste*

Scope of Review (e.g., document section or portion of calculation):

Complete document.

Yes	No	NA*		
[X]	[ ]	[ ]	1.	Previous reviews are complete and cover the analysis, up to the scope of this review, with no gaps.
[X]	[ ]	[ ]	2.	Problem is completely defined.
[ ]	[ ]	[X]	3.	Accident scenarios are developed in a clear and logical manner.
[X]	[ ]	[ ]	4.	Analytical and technical approaches and results are reasonable and appropriate.
[X]	[ ]	[ ]	5.	Necessary assumptions are reasonable, explicitly stated, and supported.
[X]	[ ]	[ ]	6.	Computer codes and data files are documented.
[X]	[ ]	[ ]	7.	Data used in calculations are explicitly stated.
[X]	[ ]	[ ]	8.	Bases for calculations, including assumptions and data, are consistent with the supported safety basis document (e.g., the Tank Farms Final Safety Analysis Report).
[X]	[ ]	[ ]	9.	Data were checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	10.	For both qualitative and quantitative data, uncertainties are recognized and discussed, as appropriate.
[X]	[ ]	[ ]	11.	Mathematical derivations were checked including dimensional consistency of results.
[X]	[ ]	[ ]	12.	Models are appropriate and were used within their established range of validity or adequate justification was provided for use outside their established range of validity.
[X]	[ ]	[ ]	13.	Spreadsheet results and all hand calculations were verified.
[X]	[ ]	[ ]	14.	Calculations are sufficiently detailed such that a technically qualified person can understand the analysis without requiring outside information.
[X]	[ ]	[ ]	15.	Software input is correct and consistent with the document reviewed.
[X]	[ ]	[ ]	16.	Software output is consistent with the input and with the results reported in the document reviewed.
[X]	[ ]	[ ]	17.	Software verification and validation are addressed adequately.
[X]	[ ]	[ ]	18.	Limits/criteria/guidelines applied to the analysis results are appropriate and referenced. Limits/criteria/guidelines were checked against references.
[ ]	[ ]	[X]	19.	Safety margins are consistent with good engineering practices.
[X]	[ ]	[ ]	20.	Conclusions are consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	21.	Results and conclusions address all points in the purpose.
[X]	[ ]	[ ]	22.	All references cited in the text, figures, and tables are contained in the reference list.
[X]	[ ]	[ ]	23.	Reference citations (e.g., title and number) are consistent between the text callout and the reference list.
[X]	[ ]	[ ]	24.	Only released (i.e., not draft) references are cited.
[X]	[ ]	[ ]	25.	Referenced documents are retrievable or otherwise available.
[X]	[ ]	[ ]	26.	The most recent version of each reference is cited, as appropriate.
[X]	[ ]	[ ]	27.	There are no duplicate citations in the reference list.

Reviewer's Initials

Appendix H

[X] [ ] [ ]	28. Referenced documents are spelled out (title and number) the first time they are cited.
[X] [ ] [ ]	29. All acronyms are spelled out the first time they are used.
[X] [ ] [ ]	30. The Table of Contents is correct.
[X] [ ] [ ]	31. All figure, table, and section callouts are correct.
[X] [ ] [ ]	32. Unit conversions are correct and consistent.
[X] [ ] [ ]	33. The number of significant digits is appropriate and consistent.
[X] [ ] [ ]	34. Chemical reactions are correct and balanced.
[X] [ ] [ ]	35. All tables are formatted consistently and are free of blank cells.
[X] [ ] [ ]	36. The document is complete (pages, attachments, and appendices) and in the proper order.
[X] [ ] [ ]	37. The document is free of typographical errors.
[X] [ ] [ ]	38. The tables are internally consistent.
[X] [ ] [ ]	39. The document was prepared in accordance with HNF-2353, Section 4.3, Attachment B, "Calculation Note Format and Preparation Instructions".
[X] [ ] [ ]	**Concurrence**

Comments:

6. Accident scenarios are not discussed in report.
19. Safety margins are not discussed in report

Steven A. Barker _____ 6/17/02
Reviewer (Printed Name and Signature) Date

* If No or NA is chosen, an explanation must be provided on this form

This document was too large to scan as a single document. It has been divided into smaller sections.

Section 1 OF 2

Document Information			
Document #	RPP-5926	Revision	2
Title	STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION & LOWER FLAMMABILITY LEVEL EVALUATION FOR HANFORD TANK WASTE		
Date	06/20/2002		
Originator	HU TA	Originator Co.	CHG
Recipient		Recipient Co.	
References	ECN-664039		
Keywords			
Projects			
Other Information			

ENGINEERING CHANGE NOTICE

1. ECN 664039

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental ☐ Direct Revision ☒ Change ECN ☐ Temporary ☐ Standby ☐ Supersedure ☐ Cancel/Void ☐	Hu, T. A., Process Engineering R2-11	☒ Yes ☐ No Detection under TF02-0434, NWD	June 19, 2002
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No. 2750/200E	8. Approval Designator N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.) RPP-5926, Rev. 1	10. Related ECN No(s). N/A	11. Related PO No. N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Completed	12d. Restored to Original Condition (Temp. or Standby ECNs only)
☐ Yes (fill out Blk. 12b) ☒ No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change

13b. Design Baseline Document? ☐ Yes ☒ No

This ECN is to:

1) Resolve the U.S. Department of Energy's comments on Revision 1 of this report to redefine the off-normal ventilation conditions and make clear that the off-normal conditions rarely occur.
2) Rewrite the discussion on the discrepancies of the ammonia mass transport proprieties between the field-data-derived values and the direct calculation.
3) Update the hydrogen generation rates and flammability calculations for 177 tanks based on BBI data on Nov. 15, 2001, and SACS data on Nov. 1, 2001.
4) Update (to February 28, 2002) the hydrogen generation rate and flammability calculations for tank 241-A-101 based on the waste volume to reflect the saltwell pumping activity.
5) Conduct flammability assessments on several waste addition cases for DSTs.
6) Perform the flammability calculations at zero ventilation for SSTs.
7) Make minor wording changes for clarification, typographical corrections, format and additional changes.

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☒ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	This document reports flammability assessment for 177 tanks to support the closure of flammable gas issues. The change is necessary to update the flammability calculation based on current and projected condition of the tanks.

15. Distribution (include name, MSIN, and no. of copies)

See distribution sheet

RELEASE STAMP

JUN 20 2002

DATE:

HANFORD RELEASE

STA: 4

ID: 21

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 664039

16. Design Verification Required	17. Cost Impact		18. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
☐ Yes	Additional ☐ $	Additional ☐ $	Improvement ☐
☒ No	Savings ☐ $	Savings ☐ $	Delay ☐

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☒	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☒	Essential Material Specification	☐	Purchase Requisition	☒
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐	Tickler File	☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
N/A		

21. Approvals

	Signature	Date		Signature	Date
Design Authority			Design Agent		
Cog. Eng.	T. A. Hu [signature]	6/20/02	PE		
Cog. Mgr.	N. W. Kirch [signature]	6/20/02	QA		
QA			Safety		
Safety			Design		
Environ.			Environ.		
Other	W. L. Cowley [signature]	6/20/02	Other		
	[signature] NS&E	6/20/02			

DEPARTMENT OF ENERGY

Signature or a Control Number that tracks the Approval Signature

ADDITIONAL

DISTRIBUTION SHEET

To	From	
Distribution	Hu, T. A., Process Engineering	Page 1 of 1
Project Title/Work Order		Date June 19, 2002
Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste - RPP 5926 R2		EDT No. N/A
		ECN No. 664039

Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
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STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION AND LOWER FLAMMABILITY LEVEL EVALUATION FOR HANFORD TANK WASTE

T. A. Hu
CH2M HILL Hanford Group, Inc.
Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-99RL14047

EDT/ECN: 664039 UC:
Cost Center: 7KN00 Charge Code: 101898
B&R Code: EW3120074 Total Pages: 491

Key Words: hydrogen generation, flammable gas, lower flammability limit rate equation model, ammonia, liquid/vapor equilibrium

Abstract: Assess the steady-state flammability level at normal and off-normal ventilation conditions. The hydrogen generation rate was calculated for 177 tanks using the rate equation model. Flammability calculations based on hydrogen, ammonia, and methane were performed for 177 tanks at various scenarios.

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6/20/02
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RPP-5926
Revision 2

STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION AND LOWER FLAMMABILITY LEVEL EVALUATION FOR HANFORD TANK WASTE

T. A. Hu
S. A. Barker
CH2M HILL Hanford Group, Inc.

Date Published
June 2002

CH2MHILL
Hanford Group, Inc.

Prepared for the U.S. Department of Energy
Office of River Protection

Approved for public release; distribution unlimited

RECORD OF REVISION

(1) Document Number: RPP-5926 Rev 2

Page 1

(2) Title: Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste

Change Control Record

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release (5) Cog. Engr.	Authorized for Release (6) Cog. Mgr. Date
2 RS	(7) Total document revision per ECN 664039	6/20/02	6/20/02

A-7320-005 (10/97)

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EXECUTIVE SUMMARY

Flammable gases such as hydrogen, ammonia, and methane are observed in the tank dome space of the Hanford Site high-level waste tanks. This report assesses the steady-state flammability level under normal and off-normal ventilation conditions in the tank dome space for 177 double-shell tanks and single-shell tanks at the Hanford Site. The steady-state flammability level was estimated from the gas concentration of the mixture in the tank dome space using estimated gas release rates, Le Chatelier's rule, and lower flammability limits of fuels in an air mixture. A time-dependent equation of gas concentration, which is a function of the gas release and ventilation rates in the tank dome space, has been developed for both soluble and insoluble gases. With this dynamic model, the time required to reach the specified flammability level at a given ventilation condition can be calculated.

In the evaluation, hydrogen generation rates can be calculated for a given tank waste composition and its physical condition (e.g., waste density, waste volume, temperature etc.) using the empirical rate equation model provided in HNF-3851, *Empirical Rate Equation Model and Rate Calculations of Hydrogen Generation for Hanford Tank Waste*. The release rate of other insoluble gases and the mass transport properties of the soluble gas can be derived from the observed steady-state gas concentration under normal ventilation conditions. For most cases the off-normal ventilation rate in the flammability calculation is assumed to be natural barometric breathing only; however, the flammability calculations under zero ventilation rates are also performed for single-shell tanks. Some SSTs have been interim stabilized and have no guarantee that barometric breathing is available. Significant amounts of data are required to do both the hydrogen generation rate calculation and the flammability level evaluation. For tank waste that does not have sample-based data, a statistical-based value from probability distribution regression was used based on data from tanks belonging to a similar waste group.

This report (Revision 2) updates input data of the hydrogen generation rates calculation for 177 tanks to November 2001 using the waste composition information in the *Best Basis Inventory* detail report (CHG 2001a) and the waste temperature data in the *Surveillance Analysis Computer System* (CHG 2001b). However, the release rate of methane, ammonia, and nitrous oxide is based on the input data as stated in Revision 1 of this report. In addition, the waste

volume of tank 241-A-101 is updated to February 28, 2002 in the calculation to reflect the salt well pumping status. This tank had the highest flammability level among the single-shell tanks before salt well pumping. Salt well pumping reduces the waste volume and thus reduces the hydrogen generation rate. The flammability calculation also has been updated accordingly. Scenarios for adding waste to the November 2001 waste levels have been studied to determine the gas generation rates and the effect of smaller tank dome space on the flammability limits to address the issues of routine water additions and other possible waste transfer operations.

Overall, the flammability assessment indicates that no tank will exceed 25% of the lower flammability limit under normal ventilation conditions. Off-normal ventilation conditions evaluated in this report are referred to as the shutdown of active ventilation systems coupled with closure of the air inlet for actively ventilated systems and isolation of the high-efficiency particulate air breather filter for passively ventilated tanks. The shortest time to reach 25% of the lower flammability limit during off-normal ventilation conditions with the barometric breathing rate is 23 days for double-shell tanks (tank 241-AY-102) and 41 days for single-shell tanks (tank 241-B-203). With zero ventilation, the shortest time to reach 25% of the lower flammability limit is 37 days for single-shell tanks (tank 241-B-203). Note that off-normal ventilation conditions occur rarely. For the waste addition study on double-shell tanks, the shortest time to reach 25% and 100% of the lower flammability limit for double-shell tank 241-AY-102 are 4 and 18 days, respectively, if filled with same waste; and 9 and 39 days, respectively if filled with water.

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LIST OF TERMS

atm	atmosphere
BBI	*Best Basis Inventory*
CH_4	methane
C^{ss}	steady-state vapor concentration
DST	double-shell tank
eV	electron volt
°F	degrees Fahrenheit
ft	feet
ft^2	square feet
ft^3	cubic feet
ft^3/min	cubic feet per minute
g-mole/L	gram-mole per liter
G_r	generation rate
GRE	gas release event
HEPA	high-efficiency particulate air
HGR	hydrogen generation rate
in.	inch
kg	kilogram
kgal	kilogallon
kJ/mole	kiloJoule per mole
L	liter
LFL	lower flammability limit
M	g-mole per liter
m^2	square meter
m^3	cubic meter
NH_3	ammonia
N_2O	nitrous oxide
O_2	oxygen
ppm	parts per million
ppmv	parts per million volume
SACS	*Surveillance Analysis Computer System*
SST	single-shell tank
TOC	total organic carbon
TWINS	*Tank Waste Information Network System*
μg/mL	micrograms per milliliter
V_{bb}	barometric breathing rate
%	percent

1.0 INTRODUCTION AND BACKGROUND

This report provides the methodology to predict the steady-state gas release rate and to evaluate the steady-state flammability level of the tank dome space under both normal and off-normal ventilation conditions for 177 underground nuclear waste storage tanks at the Hanford Site. Revision 0 of this report replaced two previous calculation notes: HNF-SD-WM-CN-116, *Calculation Note Hydrogen Generation Rates At Steady State Flammable Gas Concentrations for Single-Shell Tanks*, and HNF-SD-WM-CN-117, *Calculations of Hydrogen Release Rate at Steady State for Double-Shell Tanks* and provided the technical basis for establishing flammable gas controls. The focus of this report is the loss of ventilation transient such that technical safety requirement surveillance frequencies and action times can be established. This report also provides the following:

- Estimates of the flammable gas release rates in the tank dome space
- Estimate of the flammable gas concentration under normal operating condition
- Estimates of the time to reach 25% of the lower flammability limit (LFL) and the LFL following the loss of normal ventilation in actively and passively ventilated double-shell tanks (DST) and single-shell tanks (SST)
- Estimates of the minimum ventilation rate required to maintain less than 25% LFL
- Estimates of the maximum flammable gas concentrations in the tank dome space following an extended loss of normal ventilation.

This report also provides the methodology that can be used in other applications.

To clarify the application of the subject document, "steady-state" has been defined as the condition of no active operational changes to the tank, and the non-GRE (gas release event) condition with GRE defined as 500-parts per million (ppm) rise in hydrogen concentration followed by exponential decay. The following assumptions were used for this application: (1) long-term variations in ventilation rates brought about by seasonal effects or ventilation rate changes within the exhaust system operating range; (2) the variability of the hydrogen concentration in the baseline is less than that produced by a GRE. When the results from only one sample were available, it was assumed to have been taken at steady-state condition, unless clear documentation showed the existence of a GRE condition.

This report is organized as follows: Chapter 2.0 describes the hydrogen generation rate (HGR) model calculation and summarizes the empirical equation of HGRs. Chapter 3.0 describes the methodology to evaluate the flammability level of the gas mixture in the dome space. Details of the validity of the LFLs in air, ammonia liquid-vapor equilibrium model, time-dependent gas concentration model, and the flammability level calculations are discussed. Chapter 4.0 discusses the input data and results of the gas generation calculations and the flammability evaluations under various ventilation conditions. Chapter 5.0 provides the results of the flammability assessment on waste addition scenarios for DSTs. Chapter 6.0 gives the overall

summary and conclusions. Detailed formula, input data, and calculation results are given in Appendices A through G.

1.1 REVISION 1

Revision 1 of this report differs from Revision 0 in the following ways:

- The mass balance equation (Equation 3-5) and its derived equations in the methodology of flammability assessment section (Chapter 3.0) were modified by redefining the ventilation rate as the outlet measurement or calculated outlet flow for natural breathing as well as gas generation to reflect total gas leaving the tank.

- The input data and calculations for tank 241-SY-101 were updated to reflect the tank waste status after 616 kilo-gallons (kgal) of active flammable-gas-generation waste material were transferred between December 1999 and February 2000, as provided in RPP-6517, *Evaluation of Hanford High-Level Waste Tank 241-SY-101*. As of April 2001, the HGR in tank 241-SY-101 is 3.1 E-3 cubic feet per minute (ft^3/min), which is one-tenth the generation rate before the remediation task. Other than the data for tank 241-SY-101, all the input data used were taken from Revision 0, which presents data as of October 1999, unless noted in Revision 1.

- The liquid/vapor equilibrium model was added to address the behavior of the highly soluble gas ammonia.

- The off-normal ventilation calculations used in the flammability assessment were more clearly defined and text was added.

1.2 REVISION 2

Revision 2 is being issued to include the following:

- Revision 1 comments, from the U.S. Department of Energy's, were resolved. Primarily, the off-normal ventilation conditions were redefined and it was clarified that off-normal conditions rarely occur. Second, discussions on discrepancies of the ammonia mass transport properties between the field data-derived values and the direct calculation of mass transport coefficient h and using 100% surface area were redone. Third, several editorial errors were identified and corrected.

- HGRs for 177 tanks were updated to November 2001 using the waste composition information and detailed calculation report in the *Best Basis Inventory* (BBI) (CHG 2001a) and temperature data in *Surveillance Analysis Computer System* (SACS) (CHG 2001b) as the input data. In this revision, tank 241-AY-102 has the highest HGR instead of tank 241-AN-102 (Revision 1). This is because the updated input data for tank 241-AY-102 include the waste received from tank 241-C-106, and the tank also shows higher tank waste temperature.

- Flammability calculations for 177 tanks were updated to reflect the updated HGRs. For off-normal ventilation condition, the updated flammability calculations were performed at the barometric breathing rate for DSTs. For SSTs, two possible ventilation rates under off-normal conditions were considered, barometric breathing rate and zero ventilation rate. Although, in general, the zero ventilation condition is considered to be impossible because of the many openings into the tanks, many SSTs were sealed off as much as possible under the interim stabilization project and the pathway of barometric breathing has not been verified for those interim stabilization SSTs.

- Using BBI data of November 15, 2001 (CHG 2001a), tank 241-A-101 has the highest HGR among the SSTs, but the tank is undergoing salt well pumping, which will reduce both the HGR and flammability. The HGR and flammability are recalculated based on the latest waste volume information of February 28, 2002 (CHG 2002a and Parkman 2002) to reflect the salt well pumping activity.

- To address routine water addition and other possible waste transfer operations, flammability assessments were performed on several waste addition cases. The resulting information can be used to determine the flammable gas control for the ventilation surveillance frequency and the waste compatibility program.

1.3 GAS GENERATION

The gases generated in the tank waste include a mixture of hydrogen, nitrogen, ammonia, nitrous oxide, a small amount of methane, and other hydrocarbons. Hydrogen is the most abundant gas and contributes more than 90% of the flammable components in the dome space for most of the storage tanks containing gas-generating waste. All of these gases, except ammonia, have little solubility and are either fully released to the dome space or partially trapped in the solid layers of waste. Because of its high solubility, 99% of the ammonia generated is dissolved and stored in the liquid waste (PNNL-11450, *Composition and Quantities of Retained Gas Measured in Hanford Waste Tanks 241-AW-101, A-101, AN-105, AN-104, and AN-103*) rather than being released to the tank dome space. For most of the tanks, little methane is generated, but methane is the major species among the observed hydrocarbon vapors. Nitrous oxide is not flammable by itself, but it is an oxidizer. Studies provided in the Explosion Dynamics Laboratory Report FM97-4, *Flammability and Flame Propagation in H_2-N_2O-CH_4-NH_3-O_2-N_2 Mixtures*, (Pfahl and Shepherd 1997) show that concentrated nitrous oxide can lower the flammability limit of fuels in an air mixture.

Understanding the gas generation phenomena and predicting the gas generation and gas release rates are important in controlling the flammable gas hazard and planning daily operations in the tank farms. For example, the overall rate of generation is needed to verify that any given tank has sufficient ventilation to ensure the level of flammable gases is maintained below the operational flammability limit in the dome space. In the past, many studies (HNF-SP-1193, *Flammable Gas Project Topical Report*) have been completed for gas generation, gas release, and gas retention of tank waste using simulated or actual waste. Systematic tank waste characterization programs and various tank safety programs have generated a large amount of tank waste data. This information provided the basis for HNF-3851, *Empirical Rate Equation Model of Hydrogen Generation*. The model is tank-waste-constituent and tank-condition-based

and provides a tool to estimate the generation rate for current tank waste contents and tanks with contents that have changed. The other observed gases, ammonia, methane, and nitrous oxide do not have a general rate equation for calculating generation rates as a function of waste constituents.

This report provides the methodology for calculating gas release rates. The HGR equation model (HNF-3851) is used to estimate the hydrogen release rate by subtracting the field-observed gas accumulation rate, if any, from the model-calculated generation rate. The gas release rates for ammonia, methane, and nitrous oxide (the minor gases of interest observed in the dome space) are derived from vapor concentration data, ventilation rates in the dome space, and other information about tank waste.

While updating the HGR calculations for tank 241-SY-101 in Revision 1, the dome space steady-state ammonia concentration in tank 241-SY-101 rose from a pre-remediation concentration of 4 ppm (before the waste was transferred) to 400 ppm (January 14, 2001). Based on the value of 400 ppm, the derived ammonia release rate, if used as a constant, will predict a value of 108% LFL as the steady-state ammonia concentration under the off-normal condition of a loss of active ventilation. This is a factor of 50 larger than the equilibrium value predicted by the model. Apparently, treating the ammonia release rate as constant is over-conservative when the ammonia concentration in the dome space is high. Therefore, the liquid-vapor equilibrium model provided in RPP-4941, *Methodology for Predicting Flammable Gas Mixtures in Double-Contained Receiver Tanks*, is introduced into the methodology to address the ammonia concentration in the dome space.

A time-dependent equation for gas concentration in the tank dome space was developed by solving the mass balance equations for the gas volume. Once the steady-state gas release rates of insoluble gas or the mass transport properties of soluble gas are obtained, a time-dependent gas concentration can be derived from the equation for a given ventilation condition. Therefore, the flammability level of the gas mixture in the dome space can be calculated under normal and off-normal ventilation conditions. Also, the time required to reach a specified flammability level in the dome space and the minimum ventilation rate required to prevent reaching that level can be estimated.

2.0 HYDROGEN GENERATION RATE MODEL

Several hydrogen generation models have been proposed (WHC-EP-0702, *Criteria for Flammable Gas Watch List Tanks*; WHC-SD-WM-TI-724, *Methodology for Flammable Gas Evaluations*; WHC-SD-WM-SARR-015, *Topical Report on Flammable Gases in Non-Burping Waste Tanks*; PNNL-11297, *Status and Integration of Studies of Gas Generation in Hanford Wastes*; and HNF-SD-WM-CN-117) to estimate the HGR for Hanford Site tank waste, but these models are based on either the waste simulant data or very limited tank waste data. A more comprehensive HGR model (described in a paper presented at American Nuclear Society, 1999 Winter Meeting, *Empirical Rate Equation Model of Hydrogen Generation for Hanford Tank Waste*, and HNF-3851) was developed and validated based on a large amount of tank waste data. The model constructed a set of semi-empirical rate equations to simulate the gas generation mechanisms of thermal-chemical reactions, radiolysis of water and organic components, and corrosion processes. The rate equations are formulated as a function of physical and chemical properties of tank waste and are capable of estimating the HGR of waste under current conditions, as well as the rates for newly mixed waste with known properties. The model has been applied to calculate the generation rate for more than 30 SSTs and DSTs and shows good agreement with field-observed rates.

2.1 SEMI-EMPIRICAL RATE EQUATIONS

The total HGR (HNF-3851) in units of moles of hydrogen per day per kilogram of total waste consists of the thermal-chemical rate (HGR_{thm}), the radiolysis rate (HGR_{rad}), and the corrosion rate (HGR_{cor}). Equation 2-1 takes into account the dependence of the rate on tank waste composition, temperature, radiation level, and liquid fraction:

$$HGR = HGR_{thm} + HGR_{rad} + HGR_{corr} \tag{2-1}$$

where:

$$HGR_{thm} = a_{thm} \times r_f \times [TOC] \times [Al]^{0.4} \times L_f \times e^{-(Ethm/RT)}$$

$$HGR_{rad} = (G_{H2O} + G_{ORG} \times L_f) \times H_{load} \times CF_1$$

$$HGR_{corr} = R_{corr} \times A_{wetted} / M_{tank} \times CF_2$$

with

$$G_{ORG} = a_{rad} \times e^{(-Erad/RT)} \times (r_f \times [TOC])$$

$$G_{H2O} = 0.45 - 0.56 \times [NO_3^-]^{1/3} - 0.43 \times [NO_2^-]^{1/3}$$

and

E_{thm} = activation energy for thermal reaction (89.3 kJ/mole)

E_{rad} = activation energy for radiolytic reaction (44.3 kJ/mole)

a_{thm} = pre-exponential factor for thermal reaction (2.76 E+09 mole/kg-day)

a_{rad} = pre-exponential factor for radiolytic reaction (2.49 E+06 H_2/100 eV)

R	=	universal gas constant
T	=	temperature in Kelvin
TOC	=	total organic carbon concentration in moles per liter
Al	=	aluminum concentration in moles per liter
NO_2^-	=	nitrite ion concentration in moles per liter
NO_3^-	=	nitrate ion concentration in moles per liter
G_{ORG}	=	hydrogen yield per 100eV energy from organic radiolysis
G_{H2O}	=	hydrogen yield per 100eV energy from water radiolysis (G_{H2O} has a minimum value of 0.005 H_2/100 eV)
r_f	=	TOC reactivity coefficient (average value is 0.7 for DSTs and 0.4 for SSTs)
R_{corr}	=	corrosion coefficient [1.831 E-08 for DSTs and 3.666 E-08 for SSTs (m^3/min-m^2) at 25 °C]
H_{load}	=	heat load (Watt/kg)
L_f	=	liquid weight fraction in the waste
A_{wetted}	=	wetted surface area of the tank (m^2)
M_{tank}	=	total waste mass (kg) in the tank
CF_1	=	conversion factor to convert the units from (H_2/100eV)(Watts/kg) to (mole/kg-day)
CF_2	=	conversion factor to convert the units from (m^3/kg-min) to (mole/kg-day).

In general, the HGR caused by thermal-chemical reactions follows Arrhenius behavior and the rate from radiolysis is proportional to the radiation dose. In addition, the HGRs from radiation effects in tank waste samples have been observed to be temperature dependent as provided in PNNL-12181, *Thermal and Radiolytic Gas Generation on Material from Tanks 241-U-103, 241-AW-101, 241-S-106, and 241-S-102: Status Report*. The analysis of all available gas generation data provided in HNF-3851 shows that this temperature-dependent reaction follows Arrhenius behavior, which may result from a multi-step degradation of organic compounds initiated by radiolysis, followed by thermal reactions. The water radiolysis rate is assumed to be temperature independent, with the G_{H20} value reduced by scavenging effects from salts.

The numerical parameters in the equations are established by analyzing gas generation kinetic data from waste samples with the aid of tank field surveillance data and tank waste characterization data. The reactivity coefficient, r_f, was used to adjust for differences in reactivity of total organic carbon (TOC) among the tanks. HNF-3851 describes this model in detail.

3.0 METHODOLOGY TO ESTIMATE STEADY-STATE FLAMMABILITY LEVEL

This chapter describes the methodology used to evaluate the steady-state flammability level in the dome space for all DSTs and SSTs. The methodology also provides a technical basis for flammable gas controls in tank farm operations. The evaluation will address the flammability level in the dome space under both normal and off-normal ventilation conditions. In the evaluation, the steady-state gas release rates and ventilation rates are needed to derive the steady-state gas concentration under given ventilation conditions. Based on the flammable gas concentrations, the level of flammability of the mixture can be calculated. Under current normal ventilation conditions, the steady-state flammability level in the tank dome space is below 25% LFL for all tanks (HNF-3294, *Adequacy of Ventilation Rates to Remediate Flammable Gas Levels in Headspace of Hanford Tanks – Status Report*). The evaluation is focused on the flammable gas level under off-normal ventilation conditions.

Major gases of concern are hydrogen, ammonia, nitrous oxide, and methane in the tank dome space. Among these gases, hydrogen is the primary flammable gas in the tank dome space. The gas release rate of hydrogen in the dome space can be determined by subtracting the gas accumulation rate from the generation rate calculated with the rate equation model described in Chapter 2.0. The other two flammable gases, ammonia and methane, have much lower concentrations in the dome space and have no general model for calculating their gas generation rates; therefore, the steady-state gas release rates for ammonia and methane are estimated by their steady-state gas concentrations under normal ventilation conditions. However, ammonia is very soluble and its concentration in dome space is governed by the equilibrium between the liquid and dome space. The release rate of ammonia derived from the above method could be overestimated if the ammonia concentration in the dome space is high. Thus a liquid-vapor equilibrium model is introduced (RPP-4961) and modified in this report for ammonia calculation. Nitrous oxide is an oxidizer; the concern is whether its concentration is high enough to lower the LFL of hydrogen, ammonia, and methane as established in air. The gas release rate of nitrous oxide also is derived by the steady-state gas concentration under normal ventilation conditions.

To evaluate the flammable gas level, a time-dependent gas concentration model was established. This model can calculate the steady-state flammability level for a given ventilation condition. The model also can estimate the time required to reach certain flammability levels in the dome space under different ventilation conditions and calculate the minimum ventilation rate to keep the dome space below the specified flammability limit.

3.1 LOWER FLAMMABILITY LIMITS

National Fire Protection Agency codes require that operations be terminated when the concentration of flammable gases exceeds 25% LFL. Based on the empirical rule developed by Le Chatelier in the late 19th century, the LFL of mixtures of multiple flammable gases in air can be determined. Le Chatelier's rule, provided in Coward and Jones (1952), *Limits of Flammability of Gases and Vapors*, can be written in terms of the LFL concentration of the fuel mixture (LFL_m) and is provided in Equation 3-1:

$$LFL_m = \frac{100\%}{\sum_i^n \left(\frac{C_i}{LFL_i} \right)} \tag{3-1}$$

where:

C_i = volume percent of fuel gas *i* in the fuel gas mixture

LFL_i = volume percent of fuel gas *i* at its LFL in air alone.

If LFL_m is greater than 100%, the mixture is above the LFL. In the tank dome space, hydrogen gas is the fuel of concern; other gas fuels identified are ammonia and methane. WHC-SD-WM-ES-219, *Laboratory Flammability Studies of Mixtures of Hydrogen, Nitrous Oxide, and Air*, shows that the LFL_m of a mixture of hydrogen, ammonia, and methane in an air-nitrous oxide atmosphere can be computed using Le Chatelier's rule as presented in Equation 3-2:

$$LFL_m = \left(\frac{[H_2]}{LFL_{H2}} + \frac{[NH_3]}{LFL_{NH3}} + \frac{[CH_4]}{LFL_{CH4}} \right) \times 100\% \tag{3-2}$$

where:

$[H_2]$ = volume percent of hydrogen in the fuel gas mixture

$[NH_3]$ = volume percent of ammonia in the fuel gas mixture

$[CH_4]$ = volume percent of methane in the fuel gas mixture

LFL_{H2} = volume percent of hydrogen at its LFL in air alone

LFL_{NH3} = volume percent of ammonia at its LFL in air alone

LFL_{CH4} = volume percent of methane at its LFL in air alone.

For simplicity, flammable gases with concentrations lower than methane are omitted. The flammability of the individual gases in air is fairly well characterized. The LFL_{H2}, LFL_{NH3} and LFL_{CH4} are 4, 15, and 5%, respectively, at the upward propagation LFL, which is more conservative than the downward propagation LFL. In addition to the flammable gases included in Equation 3-2, nitrous oxide was observed in the tank dome space. Nitrous oxide plays the role of oxidizer in the mixture and has the potential to decrease the amount of fuel required to reach the LFL. The effect of the multiple oxidizers (e.g., nitrous oxide and oxygen) was not addressed in Equation 3-2.

Pfahl and Shepherd (1997) from the California Institute of Technology have written a series of flammability studies on gas mixtures generated from Hanford Site tank waste. The studies show that the established LFLs of individual fuels in the air will decrease if concentrated nitrous oxide is present in the mixtures. For example, in the mixture NH_3-N_2O-air with a ratio of 13.2-19.8-67.0, the system will be flammable, although the ammonia volume percent is 13.2 and is lower than the LFL_{NH3} of 15% in air. This fuel-oxidizer mixture will be flammable with the ammonia volume percent as low as 8% if the nitrous oxide concentration is 65%. For NH_3-N_2O-air mixtures, Pfahl and Shepherd (1997, Figure 32) suggest the ammonia flammability

limit will be 15% if the nitrous oxide does not exceed 8%. These test results are for turbulent conditions, with an ignition energy of 8 Joules (J). For a CH_4-N_2O-air mixture, the data show that the ratio of 4.5-10.1-85.4 is not flammable. For an H_2-N_2O-air mixture, the data show that a mixture with the ratio of 5.7-10-84.3 has incomplete combustion. It should be noted here that the ignition energy of 8 J used in these experiments is very large compared to the energy in most electrostatic discharge sparks (typically a few millijoules) that might occur inside a Hanford Site tank.

This information suggests that the flammability limit established in the fuel-air mixture for each gas will not be reduced unless the nitrous oxide volume percent exceeds 8%. In this evaluation, the volume percents of 4, 15, and 5 will be used for LFL_{H2}, LFL_{NH3} and LFL_{CH4}, respectively, in Equation 3-2. In the calculations in Chapters 4.0 and 5.0, the concentration of nitrous oxide is evaluated and limited to less than 8%, therefore, the oxidizer effect of lowering these flammability limits can be ignored.

3.2 VENTILATION CONDITIONS IN TANK DOME SPACE

Under normal operating conditions, the ventilation conditions can be active ventilation or passive ventilation. The tank dome spaces of all DSTs and some SSTs are equipped with an active ventilation system. For active ventilation systems, the main ventilation flow is designed to go through an installed inlet filter. The AP Tank Farm is an exception to this system; inlet air flows through cover blocks or gaps in riser covers, and other tank openings. The size of the inlet openings was designed to be either fully adjustable or to have an on-off valve. These filtered inlets are used to control the ventilation rate and to adjust the negative pressure to prevent leakage of tank hazardous materials or to provide control for other operational needs.

For passively ventilated tanks, the ventilation flows mainly through high-efficiency particulate air (HEPA) breather filters. Under normal operating conditions, the active ventilation rates range from 100 to 700 ft^3/min, while the passive ventilation rates typically range from 0.5 to 10 ft^3/min. On actively ventilated tanks, the off-normal operating ventilation condition considered in the flammability assessment is that the ventilation system is shut down and the air inlet is closed. On passively ventilated tanks, the HEPA breather filter isolation valve is closed or a blank is installed. For these conditions, the only venting flow is through the gaps between the cover blocks or riser covers.

The off-normal condition allows three possible tank ventilation conditions: no ventilation flow; ventilation flow caused only by barometric breathing; or ventilation flow caused by natural breathing, which is a combination of ventilation by barometric breathing plus thermal convection. The barometric breathing rate (V_{bb}) is estimated as 0.45% of the dome space volume per day (WHC-EP-0651, *Barometric Pressure Variations*) and is given in Equation 3-3:

$$V_{bb} = 0.45\% \cdot Vol_{headspace} \left(\frac{ft^3}{day} \right) \tag{3-3}$$

where:

$Vol_{headspace}$ = volume of the tank dome space (ft^3).

During off-normal operating conditions, the most likely ventilation rate is either natural breathing or barometric breathing. The natural breathing rate is estimated to be 5 to 10 times the barometric breathing rate, but the estimation of the thermal convection flow is not available. In general, the zero-flow condition is considered to be impossible because of the many openings into the tanks. However, since 1980, a great effort has been made to seal-off openings as much as possible for SSTs under the interim stabilization project to prevent water intrusion.

In the flammability evaluations, the barometric breathing rate, which is more conservative but reasonable, will be used for the ventilation rate for DSTs when normal ventilation is not present. For SSTs, the barometric breathing rate and zero ventilation rate will be evaluated under off-normal ventilation condition. Using a tracer gas, the measured passive ventilation rates (PNNL-11925, *Waste Tank Ventilation Rates Measured with A Tracer Gas Method, Fiscal Year 1998 Summary*) under normal ventilation conditions in SSTs ranged from 1.7 to 10 ft^3/min for most tanks.

No similar measurements for the passive rates are available for DSTs (i.e., the active ventilation system is shut down with the air-inlet open). Unfortunately, no ventilation rate measurements have been made for the condition where the air inlet is shut off. For the off-normal condition, based on Equation 3-3, the calculated barometric breathing rate for most tanks is around 0.5 ft^3/min or less (as shown in Table D-2 of Appendix D), which is one-third to one-twentieth of the normal conditions.

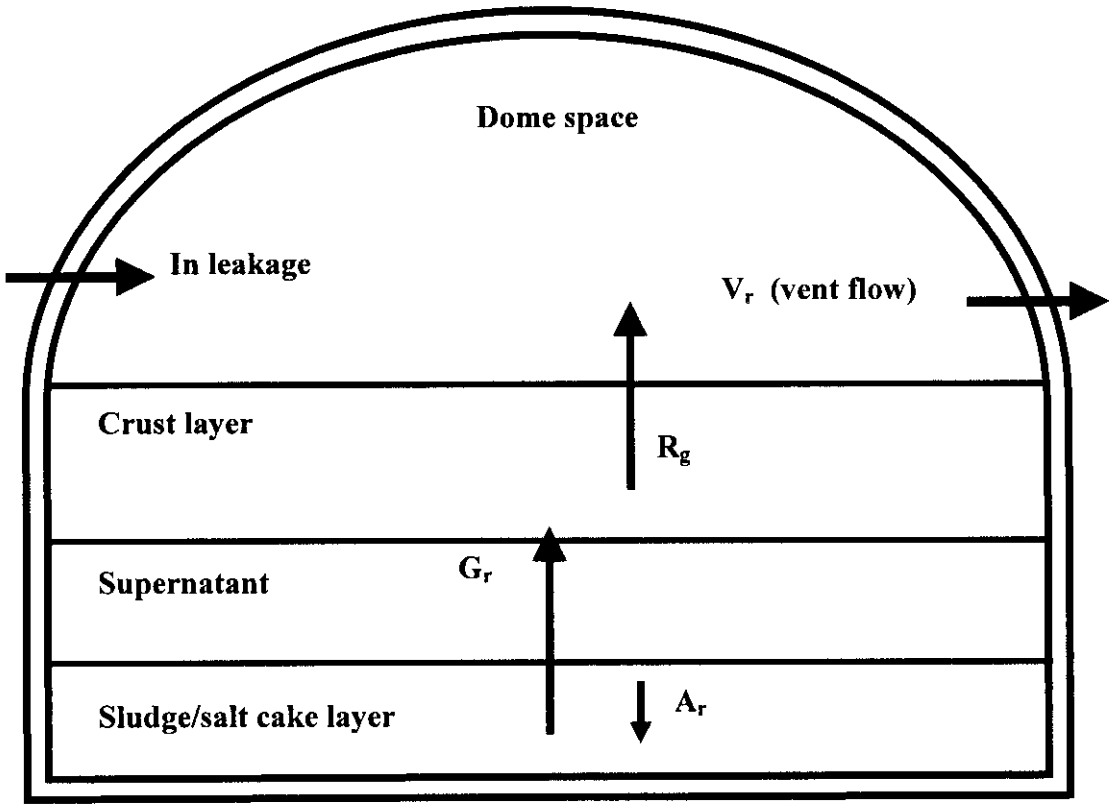
3.3 TIME-DEPENDENT GAS CONCENTRATION MODEL

An equation was developed to calculate the time-dependent flammable gas concentration in the tank dome space. The concentration is a function of the gas release rate and the ventilation rate. Figure 3-1 shows a simplified tank dome space system.

In general, most of the tanks contain supernatant liquid and sludge/salt cake layers. A few tanks, including tank 241-AN-103, have a thin crust layer above the supernatant liquid. The gas release rate (R_g) is the net result of the generation rate (G_r) and the accumulation rate (A_r). The gas accumulation rate refers to the rate at which gas is trapped in the sludge/salt cake layer. The ventilation flows (V_r) are available as field measurements taken at the output streams. These flows are the sum of air inflows from the inlets, tank cracks and openings, and the gases released from tank waste. The gas volume change rate can be formulated from a mass balance as provided in Equation 3-4:

$$\text{Gas Change Rate in Tank Dome Space} = \text{Gas Release Rate from the Waste Surface} - \text{Gas Exit Rate} \qquad (3\text{-}4)$$

Figure 3-1. A Simplified Tank System for Time-Dependent Gas Concentration Model.



3.3.1 Insoluble Gas

For the less soluble gases such as hydrogen or methane, the gas release rate can be considered to be constant; therefore, the mass balance equation can be written as a differential equation as given in Equation 3-5:

$$Vol\frac{\partial[C_g]}{\partial t} = R_g - V_r \cdot [C_g] \tag{3-5}$$

where:

$[C_g]$ = gas concentration (volume percent)
Vol = volume of the tank dome space (volume)
R_g = gas release rate from the waste surface (volume/time)
V_r = ventilation rate in the dome space (volume/time).

As given in Equation 3-5, the gas exhaust rate is simply the gas concentration times the output ventilation rate. By solving the differential Equation 3-5, a time-dependent gas concentration at time t, $[C_g]_{\%}(t)$, in units of volume percent is given in Equation 3-6:

$$[C_g]_{\%}(t) = [C_g]_{\%}(t_0)\exp(-\lambda t) + \left[\frac{R_g}{V_r}\right]_{\%}[1-\exp(-\lambda t)] \tag{3-6}$$

with

λ = V_r / Vol

where:

R_g	=	hydrogen release rate from the waste surface (volume/time)
V_r	=	ventilation rate in the dome space (volume/time)
$[C_g]_{\%}(t_o)$	=	initial gas concentration at time t (volume percent)
Vol	=	volume of the tank dome space (volume)
λ	=	decay parameter from the venting (inverse time).

In Equation 3-6, the first term represents how the initial gas concentration decays away exponentially with the factor of $e^{(-\lambda t)}$ and second term represents how the gas level builds up in the form of $[R_g/V_r]_{\%}$ with the factor of $[1- e^{(-\lambda t)}]$ as time goes on.

3.3.2 Soluble Gas

For a highly soluble gas such as ammonia, the gas release rate from liquid waste is not a constant, but depends on the material transport properties and the ammonia concentration gradient between the liquid and vapor phases and appropriate Henry's Law constants. Thus, the differential equation of mass balance in Equation 3-5 and the time-dependent gas concentration Equation 3-6 have different formats. For a closed system, Henry's Law describes the relationship of a soluble gas in the liquid and vapor phases as provided in Equation 3-7:

$$C_l = K_H \cdot P_g \tag{3-7}$$

where:

C_l	=	ammonia concentration in the liquid phase (mole/L)
K_H	=	Henry's Law constant (mole/L-atm)
P_g	=	partial pressure of the ammonia (atm).

The Henry's Law constant is a function of temperature in pure water. In mixed salt solutions, Henry's Law constants are functions of both temperature and concentrations of the ions in the solution. Weisenberger and Schumpe (1996), "The Estimation of Gas Solubility in Salt Solutions at Temperature from 273 K to 363 K," AICHE Journal, provide a formula to calculate Henry's Law constant as given in Equation 3-8:

$$K_H = K_H{}^o \cdot 10^{-\sum_i (h_i + h_g) \cdot C_i} \tag{3-8}$$

with

$K_H{}^o = e^{(-8.0964+3917.5/T-0.00314T)}$

where:

$K_H{}^o$ = Henry's Law constant in the pure water (g-mole/L-atm)

h_i = ionic dependent coefficient

h_g = gas specific constant for ammonia

C_i = ion concentration in the solution.

However, the Weisenberger and Schumpe (1996) formula is good only for the solution up to 5 g-mole per liter (M). RPP-4941 reported Henry's Law constants for tank 241-SY-101 simulant waste at different dilution conditions and temperatures. This study includes solution concentrations ranging from 5 to 21 M at temperatures of 20 °C to 70 °C. These results provide a correction factor to the calculated Henry's Law constant from the Weisenberger and Schumpe (1996) formula. For example, the measured Henry's Law constant is five times the calculation from the Weisenberger and Schumpe (1996) formula for the undiluted sample of 21 M at 70 °C.

For soluble gas, the gas release rate depends on the equilibrium mechanism between the liquid and vapor phases described earlier. A comprehensive soluble gas transfer methodology applied to Hanford Site waste is provided in RPP-4941. Consider the two-film theory of gas transfer. The ammonia release will encounter the resistance from two films, the liquid film and the gas film, between the bulk liquid and bulk vapor phases. The release rate is proportional to the difference between the ammonia liquid concentration and the ammonia vapor concentration before reaching equilibrium. It also is proportional to the mass transport coefficient, h, and the effective area, A. Therefore, the release rate can be derived as shown in Equation 3-9:

$$R_g = h \cdot A \cdot (C_l - C_l^{EQ}) = h \cdot A \cdot (C_l - K_H \cdot P_g) = h \cdot A \cdot (C_l - K_H \cdot P \cdot v \cdot C_g) \tag{3-9}$$

where:

h = overall mass transport coefficient from liquid to vapor (m/sec)

A = effective area for the transport (1000 x m^2)

C_l^{EQ} = corresponding liquid ammonia concentration in equilibrium at the current ammonia vapor pressure (g-mole/L)

C_l = current ammonia concentration in liquid (g-mole/L)

P_g = ammonia gas partial pressure (atm)

P = dome space total pressure (atm)

v = specific molar volume of gas in the dome space (L/mole)

C_g = current ammonia concentration in the dome space (g-mole/L)

K_H = Henry's Law constant (mole/L-atm).

As shown in Equation 3-9, the ammonia gas release rate clearly is a function of the ammonia concentrations in the liquid and vapor phases and the Henry's Law constant for ammonia in the solution. In the two-film theory of gas transfer, the overall mass transport coefficient, h, contains the transport coefficient, h_l, for gas through the liquid film and h_g for the gas through the gas film. Equations of the calculated h are described in RPP-4941 and summarized in Appendix B.

A sensitivity study indicates that the overall mass transport coefficient, h, varies by several factors, while the effective tank waste surface area, A, for mass transport is difficult to determine, particularly for the SSTs where the waste surfaces are mostly crusts. Dome space ammonia concentrations would be overestimated by several orders of magnitude if the full area for the SST is used as the effective transport surface. As discussed in Section 3.4, however, the product of h and A can be determined by field data at steady-state conditions. Once h times A is determined, the gas release rate can be calculated by Equation 3-9. Applying the ammonia release rate from Equation 3-9 to the mass balance in Equation 3-5 results in Equation 3-10:

$$Vol\frac{\partial[C_g]}{\partial t} = h \cdot A \cdot (C_l - K_H \cdot P \cdot v \cdot C_g) - [V_r] \cdot [C_g] \tag{3-10}$$

Dividing by Vol and rearranging the terms, Equation 3-10 becomes Equation 3-11:

$$\frac{\partial[C_g]}{\partial t} = k_2 - k_1 \cdot [C_g] \tag{3-11}$$

with $$k_1 = [V_r + h \cdot A \cdot K_H \cdot P \cdot v]/[Vol]$$

and $$k_2 = [h \cdot A \cdot C_l]/[Vol].$$

The solution of Equation 3-11 is given as Equation 3-12:

$$[C_g](t) = [C_g](t_0)\exp(-k_1 \cdot t) + \left[\frac{k_2}{k_1}\right][1 - \exp(-k_1 \cdot t)]. \tag{3-12}$$

3.4 STEADY-STATE GAS CONCENTRATION AND GAS RELEASE RATE

For insoluble gas, when the systems reach steady state (set time, t, to infinity in Equation 3-6), the exponential term drops out from Equation 3-6 and a steady-state gas concentration is given in Equation 3-13:

$$[C_g]_{\%}^{ss} = \left[\frac{R_g}{V_r}\right] \times 100\% \tag{3-13}$$

where:

$[C_g]_{\%}^{ss}$ = steady-state gas concentration (volume percent)

R_g = gas release rate (volume/time)

V_r = ventilation rate in the dome space (volume/time).

Using Equation 3-13, the steady-state gas concentrations in the tank dome space can be calculated by knowing the gas release rate and the ventilation rate. The gas release rate, R_g, can be estimated by subtracting the gas accumulation rate from the gas generation rate as shown in Equation 3-14:

$$R_g = G_r - A_r \tag{3-14}$$

where:

R_g = gas release rate (volume/time)
G_r = gas generation rate from waste (volume/time)
A_r = gas accumulation rate due to gas trapping (volume/time).

For hydrogen, the generation rate can be calculated using the empirical rate equation described in Section 2.1. The accumulation rate (HNF-3851) can be determined in the field, based on the waste level change rate and the gas composition data from the retained gas sampler. If the waste level does not change noticeably, the hydrogen release rate will be the same as the HGR.

For other insoluble gases, no gas generation rate model is available. Therefore, the steady-state gas release rate can be estimated from the known steady-state concentration in the dome space under normal ventilation conditions by rearranging Equation 3-13 as shown in Equation 3-15:

$$R_g = \left(\frac{[C_g]_{\%}^{ss}}{100} \right) \cdot V_r \tag{3-15}$$

where:

R_g = gas release rate (volume/time)
$[C_g]_{\%}^{ss}$ = steady-state gas concentration (volume percent)
V_r = ventilation rate in the dome space (volume/time).

In this report, the gas release rates for methane and nitrous oxide were obtained from their steady-state concentrations under normal ventilation conditions using Equation 3-15. Then the calculated gas release rate was used to calculate the steady-state concentrations for off-normal conditions. This methodology is a reasonable way to determine methane concentrations under off-normal conditions because methane is insoluble and whatever gases are generated are directly released to the tank dome space.

For highly soluble gases (similarly, set time, t, to infinity in Equation 3-12) the steady-state concentration can be expressed as Equation 3-16:

$$[C_g]_{\%}^{ss} = \left[\frac{k_2}{k_1} \right] = \left[\frac{h \cdot A \cdot C_l}{V_r + h \cdot A \cdot K_H \cdot P \cdot v} \right] \times 100\% \tag{3-16}$$

As discussed in Section 3.3, the mass transport properties (the product of h and A) are difficult to estimate directly from tank waste properties, particularly for tank waste covered with an irregular crust layer. However, for the known steady-state vapor concentration $[C_g]_{\%}^{ss}$, the liquid concentration C_l; along with Henry's Law constant and the ventilation rate V_r, the product of h and A can be determined. By rearranging Equation 3-16, the product of h and A can be expressed as Equation 3-17:

$$h \cdot A = \left[\frac{[C_g]_{\%}^{ss} \cdot V_r}{(C_l - K_H \cdot P \cdot v \cdot [C_g]_{\%}^{ss})} \right] \tag{3-17}$$

Once the product of h and A is determined from the steady state under normal ventilation conditions, the steady-state concentration under off-normal condition can be calculated using Equation 3-16. In addition, under the off-normal ventilation conditions, the ammonia concentration can be estimated using the time-dependent gas concentration of Equation 3-12, as well as the gas release rate of Equation 3-9.

Note that the product of h and A depends on the waste configuration and will be different if the waste is disturbed or changed physically. For the off-normal ventilation calculations, the overall steady-state ammonia concentration is governed by the liquid ammonia concentration. The product of h and A will change only the ammonia release rate, which indicates how fast the system will reach the steady state.

The steady-state flammability evaluation is based on current tank waste data at storage conditions. For those tanks actively receiving waste, including tanks 241-AP-108 and 241-AN-101 as dilute receiver tanks, the flammability level will be re-evaluated during the waste transfer compatibility assessment based on the predicted post-transfer condition of the tank waste. For hydrogen, the release rate can be calculated based on the predicted tank waste condition using this rate equation model. For methane, because steady-state methane vapor data are not available before the waste transfer, the release rate will be estimated as 10% of the model-calculated HGR. This is a reasonable estimate because, for all tanks, methane is less than 10 volume percent of the hydrogen in the generated gas as provided in PNNL-12181 and the retained gas sampler results in PNNL-13000, *Retained Gas Sampling Results for the Flammable Gas Program*. For ammonia, instead of estimating the release rate, the ammonia vapor concentration at thermodynamic equilibrium for a given waste condition will be used as a bounding value in the flammability level evaluation. This ammonia vapor concentration can be calculated based on the measured liquid ammonia concentration and other tank waste conditions using Henry's Law and the Weisenberger and Schumpe (1996) model as described earlier. For the off-normal ventilation condition, which is about 0.5 ft^3/min or lower, an equilibrium prediction of the ammonia concentration is reasonable and conservative.

3.5 TIME TO REACH LOWER FLAMMABILITY LIMIT

For active ventilation system interruptions, the time for the tank dome space to build up to flammable gas concentrations exceeding the LFL is one of the main concerns of this evaluation. A time-dependent LFL of the mixture, $LFL_m(t)$, can be calculated using the time-dependent gas concentration (Equation 3-6 for insoluble gas or Equation 3-12 for soluble gas) and Le Chatelier's rule (Equation 3-2) as provided in Equation 3-18:

$$LFL_m(t) = \left(\frac{[H_2](t)}{LFL_{H2}} + \frac{[NH_3](t)}{LFL_{NH3}} + \frac{[CH_4](t)}{LFL_{CH4}} \right) \times 100\% \tag{3-18}$$

where:

$[H_2](t)$	=	hydrogen concentration (volume percent) at time t
$[NH_3](t)$	=	ammonia concentration (volume percent) at time t
$[CH_4](t)$	=	methane concentration (volume percent) at time t
LFL_{H2}	=	volume percent of hydrogen at its LFL in air alone
LFL_{NH3}	=	volume percent of ammonia at its LFL in air alone
LFL_{CH4}	=	volume percent of methane at its LFL in air alone.

The volume percent of the LFLs; LFL_{H2}, LFL_{NH3}, and LFL_{CH4} are 4, 15, and 5%, respectively, which have been established for a fuel-air mixture.

The time to reach a specified gas concentration under given ventilation conditions for insoluble gas can be obtained by rewriting Equation 3-6 as Equation 3-19:

$$t = \frac{\ln\left\{ \frac{R_g - V_r \cdot C_g(t_0)}{R_g - V_r \cdot C_g(t)} \right\}}{\lambda} \tag{3-19}$$

with

λ = V_r /Vol

where:

R_g	=	gas release rate (volume/time)
V_r	=	barometric breathing rate (volume/time)
$[C_g](t_o)$	=	initial gas concentration at time t_o (ppmv)
$[C_g](t)$	=	gas concentration at time t (ppmv).

Similarly, for soluble gases, the time to reach a specified gas concentration under a given ventilation condition can be obtained by rewriting Equation 3-12 as Equation 3-20:

$$t = \frac{\ln\left\{\dfrac{k_2 - k_1 \cdot C_g(t_0)}{k_2 - k_1 \cdot C_g(t)}\right\}}{k_1} \tag{3-20}$$

with $$k_1 = [V_r + h \cdot A \cdot K_H \cdot P \cdot v]/[Vol]$$

and $$k_2 = [h \cdot A \cdot C_l]/[Vol].$$

However, the time to reach a specified flammability limit of the mixture was not calculated explicitly. A customized EXCEL[1] macro function, which was developed using Visual Basic[2] and is based on Equation 3-19 for an insoluble gas and Equation 3-20 for a soluble gas, is used to calculate the time to reach a specific flammability limit.

3.6 MINIMUM VENTILATION RATE TO MAINTAIN DOME SPACE BELOW 25 OR 100 PERCENT LOWER FLAMMABILITY LIMIT

Whether the dome space of a tank reaches the specified flammability limit depends on the competition between the gas release rates and the ventilation rates of the system. For steady state, the flammability limit of the mixture in the dome space can be calculated using Equation 3-2. A minimum ventilation rate is defined as the ventilation rate in which the steady-state concentrations will just reach the specified steady-state flammability limit. The required steady-state gas concentrations in Equation 3-2 can be calculated using Equation 3-13 and Equation 3-16 for insoluble and soluble gas, respectively. If the dome space ventilation rate is larger than this minimum, the system will never reach the specified flammability limit. The ventilation rate is embedded in Equation 3-2, and a customized EXCEL macro function developed in Visual Basic code is used to calculate the minimum ventilation needed to reach the specified flammability limit.

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[1] EXCEL is a registered trademark of Microsoft Corporation.

[2] Visual Basic is a registered trademark of Microsoft Corporation.

4.0 EVALUATIONS OF STEADY-STATE FLAMMABILITY LEVEL

In this chapter, steady-state gas releases from the 28 DSTs and 149 SSTs are evaluated quantitatively against tank ventilation conditions using the methodology described in Chapters 2.0 and 3.0 to determine if the resulting flammability level becomes a safety concern.

Section 4.1 contains the calculated HGRs and discusses collection of input data and setup of the EXCEL spreadsheet for rate calculations. Section 4.2 includes ventilation rates data collection, estimates of ventilation rates for both normal and off-normal conditions, and the steady-state gas concentrations under normal ventilation condition. Section 4.3 discusses the steady-state gas release rates for the flammability level evaluation. For hydrogen, the gas release rate is the net result of the model-calculated gas generation rate minus the field-estimated gas accumulation rate. For ammonia, methane, and nitrous oxide, the gas release rates were extrapolated from steady-state concentrations at normal ventilation rates. However, the ammonia concentration is governed by the equilibrium mechanism between liquid and vapor phase, and the gas release rate of ammonia extrapolated from Section 4.3 could be overestimated. Section 4.4 reanalyzes the ammonia concentration with the liquid/vapor equilibrium model as described in Sections 3-3 and 3-4 for those tanks showing high predicted steady-state ammonia concentrations (more than 0.5%) and total flammability levels exceeding 25% LFL under off-normal ventilation conditions as reported in Revision 0.

Section 4.5 describes the evaluation of flammability levels in the tank dome space for all 177 tanks. The evaluations calculate the flammability level for the normal ventilation condition and the off-normal ventilation condition. For the off-normal condition, the evaluations are carried out at barometric breathing rate for 177 tanks, and at zero ventilation rate for SSTs. The flammability evaluations at barometric breathing rate for 177 tanks include the time required to reach various flammability levels and the minimum ventilation rate required to keep the tank dome space concentration below the specified flammability limit.

Details of the results of the inventory data from BBI and surveillance data from SACS, HGR calculations, ammonia mass transport properties, and flammability evaluations in the tank dome space for the 177 tanks are given in Appendices A through F. Appendix G validates the HGR calculation from empirical rate equations and flammability evaluations independently using tank 241-AY-102 as an example. Appendix G also gives a preliminary uncertainty analysis on both the HGR calculation and the flammability evaluation using a Monte Carlo simulation for tank 241-AN-104. Appendix H provides the Peer Review Checklist.

4.1 HYDROGEN GENERATION RATE MODEL CALCULATIONS

The HGRs were calculated for each tank based on the semi-empirical rate equation model. The total generation rate was calculated for each waste layer in each tank. The generation rate is a function of tank waste conditions; thus, a large tank waste database is needed. The analytical and surveillance data necessary to perform the rate calculations are available for some tanks. For tanks without current measured data, process history data and waste type information were used.

An EXCEL spreadsheet was set up to calculate HGRs for all 177 Hanford Site DSTs and SSTs. The spreadsheet provides input data (Section 4.1.1), derived data (Section 4.1.2), and calculated unit rates and total rates (Section 4.1.3). The spreadsheet was set up to allow easy upgrades and to facilitate checking the rate calculations.

4.1.1 Input Data

Tank waste data are grouped as supernatant and solid layer. The supernatant is the liquid waste above the solid layer. The solid layer contains salt cake and/or sludge, and the interstitial liquid and/or retained gas within them. Data required from each waste layer to estimate hydrogen generation include:

- Concentrations of TOC, nitrate ion, nitrite ion, and aluminum in the liquid phase
- Total heat load for cesium and strontium
- Liquid and bulk densities
- Tank waste volumes
- Weight percent of water
- Tank waste temperature
- Tank dome space temperature.

The various input data collected for HGR calculation are used as follows:

- TOC data are used as an indicator of organic species because organic species provide the source term for thermolysis and organic radiolysis

- Aluminate is a catalyst in the thermal-chemical reaction and its concentration is used in the thermolysis rate calculation

- Nitrate and nitrite concentrations are used to estimate the scavenger effect for radiolysis of pure water

- Tank waste temperature is needed to calculate the radiolysis G-value and to account for the Arrhenius behavior of the thermolysis rate

- Cesium and strontium concentrations are used to estimate the heat load of the tank waste, which is the power source for both water and organic radiolysis

- Weight-percent water data are used to estimate the liquid fraction of the waste because the model considers gas generation reactions occur more effectively in the liquid phase

- Density and waste volume are used to calculate the total mass of the waste and to estimate the wetted tank surface area when calculating corrosion rates

- Temperature in the tank dome space is used to convert the total gas generation rate from a moler to a volumetric basis.

The BBI tank characterization database and SACS were queried to obtain the required waste properties and compositions. Data not available from the databases were estimated based on the methodology presented in SNL-000198, *Flammable Gas Safety Analysis Data Review*. In Revision 0 of this report, the input data used were prepared based on data available as of October 1999 and documented in RPP-6069, *Input Data for Hydrogen Generation Rate Model Calculation*. In Revision 2 of this report, the following input data are updated to November 2001. The input data of waste compositions including TOC, nitrate ion, nitrite ion, aluminum, cesium, strontium, density, and volume were queried from the BBI detail calculation database (CHG 2001a). The required temperature data of the tank waste and tank headspace were obtained from the SACS (CHG 2001b). However, the required weight-percent water data for 177 tanks were not available from the BBI so the values used in Revision 0 were used. In addition, for about 40 SSTs, the concentrations of TOC, nitrate ion, nitrite ion, and aluminum in liquid phase were not available from the BBI detail calculations so the values prepared in Revision 0 were used.

The BBI detail calculation database (CHG 2001a) was rebaselined systematically to have a uniform waste layer and type, and updated waste volume, density, and waste compositions. Note that the date of data quoted in parenthesis is referred to as the date of data published, but is not the date of data gathering. The actual date of the data gathering can be found in the inventory derivation documents. This database has the elements of the required input data for waste composition except weight-percent water. To extract information from the BBI detail report to the format of the required input data, the following activities were performed:

- The required data were downloaded from the BBI detail calculation database and listed in Appendix A.

- In BBI detail calculations, more than one density was used in a waste layer for a number of tanks. A single representative density was chosen for each waste layer for 177 tanks, and the data were listed in Table A-1 of Appendix A.

- In BBI detail calculations, the multiplier was introduced to compensate for differences in weight-percent water and density when the concentration data came from different data sources for a given waste layer. The concentrations used in the input data of Revision 2 of this report were recalculated by dividing the inventory of each analyte with the chosen representative density and the waste volume as:

  In BBI: $$Inventory = density \times Volume \times Concentration \times Multiplier \quad (4\text{-}1)$$

  In this report: $$NewConcentration = Inventory \div (SelectedDensity \times Volume) \quad (4\text{-}2)$$

- The input data required information from the supernatant liquid layer, solid layer (the waste below the supernatant liquid layer), and total waste. The values of waste composition from various waste types of the solid layer were weight averaged to one value. The data of total waste are weight averaged from the data of supernatant and solid layers.

- The concentrations of TOC, nitrate ion, nitrite ion, and aluminum in the liquid phase and the liquid density for solid layer were assigned the same value as the supernatant if no

interstitial liquid data were available. The final waste inventory data are listed in Table A-2 of Appendix A. The *Tank Waste Information Network System* (TWINS) (CHG 2001c) BBI database is frequently updated. Since it is difficult and time-consuming to restore the database to a given time, TWINS/BBI information should be downloaded and stored electronically to allow re-creation of the data collection. Attached to selected copies of this report (see distribution sheet) is a compact disk that contains information downloaded from the BBI detail calculations.

In the BBI database, the total waste volume is divided into three parts: solid, liquid, and retained gas (if any). In the detail calculation report, the volume of retained gas is not reported because it has no contribution to the analytes inventory. Although the retained gas has no contribution to the HGR calculations, it is part of the total waste volume and will impact the headspace volume calculation, and thus the flammability calculations. Appendix A, Table A-3, lists the tanks with reported retained gas inventory from the BBI derivation document in TWINS.

The temperature data of tank waste and tank headspace were obtained from SACS (CHG 2001b). The maximum temperature from November 1, 2000, to November 1, 2001, was used. The maximum value over a 1-year period throughout the tank was used to cover the seasonal effect and to prevent the possible underestimation of the temperature gradient vertically caused by cooling if the average value were used.

With the given tank waste inventory data, physical properties such as volume and density, and the waste and headspace temperature data as discussed above, an input data spreadsheet for HGR calculation was prepared and is provided in Appendix B, Table B-1. For the data not available from BBI and SACS, the information and data from Revision 0 are used.

In Revision 0 of this report, missing data were estimated based on the methodology presented in SNL-000198. Waste tanks were first classified into one of six groups, based on the volumes of the liquid, salt cake, and sludge layers. Criteria for various tank classifications also are presented in SNL-000198. Data from tanks in a given classification were used to create a distribution that was assumed to describe the total population of data for a given tank classification. This distribution was used to provide a range of data including the missing data. In cases where insufficient data were available to create a statistically valid distribution, data from similar groups of tanks were combined to create a distribution of data (SNL-000198). For single-point calculations, the mean of the distribution is used to describe the missing values. In the Monte Carlo statistical analyses, all data for the tank waste classification was used.

The methodology of providing values and distributions for missing data was not optimized to provide the "best" waste properties or compositions with respect to waste chemical makeup. This methodology was prepared to determine missing data for flammable gas safety analyses. Because analytical data for all waste types are insufficient to estimate the missing data at the waste-type level, the methodology in SNL-000198 was used to determine overall composition ranges when a finer resolution of data was not statistically justified. As a result, the mean values used in this analysis were not optimized based on waste characteristics, but were developed to fit the available data related to flammable gas safety analyses.

The HGR for tank 241-A-105 has not been calculated. As described in HNF-SD-WM-SAR-067, *Tank Farms Final Safety Analysis Report* (FSAR), Chapter 2.0, the steel liner leaked and the

tank has been interim stabilized. The waste moisture content is unknown, but is expected to be very low. The HGR is very sensitive to moisture content (the main hydrogen source). Because this key parameter is unknown and cannot be estimated, no attempt is made to estimate the corresponding HGR.

4.1.2 Derived Data

Once the input data were provided, the derived data were calculated before performing the final rate calculations. In the "derived data section" the input data are converted to the system of units used in the equations and other necessary parameters are derived. The derived data includes waste level, tank surface area wetted by the waste, total mass, liquid fractions of the layers, layer head load, layer density, total heat load, conversion of nitrate ion and nitrite ion to units of "moles per liter," conversion of TOC and aluminum to units of "weight percent," water radiolysis and total radiolysis G-values. The derived data section is two fold: First, necessary unit conversions were put into the spreadsheet so the spreadsheet can take the input data directly from the tank characterization database. Second, it prepares the necessary parameters, which reduces the cumbersome task of completing the rate calculations, making error checking easier and more effective. Details of the derived data are provided in Appendix B, Table B-2.

4.1.3 Calculated Hydrogen Generation Rates

The HGRs were calculated for the total tank waste, as well as for different waste layers. The waste layers are the convective layer (supernatant liquid) and the nonconvective layer (sludge/salt cake). The rates for each layer are presented as radiolysis rates, thermolysis rates, corrosion rates, and total generation rates in units of mole per kilogram per day and moles per cubic meter per second.

Details of the calculated rates per unit mass or per unit volume are provided in the Appendix B, Table B-3. Note that the unit rate of the corrosion rate is a function of wetted surface area, so the unit volume rate depends on the waste volume. The unit rate from corrosion is an average rate for a given tank waste volume. The total gas generation rate for a tank (in units of cubic feet per minute and liters per day) was calculated by multiplying the unit rates by the total waste volume; the results are provided in Appendix B, Table B-4. Table 4-1 lists the nine tanks with the highest model-calculated HGRs, and the post-remediation rates for tank 241-SY-101. Note that the updated total HGRs for tank 241-SY-101 decreased by a factor of 5 when compared to the calculations in Revision 0 of this report (i.e., pre-remediation).

Tank 241-AY-102 has the largest HGR (3.18 E-2 ft^3/min) this rate is more than twice the value of 1.4 E-2 ft^3/min calculated in Revisions 0 and 1 of this report. This rate difference is two fold: The first is the tank waste composition in Revision 2 has been updated to reflect receiving the waste from the hottest tank 241-C-106; and the second is the highest waste temperature in the past year has increased by more than 20 °F compared to the value used in Revisions 0 and 1 of this report. The temperature went up not only due to receiving hot waste, but also because the cooling system in the annulus was turned off for one day. Generation rates from radiolysis, thermolysis, and corrosion also are listed in Table 4-1 for solid and liquid layers for each tank.

Table 4-1. Tanks with Highest Model-Calculated Hydrogen Generation Rates.

Tank	HGR from radiolysis G_{rad} (ft^3/min)	HGR from thermolysis G_{therm} (ft^3/min)	HGR from corrosion G_{corr} (ft^3/min)	Percent HGR from radiolysis $(G_{rad})_{\%}$	Percent HGR from thermolysis $(G_{therm})_{\%}$	Percent HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (ft^3/min)
241-AY-102	3.00 E-02	1.24 E-03	5.71 E-04	94	4	2	3.18 E-02
Supernatant	2.26 E-04	3.31 E-04	2.11 E-04	29	43	28	7.68 E-04
Solid Layer	2.98 E-02	9.08 E-04	3.60 E-04	96	3	1	3.10 E-02
241-SX-105	5.68 E-04	1.52 E-02	8.48 E-04	3	92	5	1.66 E-02
Supernatant	na	na	na	na	na	na	na
Solid Layer	5.68 E-04	1.52 E-02	8.48 E-04	3	92	5	1.66 E-02
241-SX-103	7.79 E-04	1.29 E-02	9.99 E-04	5	88	7	1.47 E-02
Supernatant	na	na	na	na	na	na	na
Solid Layer	7.79 E-04	1.29 E-02	9.99 E-04	5	88	7	1.47 E-02
241-A-101	8.44 E-04	1.11 E-02	1.16 E-03	6	85	9	1.31 E-02
Supernatant	3.66 E-04	5.21 E-03	8.02 E-04	6	82	13	6.37 E-03
Solid Layer	4.78 E-04	5.92 E-03	3.58 E-04	7	88	5	6.75 E-03
241-AN-102	4.17 E-03	7.14 E-03	7.32 E-04	35	59	6	1.20 E-02
Supernatant	3.67 E-03	6.58 E-03	4.22 E-04	34	62	4	1.07 E-02
Solid Layer	5.01 E-04	5.57 E-04	3.10 E-04	37	41	23	1.37 E-03
241-AZ-102	5.56 E-03	4.38 E-03	7.41 E-04	52	41	7	1.07 E-02
Supernatant	3.34 E-03	4.00 E-03	4.09 E-04	43	52	5	7.75 E-03
Solid Layer	2.22 E-03	3.78 E-04	3.32 E-04	76	13	11	2.93 E-03
241-AN-107	7.03 E-03	1.92 E-03	7.20 E-04	73	20	7	9.67 E-03
Supernatant	5.18 E-03	1.50 E-03	3.44 E-04	74	21	5	7.02 E-03
Solid Layer	1.85 E-03	4.26 E-04	3.76 E-04	70	16	14	2.65 E-03
241-AZ-101	4.14 E-03	1.94 E-03	7.58 E-04	61	28	11	6.83 E-03
Supernatant	1.81 E-03	1.68 E-03	4.32 E-04	46	43	11	3.92 E-03
Solid Layer	2.33 E-03	2.60 E-04	3.25 E-04	80	9	11	2.92 E-03
241-AX-101	6.41 E-04	5.19 E-03	8.73 E-04	10	77	13	6.70 E-03
Supernatant	2.97 E-04	2.68 E-03	3.41 E-07	10	90	0	2.97 E-03
Solid Layer	3.44 E-04	2.51 E-03	8.73 E-04	9	67	23	3.73 E-03
241-SY-101	7.67 E-04	2.17 E-03	6.86 E-04	21	60	19	3.62 E-03
Supernatant	5.58 E-04	1.59 E-03	3.03 E-04	23	65	12	2.45 E-03
Solid Layer	2.09 E-04	5.76 E-04	3.84 E-04	18	49	33	1.17 E-03

Notes:

To convert cubit feet to liters, multiply the value by 28.454 L/ft^3.
HGR = hydrogen generation rate.
na = not applicable.

The contribution from thermolysis and radiolysis varied from tank to tank. Corrosion contributed less than 15% to the overall HGR for the listed tanks except tank 241-SY-101.

Tanks without sample-based data use the default data from the waste grouping analysis, which have a larger uncertainty.

4.2 TANK VENTILATION RATES AND STEADY-STATE GAS CONCENTRATIONS

Tank ventilation and steady-state gas concentration data collection and data reduction are documented in RPP-5660, *Collection And Analysis Of Selected Tank Headspace Parameter Data*. Ventilation rates at the tank outlet were determined by a number of methods, including tracer studies, Standard Hydrogen Monitoring System hydrogen composition decay curves, direct measurement, and calculations from earlier flammable gas hazard analyses. The ventilation rates were for normal ventilation conditions (either passive or active) in conjunction with steady-state gas concentration data to estimate the gas release rates.

Tank dome space gas composition data were based on analytical data from RPP-5660, when available. The TWINS (CHG 2001c) database was queried to obtain all gas sample data. The data were reduced using mean values for single-point calculations and derived distributions for Monte Carlo analyses. Values for missing data were determined using the methodology described in SNL-000198. The ventilation rates and the steady-state gas concentrations under normal operating conditions, along with waste volumes and dome space volumes for all 177 tanks, are listed in Appendix D, Table D-1. For sludge tanks, dome space flammable gas concentrations are very small, less than 50 ppm hydrogen, methane, and ammonia. For these tanks, the ratios between the various gases are questionable and are not an accurate analysis of gas generation rates.

4.3 STEADY-STATE GAS RELEASE RATES FOR HYDROGEN, AMMONIA, METHANE, AND NITROUS OXIDE

To evaluate the steady-state flammability levels under different ventilation conditions, the steady-state gas release rates were used to calculate the flammable gas concentrations for a given ventilation condition. For hydrogen, the steady-state release rates were calculated by subtracting the gas accumulation rate from the model calculated generation rate. The HGRs are provided in Section 4.1 and Appendix B. In the past, a few tanks had a noticeable waste level increase. The waste level increase rate can be converted to a total waste volume increase rate, which then is multiplied by the hydrogen fraction obtained from the retained gas sample analysis. However, in this update no gas accumulation rates are identified and thus the gas release rate for hydrogen is the HGR. The steady-state gas release rates of methane, ammonia, and nitrous oxide were derived from the steady-state concentrations under normal ventilation rates using Equation 3-15. The calculated gas release rates of hydrogen, ammonia, methane, and nitrous oxide are provided in Appendix D, Table D-1.

For ammonia, however, the method described in the previous paragraph would largely overestimate the steady-state concentrations under off-normal ventilation conditions for those tanks having relatively large release rates calculated from the steady-state concentration. For example, for tank 241-SY-101, the steady-state release rate obtained from the dome space concentration of 400 ppm under normal ventilation conditions predicts a steady-state

concentration of 108% LFL for the off-normal ventilation condition. This value is two orders of magnitude larger than the current estimated value of 0.4% LFL using the liquid-vapor equilibrium mechanism. In Revision 0, similar overestimations of ammonia concentration also were reported for tanks 241-AN-102 and 241-AN-107.

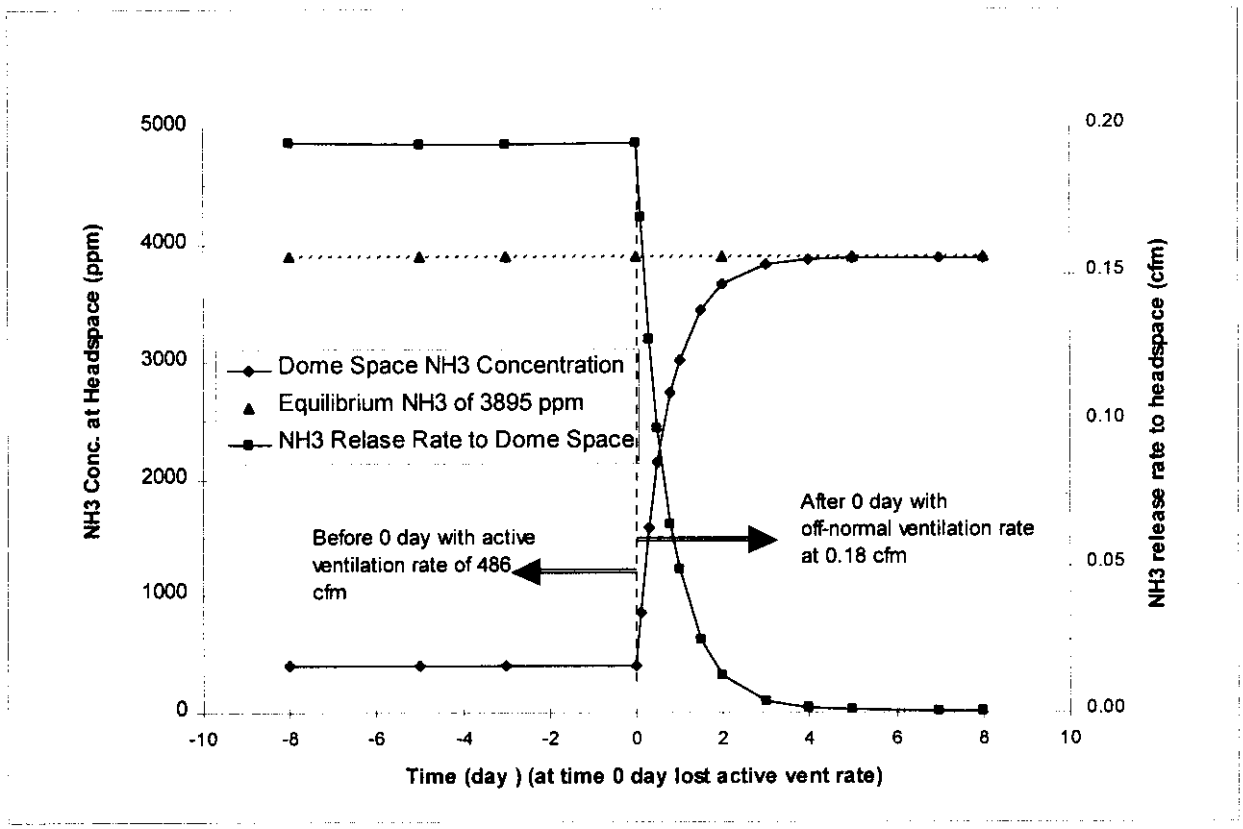
As described in Chapter 3.0, ammonia is very soluble, and the gas release rate is not a constant but is governed by the liquid-vapor equilibrium defined by Henry's Law, the mass transport coefficient, h, and the effective transport surface area, A. The ammonia release rate is driven by the gradient between the vapor and liquid phases before reaching equilibrium. Therefore, a greater difference results in a larger release rate.

For a closed system (zero ventilation rate), the final release rate is zero when the system reaches equilibrium. An open system will never reach the equilibrium concentration, but will reach a steady-state release condition. At steady state, the concentration is lower than the equilibrium value, and the larger the ventilation rate, the lower the steady-state concentration of ammonia. For a given system, the release rate at steady state also is proportional to the ventilation rate. Therefore, if the steady-state release rate obtained at a high ventilation rate (i.e., normal active ventilation) is used as a constant to predict the steady-state concentrations for the off-normal low ventilation condition, the ammonia dome space concentration for the off-normal ventilation condition could be greatly overestimated.

Figure 4-1 demonstrates the relationship of the equilibrium value, the steady-state concentration, and the release rate of ammonia under both normal and off-normal conditions for tank 241-SY-101 after remediation. As shown in Figure 4-1 for the normal ventilation rate of 486 ft^3/min, the steady-state concentration of ammonia is 400 ppm, which is far below the equilibrium value of 3,895 ppm. For an off-normal ventilation rate of 0.18 ft^3/min, the ammonia concentration was computed to increase exponentially and took less than 8 days to reach steady state with the concentration of 3,882 ppm, which is lower than but very close to the equilibrium value. Also, note that the steady-state release rate from 0.19 ft^3/min under normal ventilation conditions of 486 ft^3/min is computed to drop exponentially to 7.6 E-4 ft^3/min for the off-normal ventilation condition of 0.18 ft^3/min.

For many SSTs and some DSTs with lower concentrations of ammonia, the ammonia release rate was too small to contribute significantly to reaching 25% LFL even under off-normal ventilation conditions. Therefore, this method of considering ammonia release rates as constants would be a simple method to screen out tanks with small release rates. This also avoids having to use the liquid-vapor equilibrium method, which requires liquid and dome space ammonia concentration data and more complex calculations.

Figure 4-1. Ammonia Concentration and Release Rate for Tank 241-SY-101 Before and After Loss of Active Ventilation.



4.4 STEADY-STATE MASS TRANSPORT PROPERTIES "h" AND "A" FOR AMMONIA

As discussed in Chapter 3.0, it is difficult to estimate the effective area, A, of the mass transport in the liquid-vapor equilibrium model. The effective area is the actual waste surface area available for ammonia transport, and will be the full or partial tank cross-sectional area depending on how much true liquid surface is available. The ammonia concentration could be overestimated by two orders of magnitude in the liquid-vapor equilibrium model if 100% of the effective area is used. In this report, the ammonia concentration analysis follows the logic in the following steps to perform the tank dome space ammonia calculations:

1. The ammonia concentration in all DSTs was analyzed using the liquid-vapor equilibrium model as described in Chapter 3.0. The mass transport properties, the product of h and A, were obtained from the steady-state concentration under normal conditions by applying Equation 3-17. Then, using this product of h and A, the time-dependent ammonia concentration and flammability under off-normal conditions were calculated.

2. The ammonia concentrations for SSTs were first evaluated by assuming a constant release rate. If the ammonia concentrations computed using this conservative approach were more than 0.5% and the total flammability was above 20% LFL, the ammonia concentration was reanalyzed more accurately using the liquid-vapor equilibrium method as was done for the DSTs.

The input data collected included the ammonia concentrations in the liquid and in the dome space under normal ventilation conditions, the waste volume and ionic composition, and the temperatures of the waste and the dome space under both normal and off-normal conditions. Appendix C, Table C-1, gives the liquid concentrations in the DSTs and selected SSTs for the nitrate, nitrite, and aluminum ions used in the calculation of the HGR. Additional ion constituents required are carbonate, chloride, chromium, fluorine, hydroxide, iron, nickel, phosphate, potassium, sodium, and sulfate. Other required data include the tank waste density, temperature, and weight-percent water. These data were obtained from the BBI reports (CHG 2001a). Where tank ion concentrations or waste properties were not available in the BBI detail report, an average value from the sample analysis data contained in the tank characterization database was used. The tank waste temperature values were the only figures not taken from the BBI or the tank characterization database. They were obtained from RPP-5660, Table 3-2, "SACS [Surveillance Analysis Computer System] Database Waste Temperatures." However, the input data for ammonia calculation were not updated in Revision 2, and the ammonia calculations remain the same as Revision 1 of the report.

Based on Equation 3-8, the Henry's Law constants were calculated and are listed in Appendix C, Table C-2. Table C-2 also includes the summations of ion concentrations, the Henry's Law constants in pure water, and the correction factors for the calculated Henry's Law constants, K_H, for salt solutions. The correction factors were assigned using the tank waste concentrations and temperatures according to the study results for ammonia solubility in high-concentration salt solutions (RPP-4941). The mass transport properties of the product h and A were calculated using Equation 3-17 and are listed in Appendix C, Table C-3. Based on the products of h and A, the time-dependent ammonia concentration and percent of the LFL under off-normal ventilation conditions were calculated, as discussed in Section 4.5.

As discussed in Chapter 3.0, the product of h and A depends on the waste configuration and physical and chemical properties, particularly the surface area, A, which is the effective surface for gas transport from the liquid to the vapor phase. For example, if the waste was disturbed or the configuration of the waste surface changed, both the effective surface area and h could change, so the product of h and A would change. Therefore, what has been calculated as the product of h and A in this report reflects only the current ammonia transport status of storage tank waste at steady state.

As a comparison, Table 4-2 lists the products of h and A from the values derived from the field data under normal conditions using Equation 3-17 and from the calculated h using the equations in Appendix F with a 100% tank surface area, A. For most tanks, the values for h and A derived from field data are a few orders of magnitude smaller than the values from the calculated h and 100% area A. Several factors can contribute to this discrepancy: First, many tanks may not have 100% transport area A, particularly for those tanks having a large crust layer or solid waste on the surface; second, from Equation 3-17, the field-data-derived values of h and A rely mainly on the ammonia vapor data and ventilation rate in the headspace, and the corresponding value of

liquid concentration in the waste (usually the value of $K_H P v C_g^{ss}$ is much smaller than C_l). The uncertainties of these input data and the fact that these data are not measured simultaneously can contribute to errors in the field-derived h and A.

The ammonia under the liquid surface could be depleted and present a large gradient throughout the tank. In this case, the measured liquid-phase ammonia data from the middle or bottom sections of the tank will be too large for the observed vapor data. Also, the equations used to calculate h in Appendix F may involve large uncertainties. In all cases, note that the values of the product of h and A determine how fast the ammonia will be released to the dome space. The bounding value for the flammability is the steady-state ammonia concentration in the tank dome space. The last column of Table 4-2 lists the steady-state ammonia concentrations under off-normal conditions. For all calculated values, the ammonia concentration is less than 8,300 ppm, which contributes less than 6% LFL to the total flammability.

4.5 FLAMMABILITY EVALUATION AND RESULTS

With the collected ventilation rates and steady-state gas concentrations, the flammable gas concentrations, expressed as a percent of the LFL, in the tank dome space under normal ventilation conditions were calculated using Equation 3-2 and are listed in Appendix D, Table D - 1. The highest observed level is 4% LFL. This suggests that the tank dome space of all tanks under current ventilation rates, whether actively or passively ventilated, will not exceed 25% LFL.

For the off-normal ventilation conditions, as discussed in Section 3.2, two scenarios were performed. For DSTs, the flammability calculation will assume the barometric breathing rate is available. For SSTs, due to the seal-off action for interim stabilization there is no guarantee that every tank will have a pathway for barometric breathing, thus the flammability calculation will be performed for both barometric breathing rate and zero ventilation rate.

4.5.1 Off-Normal Condition With Barometric Breathing

For off-normal ventilation conditions, assuming only barometric breathing rate, $V_{bb,}$, is available, the steady-state concentration can be calculated using Equation 3-13 for insoluble gas and using Equation 3-16 for the soluble gas; the results are listed in Appendix D, Table D-2. In the calculation for the off-normal condition, the initial concentrations are assumed to be the steady-state concentrations under normal ventilation conditions, which are listed in Appendix D, Table D-1. As listed in Table D-2, under the off-normal condition with barometric breathing rate, 37 tanks are computed to exceed 25% LFL when the system reaches steady state, and 10 tanks are predicted to reach 100% LFL.

Table 4-2. The Calculation of Ammonia Transport Properties.

Tank	$(NH_3)^{ss}$ in dome under normal vent (ppm)	Liquid $[NH_3]$ in waste (μg/mL)	Normal vent rate in the dome space (ft^3/min)	Product h A from field data at normal vent (ft^3/min)	Product h A from calculated h and 100% A (ft^3/min)	$(NH_3)^{ss}$ at off-normal vent (ppm)
241-AN-101	11	40	113	2.85 E-02	1.02 E+00	55
241-AN-102	300	210	119	1.80 E-01	2.03 E+00	857
241-AN-103	7	345	100	1.33 E-03	3.50 E+00	2,034
241-AN-104	21	246	100	5.92 E-03	3.08 E+00	2,011
241-AN-105	15	210	100	5.02 E-03	2.91 E+00	1,523
241-AN-106	1	210	117	3.99 E-04	1.12 E+00	123
241-AN-107	400	210	129	3.60 E-01	1.94 E+00	759
241-AP-101	125	439	108	2.57 E-02	1.26 E+00	827
241-AP-102	75	439	135	1.83 E-02	1.15 E+00	728
241-AP-103	1	250	200	5.76 E-04	1.48 E+00	248
241-AP-104	3	133	71	1.23 E-03	1.18 E+00	136
241-AP-105	7	324	176	2.79 E-03	1.75 E+00	800
241-AP-106	5	68	111	6.54 E-03	1.11 E+00	104
241-AP-107	5	1060	342	1.16 E-03	7.14 E-01	909
241-AP-108	27	800	129	3.14 E-03	8.82 E-01	852
241-AW-101	5	10	100	3.92 E-02	3.05 E+00	89
241-AW-102	3	74	292	7.16 E-03	7.74 E-01	80
241-AW-103	138	512	134	3.63 E-02	7.06 E-01	437
241-AW-104	6	169	141	3.64 E-03	6.99 E-01	142
241-AW-105	43	1010	194	5.97 E-03	5.49 E-01	625
241-AW-106	28	355	158	8.59 E-03	2.06 E+00	1,164
241-AY-101	5	113	250	7.69 E-03	1.55 E+00	286
241-AY-102	4	74	250	1.05 E-02	1.60 E+00	207
241-AZ-101	1	125	150	8.31 E-04	2.79 E+00	331
241-AZ-102	6	438	112	1.01 E-03	1.96 E+00	1,181
241-SY-101	400	1044	486	1.42 E-01	2.09 E+00	3,870
241-SY-102	12	1150	363	2.67 E-03	1.24 E+00	1,771
241-SY-103	59	1290	116	3.88 E-03	3.14 E+00	5,581
241-A-101	394	531	10	5.17 E-03	3.74 E+00	8,253
241-A-103	261	531	8	2.61 E-03	3.21 E+00	2,922
241-C-103	324	1210	10	1.94 E-03	1.88 E+00	3,159
241-S-101	765	1210	6	2.94 E-03	2.59 E+00	5,817
241-S-102	588	1700	2	5.47 E-04	3.01 E+00	4,312
241-SX-103	31	1800	53	6.11 E-04	3.55 E+00	4,977
241-U-102	651	745	2	1.66 E-03	2.08 E+00	2,157
241-U-103	722	1400	2	9.56 E-04	2.47 E+00	4,582
241-U-105	1936	1600	5	5.64 E-03	2.22 E+00	6,909
241-U-107	448	403	12	1.34 E-02	1.98 E+00	1,380
241-U-108	684	1050	4	1.87 E-03	2.57 E+00	4,345

Notes: To convert the unit of ft^3 to L, multiply the value by 28.454 L/ft^3.
NH_3 = ammonia.
μg/mL = micrograms per milliliter.

Equation 3-18 gives the formula to calculate the flammable gas concentrations at a given time with the aid of a time-dependent gas concentration equation (Equation 3-6 for insoluble gas and Equation 3-12 for soluble gas). Because the time variable cannot be expressed in an equation, a customized EXCEL macro was developed using Visual Basic to iterate the calculations by increasing the time until the specified LFLs in Equation 3-18 are met. The calculated times to reach 25% and 100% LFL (time-to 25% LFL and 100% LFL) under the off-normal ventilation condition with barometric breathing rate are listed in Appendix D, Tables D-3 and D-4, respectively. In the calculations, the flammability level of each flammable gas also is calculated for each case to understand the distribution of each gas's contribution to the total LFL.

Another needed variable is the minimum ventilation rate required to prevent the tank dome space from exceeding 25% LFL. Equation 3-18 gives the time-dependent flammable gas concentration in terms of percent of the LFL; however, the ventilation rate is embedded in the time-dependent concentration as given in Equations 3-6 and 3-12. No clear solution was developed to find the minimum ventilation rate in Equation 3-18. For those tanks exceeding the specified flammability level, the minimum ventilation rate can be found by gradually increasing the ventilation rate from zero until a total flammability level of less than the specified 25% or 100% LFL, is obtained. A customized EXCEL macro was developed using Visual Basic code to iterate this equation automatically to find the minimum ventilation rate. Details of the calculated minimum ventilation rates are listed in Appendix D, Tables D-3 and D-4, for 25% and 100% LFL, respectively.

Table 4-3 lists the top 10 tanks with the shortest time to 25% LFL for both DSTs and SSTs under the off-normal ventilation condition with barometric breathing rate. Table 4-3 also lists the previously calculated times to 25% LFL, the current calculated time to reach 100% LFL, the HGRs from current and previous calculations, and the gas concentrations and percent of the LFL contribution of the different gases at the time to 25% LFL. In the off-normal condition with barometric breathing rates, tanks 241-AY-102 and 241-B-203 provide the shortest time to 25% LFL as 23 and 41 days for DSTs and SSTs, respectively, under the off-normal condition. Overall, five DSTs and five SSTs are computed to reach 100% LFL if the off-normal condition persists. It takes 114 and 250 days to reach 100% LFL for tanks 241-AY-102 and 241-B-203, respectively. As shown in Table 4-3, note that the results of this calculation are based on the BBI information (November 15, 2001) (CHG 2001a), with the exception of tank 241-A-101, which is based on waste volume information dated February 28, 2002 (CHG 2002a and Parkman 2002).

If using the November 15, 2001 BBI data, tank 241-A-101 has highest flammability among SSTs, but the tank has been undergoing salt well pumping since June 2001. The HGR and flammability, based on the best estimate waste volume on February 28, 2002, were recalculated to reflect the pumping activity on tank 241-A-101. As of February 28, 2002, 225 kgal have been pumped (Parkman 2002). However, tank waste levels measured between June 2001 and February 28, 2002, indicate the volume has decreased by 261 kgal. The waste volume, reduced from waste level readings, is 36 kgal higher than the liquid volume pumped; this 36-kgal difference could be the result of retained gas being released.

Table 4-3. Comparison of Time to 25 Percent and 100 Percent of the LFL Between Current and Previous Calculations at Barometric Breathing Rate.

Tank	Time to 25% LFL $t_{25\%}$ (day) (Rev. 2)	Time to 25% LFL $t_{25\%}$ (day) (Rev. 0)	Time to 25% LFL $t_{25\%}$ (day) (CN-116&7)	Time to 100% LFL $t_{100\%}$ (day) (Rev. 2)	HGR (ft^3/min) (Rev. 2)	HGR (ft^3/min) (CN-116&7)	HGR ratio between Rev. 2 and CN-116&7
Double-Shell Tanks							
241-AY-102	23	57	29	114	3.18 E-02	1.83 E-02	1.73
241-AN-102	27	17	18	143	1.20 E-02	1.64 E-02	0.73
241-AN-107	35	15	11	202	9.67 E-03	2.92 E-02	0.33
241-AZ-102	35	42	27	202	1.07 E-02	1.71 E-02	0.63
241-AW-101	56	73	66	514	5.06 E-03	4.31 E-03	1.17
241-AN-105	64	54	36	will not occur	4.27 E-03	7.40 E-03	0.58
241-AZ-101	66	63	24	will not occur	6.83 E-03	2.01 E-02	0.34
241-AN-104	73	92	59	will not occur	4.83 E-03	5.91 E-03	0.82
241-SY-102	125	will not occur	will not occur	will not occur	2.21 E-03	8.59 E-04	2.57
241-SY-101	121	9	7	will not occur	3.62 E-03	3.65 E-02	0.10
Single-Shell Tanks							
241-B-203	41	36	63	250	1.93 E-04	1.75 E-04	1.11
241-B-204	45	42	57	300	1.94 E-04	1.75 E-04	1.10
241-A-101	44*	22	25	303*	1.31 E-02*	1.04 E-02	1.26
241-SX-103	52	84	will not occur	455	1.47 E-02	1.50 E-03	9.8
241-SX-105	57	55	will not occur	526	1.66 E-02	1.30 E-03	12.8
241-AX-101	101	147	will not occur	will not occur	6.70 E-03	6.40 E-04	10.45
241-T-203	147	180	194	will not occur	1.56 E-04	1.75 E-04	0.89
241-T-204	154	140	161	will not occur	1.56 E-04	1.75 E-04	0.89
241-B-201	299	376	280	will not occur	1.33 E-04	1.75 E-04	0.76
241-T-201	331	424	280	will not occur	1.29 E-04	1.75 E-04	0.74
241-SX-108	will not occur	will not occur	17	will not occur	9.21 E-04	6.14 E-02	0.02
241-SX-107	will not occur	will not occur	20	will not occur	8.38 E-04	5.23 E-02	0.02
241-SX-114	will not occur	will not occur	22	will not occur	1.09 E-03	4.39 E-02	0.03
241-SX-110	will not occur	will not occur	28	will not occur	1.88 E-03	3.96 E-02	0.02
241-C-106	will not occur	will not occur	30	will not occur	8.00 E-04	2.26 E-02	0.04
241-SX-111	will not occur	will not occur	30	will not occur	1.13 E-03	3.56 E-02	0.03
241-C-105	will not occur	will not occur	35	will not occur	8.08 E-04	1.92 E-02	0.04
241-SX-112	will not occur	will not occur	36	will not occur	7.23 E-04	3.04 E-02	0.02

Notes:

*The flammability and hydrogen generation rate based on the estimate volume on February 28, 2002, to reflect the salt well pumping activity.

HNF-SD-WM-CN-116, 1997, *Calculations of Hydrogen Rate at Steady State for Double-Shell Tanks*, Lockheed Martin Hanford Corporation, Richland, Washington.

HNF-SD-WM-CN-117, 1997, *Calculation Note Hydrogen Generation Rates at Steady State*, Lockheed Martin Hanford Corporation, Richland, Washington.

LFL = lower flammability limit.

HGR = hydrogen generation rate.

Gas release events were observed during salt well pumping. The best estimate waste volume for tank 241-A-101 on February 28, 2002, is 718 kgal with 270 kgal of liquid, 397 kgal of solid waste, and 51 kgal of retained gas. Based on the estimated waste volume of 718 kgal, the calculated HGR is 1.31 E-2 ft^3/min, and time to reach 25% and 100% LFL is 44 and 303 days, respectively. In comparison, based on the volume of BBI information (CHG 2001a) the calculated HGR is 1.80 E-2 ft^3/min, and time to reach 25% and 100% LFL is 17 and 82 days, respectively.

4.5.2 Off-Normal Condition With Zero Ventilation

A zero ventilation condition means a closed system. Without considering or including other possible mechanisms for gas leaving the system such as diffusion through the tank dome space concrete wall, it is expected that every tank will eventually reach 100% LFL over time under zero ventilation. In this model calculation, it is reasonable to assume that the tank will not be pressurized, thus the newly generated gas will slowly push the old gas composition out and form a new concentration of flammable gas without increasing the pressure. Time to reach 25% and 100% LFL under zero ventilation are computed for SSTs.

In the flammability calculations, there are several tanks that the nitrous oxide concentration increased to the model limit of 8% before the total flammability reached 100% LFL due to zero ventilation assumption. As discussed in Section 3.2, the flammability level for individual flammable gas is 4%, 15%, and 5% for hydrogen, ammonia, and methane, respectively, if the nitrous oxide is less than 8%. When the mixture has more than 8% nitrous oxide, the individual flammable gas required less concentration than listed above to reach the flammability level of the LFL. For those tanks having high nitrous oxide concentration, the calculations of "the time to reach 100% LFL" simply represents the time for the nitrous oxide to reach 8% while the total flammability is still less than 100% LFL.

Table 4-4 summarizes the flammability calculation under off-normal ventilation conditions at zero ventilation rate for those tanks with "the time to reach 100% LFL" less than 1,500 days. For comparison, the time to reach 25% and 100% LFL under off-normal ventilation condition at barometric breathing rate are also given in Table 4-4. Note that the time to reach 100% LFL has substantially decreased from 250, 303, and 455 to 150, 165, 193 days for tanks 241-B-203, 241-A-101, and 241-SX-103, respectively, for the zero ventilation barometric breathing rate. It is worth mentioning that under the zero ventilation the ratio of time to 100% to 25% LFL should be roughly four (higher than four means the ammonia contribution is more significant and the ammonia concentration is not linearly increasing by time, but governs by the liquid-vapor equilibrium mechanism). Tanks with a ratio less than four means the "time to reach 100% LFL" is the time to reach the 8% nitrous oxide model limit, but the flammability is not yet 100% LFL. The minimum vent rates to keep the dome space below 100% LFL for most tanks, except a half dozen tanks, are equal or less than 0.1 ft^3/min.

Table 4-4. Summary of Flammability Calculations Under Off-normal Condition with Both Barometric Breathing and Zero Ventilation Rates for Single-Shell Tanks.

Tank	Barometric Breathing Rate			Zero Ventilation Scenario				
	Time to reach 25% LFL $t_{25\%}$ (day)	Time to reach 100% LFL $t_{100\%}$ (day)	Barometric breathing rate (ft^3/min)	Time to reach 25% LFL (days)	Time to reach 100% LFL (days)	Mini. vent to keep below 25% LFL	Mini. vent to keep below 100% LFL	Ratio of $t_{100\%}$ / $t_{25\%}$
241-B-203	41	250	0.003	37	150	0.02	0.005	4.1
241-B-204	45	300	0.004	40	164	0.02	0.005	4.1
241-A-101	44	303	0.25	39	165	1.39	0.34	4.2
241-SX-103	52	455	0.33	47	193	1.55	0.38	4.1
241-SX-105	57	526	0.38	46	194	1.70	0.42	4.2
241-T-204	154	not occur	0.009	111	305	0.02	0.005	2.8
241-T-203	147	not occur	0.009	100	326	0.02	0.005	3.3
241-AX-101	101	not occur	0.26	83	338	0.72	0.18	4.1
241-T-201	331	not occur	0.012	171	503	0.02	0.004	2.9
241-U-105	not occur	not occur	0.21	198	550	0.21	0.04	2.8
241-U-107	not occur	not occur	0.18	357	619	0.11	0.03	1.7
241-B-201	299	not occur	0.012	164	658	0.02	0.004	4.0
241-SX-102	355	not occur	0.33	175	707	0.42	0.10	4.0
241-B-202	356	not occur	0.013	177	711	0.02	0.004	4.0
241-S-112	413	not occur	0.22	187	751	0.27	0.07	4.0
241-BY-106	455	not occur	0.20	191	774	0.24	0.06	4.1
241-SX-104	508	not occur	0.36	200	806	0.40	0.10	4.0
241-U-103	441	not occur	0.18	183	844	0.21	0.05	4.6
241-A-103	591	not occur	0.40	200	874	0.43	0.10	4.4
241-S-109	not occur	not occur	0.22	219	888	0.22	0.05	4.1
241-SX-109	not occur	not occur	0.44	231	929	0.43	0.11	4.0
241-U-108	766	not occur	0.16	206	936	0.17	0.04	4.5
241-T-202	not occur	not occur	0.016	280	938	0.01	0.003	3.4
241-A-104	not occur	not occur	0.54	257	1032	0.47	0.12	4.0
241-BY-110	632	not occur	0.29	208	1067	0.37	0.09	5.1
241-C-103	not occur	not occur	0.47	234	1078	0.47	0.10	4.6
241-TX-109	not occur	not occur	0.29	389	1082	0.19	0.05	2.8
241-T-111	not occur	not occur	0.17	233	1146	0.16	0.04	4.9
241-TX-112	not occur	not occur	0.17	276	1226	0.14	0.03	4.4
241-TX-113	not occur	not occur	0.17	316	1273	0.12	0.03	4.0
241-AX-103	not occur	not occur	0.51	319	1295	0.36	0.09	4.1
241-BY-105	not occur	not occur	0.23	274	1302	0.18	0.05	4.8
241-U-102	not occur	not occur	0.23	319	1378	0.16	0.04	4.3
241-TX-105	not occur	not occur	0.20	344	1381	0.13	0.03	4.0
241-S-101	not occur	not occur	0.26	295	1390	0.20	0.04	4.7

Note: LFL = lower flammability limit.

4.6 UNCERTAINTY ANALYSIS: TANK 241-AN-104 AS AN EXAMPLE

A Monte-Carlo analysis was performed to investigate the sensitivity of the model presented. Appendix E contains a MathCad[1] model that performs a preliminary analysis of the model as applied to tank 241-AN-104. The evaluation was limited in scope and, because the sensitivity of the results to sample count has not been studied, the results might not be statistically valid. The number of samples was limited to 500. However, some interesting findings are presented. Typically, the characterization data were entered with an estimated uncertainty in the data listed as a standard deviation of 10% of the value. In the case of the waste temperature, a standard deviation of 5 K, or about 1.6% was used. Because of the exponential relationship between temperature and the HGR by thermolysis, the uncertainty in the results were amplified to about 50% for the thermolysis HGR term. In addition, the mean of the thermolysis generation rate distribution increased by approximately 25%. Although the radiolysis term also has an exponential relationship to temperature, the structure of the formula dampens the effect. (This is a result of the nontemperature-dependent G_{H2O} term being added to the temperature-dependent G_{org} term.) For the total waste in tank 241-AN-104, Table 4-5 summarizes the differences in HGRs, in steady-state flammable gas concentrations, time to 25 and 50% LFL, and the required ventilation rates to maintain concentrations below 25 and 100% LFL.

Table 4-5. Preliminary Sensitivity Study Results (Tank 241-AN-104).

Description	Single-Point Calculation	Monte Carlo Analysis Median	Monte Carlo Analysis Standard Deviation
HGR - Radiolysis	1.1×10^{-3} ft^3/min	1.1×10^{-3} ft^3/min	1.0×10^{-4} ft^3/min
HGR - Thermolysis	3.0×10^{-3} ft^3/min	3.1×10^{-3} ft^3/min	1.6×10^{-3} ft^3/min
HGR - Corrosion	7.2×10^{-4} ft^3/min	8.0×10^{-4} ft^3/min	1.2×10^{-5} ft^3/min
HGR – Total	4.8×10^{-3} ft^3/min	5.0×10^{-3} ft^3/min	1.6×10^{-3} ft^3/min
$[H_2]^{SS}$	0.12 %LFL	0.13 %LFL	0.040 %LFL
$[NH_3]^{SS}$	0.014 %LFL	0.014 %LFL	nc
$[CH_4]^{SS}$	0.004 %LFL	0.004 %LFL	nc
$[H_2]^{SS}$ (loss of ventilation)	71 %LFL	73 %LFL	22 %LFL
$[NH_3]^{SS}$ (loss of ventilation)	1.5 %LFL	1.5 %LFL	0.2 %LFL
$[CH_4]^{SS}$ (loss of ventilation)	2.4 %LFL	2.4 %LFL	0.2 %LFL
Time to reach 25 %LFL	84 days	77 days	5 days
Time to reach 50 %LFL	234 days	200 days	24 days
Min ventilation rate to maintain <25%LFL	0.52 ft^3/min	0.57 ft^3/min	0.04 ft^3/min
Min ventilation rate to maintain <100%LFL	0.13 ft^3/min	0.14 ft^3/min	0.04 ft^3/min

Notes: To convert the unit of ft^3 to L, multiply the value by 28.454 L/ft^3.
H_2 = hydrogen.
HGR = hydrogen generation rate.
LFL = lower flammability limit.
nc = not calculated.
NH_3 = ammonia.
CH_4 = methane.

[1] [1] MathCad is a registered trademark of MathSoft Engineering & Education, Inc.

4.7 DISCUSSION

In Revision 2 of this report, the flammability calculations were updated because the HGRs were recalculated based on the latest BBI detail calculation report and SACS temperature data. In the off-normal ventilation condition, under barometric breathing rate the shortest time to 25% LFL is computed to be 23 days for tank 241-AY-102, which is shorter than the previous calculation because the tank has since received the waste from the high-heat tank 241-C-106. For SSTs, the shortest computed time to 25% LFL is 41 and 37 days for tank 241-B-203 under barometric breathing and zero ventilation rate, respectively. Although tank 241-B-203 has a very low HGR (on the order of 2 E-4 ft^3/min), it has the shortest time to reach 25% LFL. This is because the tank is very full resulting in a small dome vapor space, which results in a rapid rise in flammable gas concentration. Similar situations also occurred for tanks 241-B-204, 241-T-203 and 241-T-204.

One major upgrade in Revision 1 was the incorporation of the liquid-vapor equilibrium model (RPP-4941) into the methodology to handle highly soluble ammonia. This model reduces the conservatism in estimating the ammonia flammability found in Revision 0. As a comparison, the predicted ammonia flammability concentrations for tanks 241-AP-101, 241-AP-102, 241-S-101, 241-AN-102, and 241-AN-107 are reduced from the values of 2.7, 2.5, 1.0, 1.8, and 2.2% LFL in Appendix B, Table B-3, Revision 0, to the values of 0.55, 0.49, 0.57, 0.57, and 0.51% LFL in Revision 1, Appendix D, Table D-3, respectively. In addition, the update of the status of tank 241-SY-101 having had 616 kgal of its waste transferred out and its remaining waste diluted has significantly reduced the overall flammability of its dome space. As shown in Table 4-3 of Revision 1, the computed time to reach 25% LFL with off-normal ventilation has increased from 9 days (in Revision 0) to 152 days (in Revision 1). The HGR is reduced by a factor of more than 10, from 3.7 E-2 ft^3/min (as of October 1999) to 3.0 E-3 ft^3/min (as of April 2001).

The dome space ammonia concentration in tank 241-SY-101 increased from 4 ppm (before transfer data) to 400 ppm (January 2001 data), even though the liquid concentration decreased by a factor of 4 comparing data from before and after the waste was transferred out of the tank. After the waste had been transferred from tank 241-SY-101, most of the crust layer was removed and the effective area, A, for mass transport increased; therefore, the concentration in the dome space increased even though the concentration of the ammonia in the liquid decreased. Calculations show the observed ammonia concentration increase from 50 ppm to 400 ppm can be accounted for by the observed liquid pool size increase from a diameter of 10 ft to 20 ft in the time frame of July 2000 to January 2001, respectively. Calculations also indicated that most of the SSTs analyzed had effective surface areas as small as several tenths of 1% of the total tank waste surface. Caution should be taken in using the results of the calculated product of h and A from Appendix C, Table C-3, because the accuracy is limited by the accuracy of the input data. Calculation uncertainty is also increased if data such as dome space ammonia concentration, ventilation rate, and liquid concentration are not collected at the same. The tank 241-SY-101 example shows the model calculations agree reasonably with field observations when the input data are accurate and are taken in the same time frame.

Another observation is that the area of liquid surface in tank 241-SY-101 seems to be changing continuously and, therefore, the ammonia transport rate will change accordingly. Calculations show that the steady-state dome space ammonia concentration under normal ventilation conditions would reach 2,573 ppm if the effective area were 100% for a given liquid ammonia

concentration of 1,040 μg/mL. Using this concentration, the equilibrium vapor concentration of 3,895 ppm is calculated. For the scenario of the waste surface being fully open with a 100% effective mass transport area, the total flammable gas concentration is calculated to be 1.73% under normal ventilation conditions, and the total mass transport product of h and A is 2.09 ft^3/min. Therefore the calculated time to reach 25% LFL under the off-normal ventilation condition would become 145 days rather than the 146 days predicted by the previous methods.

Monitoring data from July 2001 show that the ammonia concentration in the dome space went up to 1,700 ppm. This is a factor of four increase compared to the January 2001 data. The increase of ammonia concentration could result from the increase of open surface area as discussed previously. It also is possible that the results are from the reduced ventilation flow rate because a similar increase also was observed for both hydrogen and nitrous oxide. In any case, the ammonia concentration of 1,700 ppm is still within the range of the ammonia calculation, which shows that the time to 25% would be around 146 days whether the ammonia concentration is 400 ppm or 2,573 ppm under the off-normal ventilation condition.

The hydrogen generation model assumes that hydrogen generation occurs in the liquid phase. This model uses the liquid layer composition data when calculating generation rates. However, many SSTs do not have a supernatant liquid layer. The liquid information for these tanks is determined from the drainable liquid sample data or statistically from other tanks in the same waste group. The liquid composition data are used to estimate the gas generation rate from the interstitial liquid portion of the solid layer. The liquid fraction is estimated based on the weight-percent-water data of the solid layer.

HGRs are compared for this report, using the model in RPP-3851 and the previous calculation note HNF-SD-WM-CN-117. In general, the HGRs calculated in this reports are smaller than previously reported, unless the tank has received more waste, such as tanks 241-SY-102 or 241-AY-102. The difference is two fold. First is the improvement of the HGR model, and second is the update of input data. HNF-SD-WM-CN-117 calculated the HGRs using a preliminary HGR model, which was developed with very limited gas generation data. The HGRs calculated in this report use the current rate equation model (HNF-3851), which based on a large body of gas generation data and waste characterization data. One of the main differences between the current model (RPP-3851) and the previous model (HNF-SD-WM-CN-117) involves the basis for the radiolysis term. In the previous model, the radiolysis G-value was calculated by scaling the single G-value from tank 241-SY-103 samples at 60 °C. For most tanks, the temperatures are lower than 60 °C; therefore, the radiolysis rates had been overestimated. The current model incorporates a temperature-dependent rate equation for radiolysis, which includes the activation energy for the radiolytic reaction. In addition, current model has updated the activation energy of thermolysis, introduced the TOC reactivity coefficient, and improved the coefficient for water radiolysis.

For the input data, the updated tank data also show cooler waste temperatures (although temperatures used in Revision 2 are the maximum for the past year and are usually higher than the mean annual temperatures used in Revision 1) and reduced heat loads caused by the decay of radionuclides (radionuclides are now decayed to January 1, 2001). Also, the organic reactants are consumed as time goes on. Due to revised radionuclide decay dates, the current HGRs for DSTs are expected to be lower than the previously calculated values. As shown in Table 4-3, the ratios between the current and previous generation rates are less than one, except for active

tanks, which received wastes from high-activity SSTs, and for tank 241-AY-102, which received material from tank 241-SY-101. The calculation for tank 241-SY-101 waste was updated to reflect the waste transferred out between December 1999 and February 2000. Note that the HGR is 2.98 E-3ft^3/min in Revision 1, which is about one tenth of the rate before the waste transfer, as shown in Revision 0 of this report.

The major difference between this report and previous calculations for the flammability evaluation (HNF-SD-WM-CN-116 and HNF-SD-WM-CN-117) is that the time to 25% LFL of the mixture was calculated by fixing the ammonia and methane contribution to 2% LFL, then calculating the time for hydrogen to reach 23% LFL. The previous 2% assumption was based on the highest ammonia and methane concentration observed in the tank dome space. The current model considers all three fuels (hydrogen, ammonia, and methane) as a function of time for the off-normal ventilation condition.

The HNF-SD-WM-CN-116 calculation and the current model calculation for the SSTs use completely different approaches, bases, and assumptions, which makes comparing the results from these two calculations difficult. HNF-SD-WM-CN-116 calculates the hydrogen release rates for all 149 SSTs using two pieces of information, the hydrogen concentration and the ventilation rate as discussed in Section 3.4. Ideally, the HNF-SD-WM-CN-116-derived gas release rates required both gas concentration and ventilation rate to be measured simultaneously because the hydrogen dome space concentration is a function of the ventilation rate. It is rare to find both pieces of data measured at the same time. Because of the lack of measured data, HNF-SD-WM-CN-116 used the best-estimate or conservative bounding values to calculate the HGRs for many tanks; therefore, the uncertainty in the gas generation rate could be relatively high. For example, tanks 241-SX-107, 241-SX-108, 241-SX-110, 241-SX-111, 241-SX-112, and 241-SX-114 have high ventilation rates (about 300 to 400 ft^3/min) and were assigned a bounding value of 140 ppm for hydrogen concentration.

Therefore, the resulting time to 25% LFL calculation ranged from 17 to 36 days as summarized in Table 4-3. This resulted in a large conservatism being built into these calculations because the calculated release rates were the same size or up to two times the generation rate from tank 241-SY-101, as reported in HNF-SD-WM-CN-117. For these tanks, the HGRs calculated by the current rate equation model are all an order of magnitude smaller than the HNF-SD-WM-CN-116 calculated generation rates and the loss-of-ventilation-case dome space gas compositions in these tanks will not reach 25% LFL. On the other hand, tanks 241-SX-103 and 241-SX-105 will not reach 25% LFL based on HNF-SD-WM-CN-116 generation rates, but will reach 25% LFL in 52 and 57 days in Revision 2, respectively, in the current model calculation.

5.0 FLAMMABILITY CALCULATIONS FOR WASTE ADDITION SCENARIOS

Chapter 4.0 explained the flammability evaluations of 177 underground tanks under current waste conditions. This chapter covers the case studies of the flammability levels resulting from water or waste additions to current DST levels. One scenario is to fill tanks with water from current waste levels to 1,140 kgal (414 in.); the other is to fill the tanks with tank waste similar to what presently is in the tank. The fill-up level of 1,140 kgal is based on the current operating capacity for DSTs (HNF-SD-WM-ER-029, *Operational Waste Volume Projection*). These scenarios are the bounding cases for possible tank waste operations such as routine flushing water addition, caustic water addition, and waste transfers among DSTs to make space for receiving waste. The intent of these case studies is to provide an additional technical basis for flammable gas controls on DSTs.

To model the case of filling the tank with similar tank waste, the total gas generation rates of hydrogen and methane are estimated by the gas generation rate per unit waste volume multiplied by the total volume of 1,140 kgal. The gas generation rates per unit waste volumes are calculated by dividing the total gas generation rates listed in Appendix B, Table B-3, by the volumes listed in Table B-1. In the scenario of filling the tank with similar waste, the ammonia concentration in the liquid would remain the same. However, the mass transport coefficient, h, will be conservatively calculated directly, as described in Appendix A, using 100% surface area, A, because the waste surface configuration would be different from current storage conditions.

For the case of filling the tank with water, the gas generation rates have been re-derived because the waste has been diluted by water addition. In the model calculation, the added water is assumed to be well mixed with the supernatant liquid layer only; therefore, only the generation rate of the liquid layer needs to be recalculated. The ratio of the amount of water added to make up 1,140 kgal and the sum of the added water and the original supernatant liquid was used as a dilution factor to scale the chemical concentrations, as well as the density and weight-percent water of the supernatant liquid layer.

If the analytes are not saturated, then adding water will dilute the analyte concentration and it would be reasonable to recalculate the concentration by the dilution factor and the HGR can be calculated accordingly. In general, the waste is not saturated with TOC and aluminum; however, several tanks contain concentrated nitrite and nitrate. If the supernatant is saturated with nitrite and nitrate, then adding water would cause additional nitrite and nitrate to dissolve, and thus the nitrite and nitrate concentrations would be higher than the mathematically diluted value. As discussed in RPP-3851, the HGR from water radiolysis is reduced by salts such as nitrate and nitrite in the solution because the salts consume the solvate electron from waste radiolysis. Consequently the HGR from radiolysis would be higher using the mathematical diluted nitrite and nitrate value.

For aluminum, the solubility is complex; however it plays a catalysis role and is less sensitive in the hydrogen model calculation. These arguments should definitely hold for each small amount of water addition, such as flush water. If a large quantity, such as the amount specified in the

GRE evaluation of water or flush water, is added at once the gas generation rate should be re-evaluated.

In addition, the temperatures of the waste and dome space were expected to remain the same as before waste or when water is added. In practice, unless the added water is heated up to or beyond the temperature of the supernatant liquid, this temperature assumption would be conservative in terms of the HGR recalculation. The ion concentration and Henry's Law constant were recalculated for the ammonia calculation based on the dilution factor. The mass transport properties of the product of h and A used the calculated h and 100% area, A, because the water addition changed the configuration of the waste surface; therefore, the original field-data-derived product of h and A no longer holds. For methane and nitrous oxide, the total generation rates remain the same, assuming the water addition has no effect on the total generation of methane or nitrous oxide because no tank-waste-dependent model exists for calculating the rate of methane and nitrous oxide. This assumption would result in a conservative total flammability calculation.

Table 5-1 summarizes the flammability assessments of the waste addition to DSTs for the top five active tanks, including tank waste volume, HGR, barometric breathing rate, and times to 25% and 100% LFL.

Table 5-1. Top Five Double-Shell Tanks from Flammability Assessment on Waste Addition.

Description	241-AN-102	241-AN-107	241-AY-102	241-AZ-101	241-AZ-102
Current tank waste volume[1] (as of November 2001) (kgal)	1,054	1,041	635	944	997
Waste Addition	**Fill to 1,140 kgal with Water**				
Tank waste volume (kgal)	1,140	1,140	1,140	1,140	1,140
Total H_2 generation rate (ft^3/min)	1.2 E-2	8.7 E-3	2.7 E-2	6.2 E-3	9.8 E-3
Barometric breathing (ft^3/min)	0.11	0.11	0.11	0.11	0.11
Time to 25% LFL (days)	21	28	9	40	24
Time to 100% LFL (days)	107	149	39	246	125
Waste Addition	**Fill to 1,140 kgal with the Same Waste**				
Tank waste volume (kgal)	1,140	1,140	1,140	1,140	1,140
Total H_2 generation rate (ft^3/min)	1.3 E-2	1.1 E-2	5.6 E-2	8.1 E-3	1.2 E-2
Barometric breathing (ft^3/min)	0.11	0.11	0.11	0.11	0.11
Time to 25% LFL (days)	19	23	4	29	19
Time to 100% LFL (days)	91	115	18	156	94

Notes:
[1]The waste volume based on BBI (CHG 2001a)
To convert the unit of ft^3 to L, multiply the value by 28.454 L/ft^3.
To convert the unit of kgal to kL, multiply the value by 3.785 kL/kgal.
H_2 = hydrogen.
kgal = kilogallons
LFL = lower flammability limit.

Details of the calculation results for these waste addition studies are given in Appendix F. Tables F-1 through F-4 list the input data and the calculation results for HGRs. Appendix F, Tables F-5 and F-6, show the results of Henry's Law constant and the mass transport properties. Tables F-7 through F-10 give the results of flammability calculations and times to 25% and 100% LFL.

As shown in Tables 4-3 and 5-1, the total HGRs increase when filling the tank with similar waste compared with the rates of current waste conditions, but they decrease when adding water because of the water dilution. Tank 241-AY-102 has the highest HGRs in all cases. The total generation rate is 3.18 E-2 ft^3/min at current conditions and becomes 2.73 E-2 ft^3/min and 5.62 E - 2 ft^3/min when filling up with water and similar waste, respectively. Note that the current waste volume in tank 241-AY-102 is 635 kgal and the tank is a little over half full; that is why the total HGR goes up almost a factor of two when filling with similar waste. The flammability distributions among hydrogen, ammonia, and methane are given in Appendix F, Tables F-9 and F-10; the tables show that hydrogen is the major contributor (over 90%) to the total flammability in all cases.

The times to 25% and 100% LFL are listed in the last two rows of Table 5-1 for each type of addition. Under current conditions, as shown in Table 4-3, tank 241-AY-102 has the shortest time to 25% and 100% LFL, 23 days and 57 days, respectively. The next shortest times to 25% and 100% LFL are 27 days and 144 days, respectively, for tank 241-AN-102. In the cases of waste addition, whether with water or similar waste, the times to 25% and 100% LFL are shorter than for the current conditions for all top five tanks, even though the HGRs decrease in the water addition case. This occurs because the calculated barometric breathing rate is proportional to the tank headspace volume. All the rates decreased to 0.11 ft^3/min when filled with water or similar waste. When filling tank 241-AY-102 with waste, the times to 25% and 100% LFL are 4 days and 18 days, respectively, and 9 days and 39 days, respectively, for the case of filling with water. The next shortest times to 25% and 100% LFL for the waste addition studies are 19 days and 91 days, respectively, for the case of filling with waste, and 21 days and 107 days, respectively, for the case of filling with water for tank 241-AN-102.

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6.0 SUMMARY AND CONCLUSIONS

The results of this report may be used to establish technical safety requirements for ventilation in tanks, establish maximum permissible down times for active ventilation systems, develop procedures for operations that require closing vent valves to HEPA filters on passively ventilated tanks, and support the technical basis for flammable gas control strategies.

The HGRs were calculated for the 177 SSTs and DSTs using a rate equation model and tank waste data. Calculated HGRs for DSTs ranged from 3.2 E-2 to 3.2 E-4 ft^3/min with the highest rate found in tank 241-AY-102. For SSTs, the rate ranged from 1.7 E-2 to 4.0 E-5 ft^3/min, with tank 241-SX-105 having the highest rate. For most DSTs, the tank data are sample based. For several SSTs, the tanks were stabilized and no liquid samples were available. The waste grouping method was used to generate default values for missing tank waste data by creating a distribution from all property data for a similar class of wastes (SNL-000198).

Flammable gas concentrations, in terms of percent of the LFL in the tank dome space, were evaluated under both normal and off-normal conditions for all 177 tanks. For normal ventilation conditions, all tanks are computed to remain well below 25% LFL with the highest flammable gas concentration level at 4% LFL in tank 241-U-105. Under off-normal conditions with barometric breathing rate, the shortest time to reach 25% LFL is 41 days for SST 241-B-203 and 23 days for DST 241-AY-102; with zero ventilation scenario, the shortest time to reach 25% LFL is 37 days for SST 241-B-203. Overall, under off-normal conditions with the barometric breathing rate the calculations show that 37 tanks will reach 25% LFL and 10 tanks will reach 100% LFL. For the water addition study on DSTs, the shortest time to reach 25% and 100% LFL are 4 and 18 days, respectively for DST 241-AY-102.

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APPENDIX A

INPUT DATA FOR HYDROGEN GENERATION CALCULATIONS FROM BEST BASIS INVENTORY DETAIL CALCULATION REPORT AND DERIVATION DOCUMENT (NOVEMBER 15, 2001)

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-AN-101	Supernatant	1.17 E	1.17 E	1.17 E	1.17 E	1.17 E	1.17 E	1.17 E
241-AN-102	Supernatant	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S
241-AN-102	Salt Cake/A2-SltSlr (Solid)	1.56 E	1.56 E	1.56 E	1.56 E	1.56 E	1.56 E	1.56 E
241-AN-103	Supernatant/A2-SltSlr (Liquid)	1.49 S	1.49 S	1.48 S	1.48 S	1.49 S	1.48 S	1.49 S
241-AN-103	Salt Cake/A2-SltSlr (Solid)	1.69 S	1.69 S	1.72 S	1.72 S	1.69 S	1.72 S	1.72 S
241-AN-104	Supernatant/A2-SltSlr (Liquid)	1.41 S	1.41 S	1.40 S	1.40 S	1.41 S	1.40 S	1.41 S
241-AN-104	Salt Cake/A2-SltSlr (Solid)	1.57 S	1.57 S	1.59 S	1.59 S	1.57 S	1.59 S	1.59 S
241-AN-105	Supernatant/A2-SltSlr (Liquid)	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S
241-AN-105	Salt Cake/A2-SltSlr (Solid)	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S
241-AN-106	Supernatant	1.18 E	1.18 E	1.18 E	1.18 E	1.18 S	1.18 E	1.18 S
241-AN-106	Salt Cake	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E
241-AN-107	Supernatant/A2-SltSlr (Liquid)	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S
241-AN-107	Salt Cake	1.56 S	1.56 S	1.56 S	1.56 S	1.56 S	1.56 S	1.56 S
241-AP-101	Supernatant	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-AP-102	Supernatant	1.20 S	1.20 S	1.20 S	1.20 S	1.20 S	1.20 S	1.20 S
241-AP-103	Supernatant	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-AP-104	Supernatant	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E
241-AP-105	Supernatant/A2-SltSlr (Liquid)	1.35 E	1.35 E	1.35 E	1.35 E	1.35 E	1.35 E	1.35 E
241-AP-105	Salt Cake/A2-SltSlr (Solid)	1.58 E	1.58 E	1.58 S	1.58 S	1.58 S	1.58 S	1.58 S
241-AP-106	Supernatant	1.26 E	1.26 E	1.26 E	1.26 E	1.26 E	1.26 E	1.26 E
241-AP-107	Supernatant	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S
241-AP-108	Supernatant	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S	1.25 S
241-AW-101	Supernatant/A2-SltSlr (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-AW-101	Salt Cake/A2-SltSlr (Solid)	1.59 S	1.59 S	1.59 S	1.59 S	1.59 S	1.59 S	1.59 S
241-AW-102	Supernatant	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E
241-AW-102	Sludge/CWP1 (Solid)	1.32 S	1.32 S	1.49 E	1.49 E	1.32 S	1.49 E	1.32 S
241-AW-103	Supernatant	1.24 E	1.24 E	1.24 E	1.24 E	1.24 E	1.24 E	1.24 E
241-AW-103	Sludge/CWZr2 (Solid)	1.48 S	1.48 S	1.47 S	1.47 S	1.46 S	1.46 S	1.46 S
241-AW-103	Salt Cake/A1-SltCk (Solid)	1.48 S	1.48 S	1.69 S	1.69 S	1.64 S	1.69 S	1.69 S
241-AW-104	Supernatant/A2-SltSlr (Liquid)	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S
241-AW-104	Sludge (Solids)/PL2 (Solid)	1.20 E	1.20 E	1.28 S	1.28 S	1.20 E	1.28 S	1.28 S
241-AW-104	Sludge (Liquids)/PL2 (Liquid)	1.60 E	1.60 E	1.43 S	1.43 S	1.60 E	1.43 S	1.43 S
241-AW-104	Salt Cake (Solids)/A2-SltSlr (Solid)	1.44 S	1.44 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

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241-AW-104	Salt Cake (Liquids)/A2-SltSlr (Liquid)	1.60 E	1.60 E	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-AW-105	Supernatant	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S	1.07 S
241-AW-105	Sludge/CWZr2 (Solid)	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-AW-106	Supernatant	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E
241-AW-106	Salt Cake/A1-SltCk (Solid)	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E	1.58 E
241-AY-101	Supernatant	1.22 E	1.22 E	1.22 S	1.22 S	1.22 S	1.22 S	1.22 S
241-AY-101	Sludge (Solids)	1.59 S	1.59 S	1.59 S	1.59 S	1.59 S	1.59 E	1.59 S
241-AY-101	Sludge (Liquids)	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S
241-AY-102	Supernatant/BL (Liquid)	1.13 S	1.13 S	1.15 S	1.15 S	1.15 S	1.15 S	1.15 S
241-AY-102	Sludge (Solids)/BL (Solid)	1.48 S	1.48 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-AY-102	Sludge (Liquids)/BL (Liquid)	1.13 E	1.13 E	1.10 S	1.10 S	1.10 S	1.10 S	1.10 S
241-AZ-101	Supernatant	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S
241-AZ-101	Sludge/P3 (Solid)	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 E	1.62 S
241-AZ-102	Supernatant	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S	1.14 S
241-AZ-102	Sludge	1.35 S	1.35 S	1.38 S	1.38 S	1.35 S	1.38 S	1.38 S
241-SY-101	Supernatant/S2-SltSlr (Liquid)	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S
241-SY-101	Salt Cake/S2-SltSlr (Solid)	1.51 S	1.51 S	1.51 S	1.51 S	1.51 S	1.51 S	1.51 S
241-SY-102	Supernatant	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E
241-SY-102	Sludge/Z (Solid)	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-SY-103	Supernatant/S2-SltSlr (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-SY-103	Salt Cake/S2-SltSlr (Solid)	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S
241-A-101	Supernatant/A1-SltCk (Liquid)	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S
241-A-101	Sludge/P2 (Solid)	1.36 E	1.36 E	1.36 E	1.79 E	1.79 E	1.79 E	1.36 E
241-A-101	Salt Cake (Solids)/A1-SltCk (Solid)	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-A-102	Supernatant/A1-SltCk (Liquid)	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E
241-A-102	Salt Cake (Solids)/A1-SltCk (Solid)	1.59 S	1.59 S	1.70 S	1.70 S	1.70 S	1.70 S	1.70 S
241-A-102	Salt Cake (Liquids)/A1-SltCk (Liquid)	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E	1.57 E
241-A-103	Supernatant/A1-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.6 E	1.45 E	1.45 E	1.45 E
241-A-103	Sludge/AR (Solid)	1.3 E	1.3 E	1.3 E	1.3 E	1.3 E	1.3 E	1.3 E
241-A-103	Salt Cake (Solids)/A1-SltCk (Solid)	1.35 E	1.35 E	1.35 E	1.58 E	1.35 E	1.35 E	1.35 E
241-A-103	Salt Cake (Liquids)/A1-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.6 E	1.45 E	1.45 E	1.45 E
241-A-104	Sludge/P1 (Solids)	1.64 S	1.64 S	1.64 S	1.79 E	1.79 E	1.79 E	1.64 S
241-A-104	Sludge/AR (Solids)	1.64 S	1.64 S	1.64 S	1.30 E	1.30 E	1.30 E	1.64 S

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241-A-105	Sludge/P2 (solids)	1.54 S	1.54 S	1.54 S	1.79 E	1.79 E	1.79 E	1.54 S
241-A-106	Sludge/SRR (solids)	1.55 E	1.55 E	1.55 E	1.70 S	1.55 E	1.55 E	1.70 S
241-A-106	Sludge/AR (Solids)	1.55 E	1.55 E	1.55 E	1.70 S	1.55 E	1.55 E	1.70 S
241-A-106	Salt Cake (Solids)/A1-SltCk (solids)	1.55 E	1.55 E	1.55 E	1.70 S	1.55 E	1.55 E	1.70 S
241-AX-101	Supernatant/A1-SltCk (Liquid)	1.4 S	1.4 S	1.53 S	1.53 S	1.53 S	1.53 S	1.53 S
241-AX-101	Sludge/SRR (Solid)	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E	1.32 E
241-AX-101	Salt Cake/A1-SltCk (Solid)	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-AX-102	Sludge/BL (Solid)	1.57 S	1.57 S	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-AX-102	Salt Cake/A1-SltCk (Solid)	1.57 E	1.57 E	1.57 E	1.5 S	1.5 S	1.5 S	1.5 S
241-AX-103	Sludge/P2 (Solid)	1.8 E	1.8 E	1.8 E	1.8 S	1.8 E	1.79 E	1.8 E
241-AX-103	Salt Cake (Solids)/A1-SltCk (Solid)	1.58 E	1.58 E	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S
241-AX-103	Salt Cake (Liquids)/A1-SltCk (Liquid)	1.6 E	1.6 E	1.6 E	1.6 E	1.6 E	1.6 E	1.6 E
241-AX-104	Sludge/P2 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.79 E	1.80 S
241-B-101	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.48 S	1.48 S	1.48 S	1.48 S
241-B-101	Sludge/BL (Solid)	1.62 E	1.62 E	1.62 E	1.48 S	1.48 S	1.48 S	1.48 S
241-B-101	Sludge/B (Solid)	1.24 E	1.24 E	1.24 E	1.48 S	1.48 S	1.48 S	1.48 S
241-B-101	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.75 E	1.48 S	1.48 S	1.48 S	1.48 S
241-B-101	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.53 S	1.53 S	1.19 E	1.53 S
241-B-102	Supernatant/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-102	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 S	1.75 E
241-B-102	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-103	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-B-103	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 S	1.75 E
241-B-103	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-104	Sludge/2C (Solid)	1.27 E	1.27 E	1.36 E	1.36 S	1.36 S	1.27 E	1.36 S
241-B-104	Sludge/1C (Solid)	1.41 E	1.41 E	1.36 E	1.36 S	1.36 S	1.41 E	1.36 S
241-B-104	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.36 E	1.36 S	1.36 S	1.75 E	1.36 S
241-B-104	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-105	Sludge/2C (Solid)	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E
241-B-105	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-B-105	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-B-105	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-106	Supernatant/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-B-106	Sludge/TBP (Solid)	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S	1.36 S
241-B-106	Sludge/1C (Solid)	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S
241-B-107	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.71 S	1.71 S	1.71 S	1.71 E	1.71 E
241-B-107	Sludge/1C (Solid)	1.41 E	1.41 E	1.63 S	1.63 S	1.63 S	1.41 E	1.63 S
241-B-107	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.70 S	1.70 S	1.70 S	1.75 E	1.70 S
241-B-107	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.34 S	1.34 S	1.34 S	1.19 E	1.34 S
241-B-108	Sludge/CWP2 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S
241-B-108	Salt Cake (Solids)/B-SltCk (Solid)	1.70 S	1.75 E	1.70 S	1.70 S	1.70 S	1.75 E	1.70 S
241-B-108	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.38 S	1.38 S	1.38 S	1.19 E	1.38 S
241-B-109	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.85 S	1.85 S	1.85 S	1.85 S	1.85 S
241-B-109	Salt Cake (Solids)/B-SltCk (Solid)	1.75 E	1.75 E	1.89 S	1.89 S	1.89 S	1.89 S	1.89 S
241-B-109	Salt Cake (Liquids)/B-SltCk (Liquid)	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E	1.19 E
241-B-110	Supernatant	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E
241-B-110	Sludge/P2 (Solid)	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E
241-B-110	Sludge/2C (Solid)	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E	1.36 E
241-B-111	Supernatant	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E
241-B-111	Sludge/P2 (Solid)	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S
241-B-111	Sludge/2C (Solid)	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S
241-B-112	Supernatant	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E	1.01 E
241-B-112	Sludge/2C (Solid)	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E
241-B-112	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.69 E	1.69 E	1.69 E	1.69 E	1.69 E
241-B-112	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E
241-B-201	Sludge/224 Pre-1949 (Solid)	1.26 S	1.26 S	1.26 S	1.26 S	1.26 S	1.26 S	1.26 S
241-B-202	Sludge/224 Post-1949 (Solid)	1.22 S	1.22 S	1.22 S	1.22 S	1.22 S	1.22 S	1.22 S
241-B-203	Supernatant/224 (Liquid)	1.06 E	1.06 E	1.06 E	1.05 S	1.05 S	1.05 S	1.05 S
241-B-203	Sludge/224 Post-1949 (Solid)	1.21 E	1.21 E	1.19 S	1.19 S	1.19 S	1.19 S	1.19 S
241-B-204	Supernatant/224 (Liquid)	1.06 E	1.06 E	1.06 E	1.05 S	1.05 S	1.06 E	1.05 S
241-B-204	Sludge/224 Post-1949 (Solid)	1.19 S	1.21 E	1.19 S	1.19 S	1.19 S	1.21 E	1.19 S
241-BX-101	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-BX-101	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E
241-BX-102	Sludge/DE	1.00 E	1.00 E	0.38 E	1.00 E	1.00 E	1.00 E	1.00 E
241-BX-102	Sludge/CWP2 (solids)	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E
241-BX-103	Supernatant/CWP2 (Liquid)	1.11 E	1.11 E	1.11 E	1.11 E	1.11 E	1.11 S	1.11 E

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-BX-103	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.64 S	1.51 E
241-BX-103	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.64 S	1.71 E
241-BX-104	Supernatant/CWR1 (Liquid)	1.26 S	1.26 S	1.28 S	1.28 S	1.28 S	1.28 S	1.28 S
241-BX-104	Sludge/MW (Solid)	1.68 S	1.81 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-BX-104	Sludge/CWR1 (Solid)	1.68 S	1.81 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-BX-104	Sludge/CWP2 (Solid)	1.68 S	1.81 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-BX-105	Supernatant/CWP1 (Liquid)	1.29 E	1.29 E	1.29 E	1.15 E	1.29 E	1.29 E	1.29 E
241-BX-105	Sludge/TBP (Solid)	1.69 E	1.69 E	1.69 E	1.51 E	1.69 E	1.69 S	1.69 E
241-BX-105	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-BX-105	Sludge/CWP1 (Solid)	1.58 E	1.58 E	1.58 E	1.49 E	1.58 E	1.69 S	1.58 E
241-BX-106	Sludge/TBP (Solid)	1.69 E	1.69 E	1.69 E	1.68 S	1.69 E	1.69 E	1.69 E
241-BX-106	Sludge/CWP1 (Solid)	1.69 E	1.69 E	1.69 E	1.68 S	1.69 E	1.69 E	1.69 E
241-BX-107	Sludge/1C (Solid)	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-BX-108	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-BX-108	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-BX-109	Sludge/TBP (Solid)	1.52 S	1.52 S	1.52 S	1.52 S	1.52 S	1.52 S	1.52 S
241-BX-110	Supernatant/BY-SltCk (Liquid)	1.46 E	1.46 E	1.44 S	1.44 S	1.44 S	1.46 E	1.44 S
241-BX-110	Sludge/1C (Solid)	1.41 E	1.41 E	1.79 S	1.41 E	1.79 S	1.41 E	1.79 S
241-BX-110	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.79 S	1.41 E	1.79 S	1.79 S
241-BX-110	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S
241-BX-110	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.44 S	1.44 S	1.44 S	1.46 E	1.44 S
241-BX-111	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-BX-111	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-BX-111	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-BX-112	Supernatant/1C2 (Liquid)	1.10 E	1.10 E	1.18 S	1.18 S	1.18 S	1.10 E	1.18 S
241-BX-112	Sludge/1C (Solid)	1.31 S	1.32 S	1.31 S	1.31 S	1.31 S	1.32 S	1.31 S
241-BY-101	Sludge/TFeCN (Solid)	1.42 E	1.42 E	1.42 E	1.42 E	1.42 E	1.42 E	1.42 E
241-BY-101	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.87 S	1.87 S	1.87 S	1.87 S	1.87 S
241-BY-101	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E	1.46 E
241-BY-102	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.59 S	1.59 S	1.59 S	1.59 S	1.59 S
241-BY-102	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-BY-103	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E
241-BY-103	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.69 E	1.69 S	1.69 S	1.69 S	1.69 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-BY-103	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S
241-BY-104	Sludge/PFeCN (Solid)	1.64 S	1.64 S	1.64 S	1.64 S	1.64 S	1.64 S	1.64 S
241-BY-104	Salt Cake (Solids)/BY-SltCk (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S
241-BY-104	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.46 S	1.46 E	1.46 E	1.46 S	1.46 E
241-BY-105	Sludge/Portland Cement (Solid)	1.00 E	1.00 E	1.90 E	1.00 E	1.00 E	1.00 E	1.90 E
241-BY-105	Sludge/PFeCN (Solid)	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S
241-BY-105	Salt Cake (Solids)/BY-SltCk (Solid)	1.85 S	1.85 S	1.85 S	1.85 S	1.85 S	1.85 S	1.85 S
241-BY-105	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-BY-106	Sludge/PFeCN (Solid)	1.68 S	1.68 S	1.68 S	1.68 E	1.68 E	1.68 S	1.68 E
241-BY-106	Salt Cake (Solids)/BY-SltCk (Solid)	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-BY-106	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-BY-107	Sludge/PFeCN (Solid)	1.68 E	1.68 E	1.78 S	1.78 S	1.78 S	1.78 S	1.78 S
241-BY-107	Salt Cake (Solids)/BY-SltCk (Solid)	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S
241-BY-107	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-BY-108	Sludge/PFeCN (Solid)	1.53 S	1.68 E	1.53 S	1.53 S	1.53 S	1.53 S	1.53 S
241-BY-108	Salt Cake (Solids)/BY-SltCk (Solid)	1.50 S	1.69 E	1.50 S	1.50 S	1.50 S	1.50 S	1.50 S
241-BY-108	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.33 S	1.33 S	1.33 S	1.33 S	1.33 S
241-BY-109	Sludge/CWP2 (Solid)	1.71 E	1.71 E	2.00 S	2.00 S	2.00 S	1.71 E	2.00 S
241-BY-109	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.71 S	1.71 S	1.71 S	1.71 S	1.71 S
241-BY-109	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.50 S	1.50 S	1.50 S	1.50 S	1.50 S
241-BY-110	Sludge/PFeCN (Solid)	1.82 S	1.82 S	1.82 S	1.82 S	1.82 S	1.82 S	1.82 S
241-BY-110	**Salt Cake (Solids)/BY-SltCk (Solid)**	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S
241-BY-110	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.44 S	1.44 S	1.44 S	1.46 E	1.44 S
241-BY-111	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.7 S	1.7 S	1.7 S	1.7 S	1.7 S
241-BY-111	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.42 S	1.42 S	1.42 S	1.42 S	1.42 S
241-BY-112	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-BY-112	Salt Cake (Solids)/BY-SltCk (Solid)	1.69 E	1.69 E	1.76 S	1.76 S	1.76 S	1.76 S	1.76 S
241-BY-112	Salt Cake (Liquids)/BY-SltCk (Liquid)	1.46 E	1.46 E	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-C-101	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-C-101	Sludge/CWP1 (Solid)	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E
241-C-102	Sludge/TH1 (Solid)	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E	1.25 E
241-C-102	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-C-102	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-C-102	Sludge/CWZr1 (Solid)	1.74 E	1.29 E	1.74 E	1.74 E	1.74 E	1.74 E	1.74 E
241-C-102	Sludge/CWP2 (Solid)	1.74 E	1.71 E	1.74 E	1.74 E	1.74 E	1.74 E	1.74 E
241-C-102	Sludge/CWP1 (Solid)	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E	1.49 E
241-C-103	Supernatant/SRR (Liquid)	1.13 E	1.13 E	1.06 E	1.11 S	1.11 S	1.11 S	1.11 S
241-C-103	Sludge/CWP1 (Solid)	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S
241-C-103	Sludge/AR (Solid)	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S
241-C-104	Sludge/TH2 (Solid)	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-104	Sludge/OWW3 (Solid)	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-104	Sludge/CWZr1 (Solid)	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-104	Sludge/CWP2 (Solid)	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-104	Sludge/CWP1 (Solid)	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-104	Sludge	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-C-105	Sludge/TBP (Solid)	1.55 E	1.55 E	1.55 S	1.51 E	1.55 E	1.55 S	1.55 E
241-C-105	Sludge/CWP1 (Solid)	1.55 E	1.55 E	1.55 S	1.49 E	1.55 E	1.55 S	1.55 E
241-C-106	Supernatant/AR (Liquid)	1.13 S	1.13 S	1.14 S	1.14 S	1.13 S	1.13 S	1.13 S
241-C-106	Sludge/AR (Solid)	1.56 S	1.56 S	1.52 S	1.52 S	1.52 S	1.56 S	1.52 S
241-C-107	Sludge/SRR (Solid)	1.32 E	1.32 S	1.32 E	1.32 E	1.32 E	1.32 S	1.32 E
241-C-107	Sludge/CWP2 (Solid)	1.71 E	1.46 S	1.71 E	1.46 S	1.46 S	1.46 S	1.46 S
241-C-107	Sludge/1C (Solid)	1.41 E	1.46 S	1.41 E	1.46 S	1.46 S	1.46 S	1.46 S
241-C-108	Sludge/TFeCN (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-108	Sludge/TBP (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-108	Sludge/1C (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-109	Sludge/TFeCN (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-109	Sludge/HS (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-109	Sludge/CWP1 (Solid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-C-109	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-C-110	Supernatant/1C1 (Liquid)	1.1 S	1.1 S	1.1 S	1.1 S	1.1 S	1.1 S	1.1 S
241-C-110	Sludge/1C (Solid)	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S	1.41 E	1.34 S
241-C-111	Sludge/TFeCN (Solid)	1.44 E	1.44 E	1.44 E	1.42 E	1.42 E	1.44 E	1.42 E
241-C-111	Sludge/HS (Solid)	1.44 E	1.44 E	1.44 E	1.45 E	1.45 E	1.44 E	1.45 E
241-C-111	Sludge/CWP1 (Solid)	1.44 E	1.44 E	1.44 E	1.49 E	1.49 E	1.44 E	1.49 E
241-C-111	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-C-112	Sludge/TFeCN (Solid)	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-C-112	Sludge/CWP1 (Solid)	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S
241-C-112	Sludge/1C (Solid)	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S	1.60 S
241-C-201	Sludge/HS (Solid)	1.16 E	1.16 E	1.16 E	1.50 S	1.50 S	1.50 E	1.50 S
241-C-202	Sludge/HS (Solid)	1.16 E	1.16 E	1.16 E	1.50 S	1.50 S	1.50 S	1.50 S
241-C-203	Sludge/HS (Solid)	1.16 E	1.16 E	1.16 E	1.50 E	1.50 E	1.50 E	1.50 E
241-C-204	Sludge/HS (Solid)	1.16 E	1.16 E	1.16 E	1.50 E	1.50 E	1.50 E	1.50 E
241-S-101	Sludge/R1 (Solid)	1.75 S	1.75 E	1.75 S	1.75 S	1.75 S	1.75 E	1.75 S
241-S-101	Sludge/CWR1 (Solid)	1.75 S	1.62 E	1.75 S	1.75 S	1.75 S	1.62 E	1.75 S
241-S-101	Salt Cake (Solids)/S2-SltSlr (Solid)	1.61 S	1.65 S	1.61 S	1.61 S	1.61 S	1.65 S	1.61 S
241-S-101	Salt Cake (Solids)/S1-Sltck (Solid)	1.61 S	1.65 S	1.61 S	1.61 S	1.61 S	1.65 S	1.61 S
241-S-101	Salt Cake (Solids)/R1-Sltck (Solid)	1.61 S	1.65 S	1.61 S	1.61 S	1.61 S	1.65 S	1.61 S
241-S-101	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-S-101	Salt Cake (Liquids)/S1-Sltck (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-S-101	Salt Cake (Liquids)/R1-Sltck (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-S-102	Sludge/R1 (Solid)	1.75 E	1.75 E	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S
241-S-102	Salt Cake (Solids)/S2-SltSlr (Solid)	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S
241-S-102	Salt Cake (Solids)/S1-SltCk (Solid)	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S	1.63 S
241-S-102	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.40 S	1.40 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S
241-S-102	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.40 S	1.40 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S
241-S-103	Supernatant/S1 saltcake (liquid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-S-103	Sludge/R1	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-S-103	Salt Cake (Solids)/S2 Saltcake (solids)	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E
241-S-103	Salt Cake (Solids)/S1 saltcake (solids)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-S-103	alt Cake (Liquids)/S2 Saltcake (liquid	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-S-103	alt Cake (Liquids)/S1 saltcake (liquid	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-S-104	Sludge/R1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 E	1.75 S
241-S-104	Sludge/CWR1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.62 E	1.75 S
241-S-104	Salt Cake (Solids)/R-SltCk (Solid)	1.64 S	1.75 S	1.75 S	1.72 E	1.72 E	1.72 E	1.64 E
241-S-104	Salt Cake (Liquids)/R-SltCk (Liquid)	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S	1.37 S
241-S-105	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-S-105	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-S-105	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E
241-S-106	Salt Cake (Solids)/S1-SltCk (Solid)	1.74 S	1.74 S	1.74 S	1.74 S	1.74 S	1.74 S	1.74 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-S-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S	1.43 S
241-S-107	Supernatant	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-S-107	Sludge/R1 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S
241-S-107	Sludge/CWZr1 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S
241-S-107	Sludge/CWR2 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S
241-S-107	Sludge/CWR1 (Solid)	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S	1.80 S
241-S-107	Salt Cake (Solids)/T2-SltCk (Solid)	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S
241-S-107	Salt Cake (Solids)/S2-SltSlr (Solid)	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S
241-S-107	Salt Cake (Solids)/S1-SltCk (Solid)	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S
241-S-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-S-107	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-S-107	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S	1.31 S
241-S-108	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-S-108	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-S-108	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E
241-S-109	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-S-109	Salt Cake (Solids)/S1-SltCk (Solid)	1.66 S	1.66 S	1.66 S	1.66 S	1.66 S	1.66 S	1.66 S
241-S-109	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S	1.49 S
241-S-110	Sludge/R1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S
241-S-110	Sludge/CWR1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S
241-S-110	Salt Cake (Solids)/S1-Sltck (Solid)	1.65 S	1.65 S	1.65 S	1.65 S	1.65 S	1.65 S	1.65 S
241-S-110	Salt Cake (Liquids)/S1-Sltck (Liquid)	1.63 E	1.63 E	1.43 S	1.43 S	1.43 S	1.42 S	1.43 S
241-S-111	Supernatant/S1-SltCk (Liquid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-S-111	Sludge/R1 (Solid)	1.67 S	1.75 E	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-S-111	Sludge/CWR1 (Solid)	1.67 S	1.62 E	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-S-111	Salt Cake (Solids)/S1-SltCk (Solid)	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S	1.54 S
241-S-111	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S	1.45 S
241-S-112	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-S-112	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-S-112	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E	1.63 E
241-SX-101	Sludge/R1 (Solid)	1.69 S	1.75 E	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-SX-101	Salt Cake (Solids)/S2-SltSlr (Solid)	1.69 S	1.91 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-SX-101	Salt Cake (Solids)/S1-SltCk (Solid)	1.69 S	1.91 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-SX-101	Salt Cake (Solids)/R-SltCk (Solid)	1.69 S	1.91 S	1.69 S	1.69 S	1.69 S	1.69 S	1.69 S
241-SX-101	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S
241-SX-101	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S
241-SX-101	Salt Cake (Liquids)/R-SltCk (Liquid)	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S
241-SX-102	Sludge/R1 (Solid)	1.68 S	1.68 S	1.72 S	1.72 S	1.72 S	1.68 S	1.72 S
241-SX-102	Salt Cake (Solids)/S2-SltSlr (Solid)	1.68 S	1.68 S	1.72 S	1.72 S	1.72 S	1.68 S	1.72 S
241-SX-102	Salt Cake (Solids)/S1-SltCk (Solid)	1.68 S	1.68 S	1.72 S	1.72 S	1.72 S	1.68 S	1.72 S
241-SX-102	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-SX-102	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-SX-103	Sludge/R1 (Solid)	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S
241-SX-103	Salt Cake (Solids)/S2-SltSlr (Solid)	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S
241-SX-103	Salt Cake (Solids)/S1-SltCk (Solid)	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S	1.88 S
241-SX-103	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.48 E	1.48 E	1.48 S	1.48 S	1.48 S	1.48 E	1.48 S
241-SX-103	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.48 E	1.48 E	1.48 S	1.48 S	1.48 S	1.48 E	1.48 S
241-SX-104	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-104	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-SX-104	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-104	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-SX-104	Salt Cake (Liquids)/R-SltCk (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-SX-105	Sludge/R1 (Solid)	1.75 E	1.75 E	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-SX-105	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.64 S	1.64 S	1.64 S	1.64 S	1.64 S
241-SX-105	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-SX-106	Salt Cake (Solids)/S2-SltSlr (Solid)	1.59 E	1.59 E	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S
241-SX-106	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.61 S	1.61 S	1.61 S	1.61 S	1.61 S
241-SX-106	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.42 S	1.42 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S
241-SX-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.42 S	1.42 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S
241-SX-107	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-107	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-107	Salt Cake (Liquids)/R-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E
241-SX-108	Sludge/R1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S
241-SX-109	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-109	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-110	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-SX-110	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-111	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-111	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-111	Salt Cake (Liquids)/R-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E
241-SX-112	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-112	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-112	Salt Cake (Liquids)/R-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E
241-SX-113	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.06 E
241-SX-113	Sludge/DE (Solid)	1.06 E	1.06 E	1.06 E	1.00 E	1.00 E	1.00 E	1.06 E
241-SX-114	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-SX-114	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-SX-114	Salt Cake (Liquids)/R-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E
241-SX-115	Sludge/R1 (Solid)	1.75 E	1.75 S	1.75 S	1.75 S	1.75 E	1.75 S	1.75 E
241-T-101	Sludge/CWR2	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-T-101	Salt Cake (Solids)/T2-SltCk (solids)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-T-101	Salt Cake (Liquids)/T2-SltCk (liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-T-102	Supernatant/CSR (Liquid)	1.14 E	1.14 E	1.20 E	1.14 E	1.14 E	1.14 E	1.14 E
241-T-102	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-T-102	Sludge/CWP2 (Solid)	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S
241-T-103	Total	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	0.00 E	1.62 E
241-T-103	Supernatant/CSR (Liquid)	1.20 E	1.20 E	1.20 E	1.20 E	1.20 E	1.20 E	1.20 E
241-T-103	Supernatant/BL (Liquid)	1.13 E	1.13 E	1.13 E	1.13 E	1.13 E	1.13 E	1.13 E
241-T-103	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-T-103	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-T-103	Sludge/CWP2 (Solid)	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E	1.71 E
241-T-104	Sludge/1C (Solid)	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S	1.29 S
241-T-105	Sludge/R1 (Solid)	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S
241-T-105	Sludge/CWR1 (Solid)	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S
241-T-105	Sludge/2C (Solid)	1.27 E	1.27 E	1.51 S	1.51 S	1.51 S	1.27 E	1.51 S
241-T-105	Sludge/1C (Solid)	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S	1.32 S
241-T-106	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-T-106	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-T-107	Sludge/TBP (Solid)	1.56 S	1.56 S	1.56 S	1.46 S	1.46 S	1.56 S	1.46 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-T-107	Sludge/CWP2 (Solid)	1.56 S	1.56 S	1.56 S	1.46 S	1.46 S	1.56 S	1.46 S
241-T-107	Sludge/1C (Solid)	1.56 S	1.56 S	1.56 S	1.46 S	1.46 S	1.56 S	1.46 S
241-T-108	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-T-108	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 S	1.55 E	1.55 S	1.55 S	1.55 S	1.55 E	1.55 S
241-T-108	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-T-109	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 E	1.55 E	1.55 S	1.55 S	1.55 S	1.55 E	1.55 S
241-T-109	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-T-110	Supernatant/2C1 (Liquid)	1.05 S	1.05 S	1.08 E	1.05 S	1.05 S	1.05 S	1.05 S
241-T-110	Sludge/2C (Solid)	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E	1.27 E
241-T-110	Sludge/224 Post-1949 (Solid)	1.21 E	1.21 E	1.21 E	1.21 E	1.21 E	1.21 E	1.21 E
241-T-111	Sludge/2C (Solid)	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S
241-T-111	Sludge/224 Post-1949 (Solid)	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S	1.24 S
241-T-112	Supernatant/2C2 (Liquid)	1.05 E	1.05 E	1.05 E	1.10 S	1.10 S	1.10 E	1.10 S
241-T-112	Sludge/2C (Solid)	1.27 E	1.27 E	1.28 S	1.28 S	1.28 S	1.27 E	1.28 S
241-T-112	Sludge/224 Post-1949 (Solid)	1.21 E	1.21 E	1.28 S	1.28 S	1.28 S	1.21 E	1.28 S
241-T-201	Supernatant/224 (Liquid)	1.06 E	1.06 E	1.06 E	1.06 S	1.06 S	1.06 E	1.06 S
241-T-201	Sludge/224 Pre-1949 (Solid)	1.20 S	1.20 S	1.20 S	1.31 S	1.31 S	1.20 S	1.31 S
241-T-202	Sludge/224 Post-1949 (Solid)	1.24 S	1.24 S	1.18 S	1.18 S	1.18 S	1.24 S	1.24 S
241-T-203	Sludge/224 Post-1949 (Solid)	1.23 S	1.23 S	1.23 S	1.22 S	1.22 S	1.23 S	1.22 S
241-T-204	Sludge/224 Post-1949 (Solid)	1.21 S	1.21 S	1.21 S	1.21 S	1.21 S	1.21 S	1.21 S
241-TX-101	Sludge/Z	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-TX-101	Sludge/R1	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-TX-101	Sludge/MW	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-TX-101	Salt Cake (Solids)/T2-SltCk (solids)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-101	Salt Cake (Liquids)/T2-SltCk (liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-102	Sludge/MW	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-TX-102	Salt Cake (Solids)/T2-SltCk (solids)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-102	Salt Cake (Liquids)/T2-SltCk (liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-103	Salt Cake (Solids)/T2 Saltcake (solids)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-103	Salt Cake (Solids)/T1-SltCk (solids)	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E
241-TX-103	Salt Cake (Liquids)/T2-SltCk (liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-103	Salt Cake (Liquids)/T1-SltCk (liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TX-104	Supernatant/T2-SltCk (Liquid)	1.47 E	1.47 E	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-TX-104	Sludge/R1 (Solid)	1.75 E	1.75 E	1.89 S	1.89 S	1.89 S	1.89 S	1.89 S
241-TX-104	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S
241-TX-104	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-TX-105	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-TX-105	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-105	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-106	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-TX-106	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-TX-106	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-106	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-107	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-107	Salt Cake (Solids)/R-SltCk (Solid)	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E	1.72 E
241-TX-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-107	Salt Cake (Liquids)/R-SltCk (Liquid)	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E	1.45 E
241-TX-108	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-TX-108	Sludge/MW (Solid)	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E	1.78 E
241-TX-108	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-108	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-109	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-TX-110	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-TX-110	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-110	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-111	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-TX-111	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-111	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-112	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-112	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E
241-TX-112	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-112	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TX-113	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-TX-113	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-TX-113	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-114	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-TX-114	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-114	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E
241-TX-114	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-114	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TX-115	Sludge/TBP (Solid)	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E	1.51 E
241-TX-115	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-115	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-116	Sludge/DE (Solid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TX-116	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-116	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E
241-TX-116	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TX-117	Sludge/DE (Solid)	1.00 E	1.00 E	0.38 E	1.00 E	1.00 E	1.00 E	1.00 E
241-TX-117	Salt Cake (Solids)/T2-SltCk (Solid)	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E	1.67 E
241-TX-117	Salt Cake (Solids)/T1-SltCk (Solid)	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E	1.55 E
241-TX-117	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TX-118	Salt Cake (Solids)/T2-SltCk (Solid)	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S	1.79 S
241-TX-118	Salt Cake (Solids)	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S	1.57 S
241-TX-118	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TY-101	Sludge/1CFeCN (Solid)	1.64 E	1.64 E	1.64 E	1.65 E	1.64 E	1.64 E	1.64 E
241-TY-101	Salt Cake (Solids)/T1-SltCk (Solid)	1.64 E	1.64 E	1.64 E	1.55 E	1.64 E	1.64 E	1.64 E
241-TY-101	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TY-102	Salt Cake (Solids)/T2-SltCk (Solid)	1.88 S	1.88 S	1.88 S	1.67 E	1.88 S	1.88 S	1.88 S
241-TY-102	Salt Cake (Solids)/T1-SltCk (Solid)	1.88 S	1.88 S	1.88 S	1.55 E	1.88 S	1.88 S	1.88 S
241-TY-102	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TY-102	Salt Cake (Liquids)/T1-SltCk (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TY-103	Sludge/TBP (Solid)	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E
241-TY-103	Sludge/1CFeCN (Solid)	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E
241-TY-103	Salt Cake (Solids)/T2-SltCk (Solid)	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E	1.70 E
241-TY-103	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E	1.47 E
241-TY-104	Supernatant/DW (Liquid)	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E	1.18 E
241-TY-104	Sludge/TBP (Solid)	1.69 E	1.69 E	1.69 E	1.69 E	1.69 E	1.69 S	1.69 E
241-TY-104	Sludge/1CFeCN (Solid)	1.69 E	1.69 E	1.69 E	1.69 E	1.69 E	1.69 S	1.69 E
241-TY-105	Sludge/TBP (Solid)	1.53 S	1.53 S	1.53 S	1.51 E	1.53 S	1.53 S	1.53 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-TY-106	Sludge/TBP (Solid)	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E
241-TY-106	Sludge/DE (Solid)	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E	1.37 E
241-U-101	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-U-102	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-U-102	Salt Cake (Solids)/T2-SltCk (Solid)	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-U-102	Salt Cake (Solids)/S2-SltSlr (Solid)	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S	1.68 S
241-U-102	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S	1.48 S
241-U-103	Supernatant/S1-SltCk (Liquid)	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-U-103	Sludge/R1 (Solid)	1.75 E	1.75 E	1.90 S	1.90 S	1.90 S	1.90 S	1.90 S
241-U-103	Salt Cake (Solids)/S2-SltSlr (Solid)	1.59 E	1.59 E	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S
241-U-103	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.72 S	1.72 S	1.72 S	1.72 S	1.72 S
241-U-103	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S	1.44 S
241-U-104	Sludge/R1Sludge (solids)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-U-104	Sludge/DE (solids)	1.23 E	1.23 E	0.38 E	1.23 E	1.23 E	1.23 E	1.23 E
241-U-105	Sludge/CWR1 (Solid)	1.70 S	1.62 E	1.70 S	1.70 S	1.70 S	1.70 S	1.70 S
241-U-105	Salt Cake (Solids)/T2-SltCk (Solid)	1.70 S	1.67 E	1.70 S	1.70 S	1.70 S	1.70 S	1.70 S
241-U-105	Salt Cake (Solids)/S2-SltSlr (Solid)	1.70 S	1.59 E	1.70 S	1.70 S	1.70 S	1.70 S	1.70 S
241-U-105	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-U-105	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S	1.46 S
241-U-106	Supernatant/S1-SltCk (Liquid)	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S
241-U-106	Salt Cake (Solids)/S1-SltCk (Solid)	1.62 S	1.61 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S
241-U-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S	1.34 S
241-U-107	Supernatant/S2-SltSlr (Liquid)	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S
241-U-107	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-U-107	Salt Cake (Solids)/T2-SltCk (Solid)	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S
241-U-107	Salt Cake (Solids)/S2-SltSlr (Solid)	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S	1.77 S
241-U-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S
241-U-107	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S	1.39 S
241-U-108	Supernatant/S2-SltSlr (Liquid)	1.39 S	1.39 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S
241-U-108	Sludge/CWR2 (Solid)	1.66 E	1.66 E	1.66 E	1.66 E	1.66 E	1.66 E	1.66 E
241-U-108	Salt Cake (Solids)/S2-SltSlr (Solid)	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S
241-U-108	Salt Cake (Solids)/S1-SltCk (Solid)	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S	1.73 S
241-U-108	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.39 S	1.39 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S

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Table A-1. Density of Tank Waste Layers for 177 Tanks from BBI Detail Report (Nov. 2001). (16 Sheets)

Tank	Waste phase/type	^{137}Cs density (g/mL)	^{90}Sr density (g/mL)	Al density (g/mL)	NO_2 density (g/mL)	NO_3 density (g/mL)	TOC density (g/mL)	Chosen waste phase density (g/mL)
241-U-108	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.39 S	1.39 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S
241-U-109	Sludge/CWR1 (Solid)	1.71 S	1.71 S	1.71 S	1.71 S	1.71 S	1.71 S	1.71 S
241-U-109	Salt Cake (Solids)/S2-SltSlr (Solid)	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-U-109	Salt Cake (Solids)/S1-SltCk (Solid)	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S	1.67 S
241-U-109	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S	1.47 S
241-U-110	Sludge/R1 (Solid)	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S	1.75 S
241-U-110	Sludge/CWR1 (Solid)	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S	1.62 S
241-U-110	Sludge/1C (Solid)	1.41 S	1.41 E	1.41 S	1.41 S	1.41 S	1.41 S	1.41 S
241-U-111	Sludge/R1 (Solid)	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E	1.75 E
241-U-111	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-U-111	Salt Cake (Solids)/S2-SltSlr (Solid)	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E	1.59 E
241-U-111	Salt Cake (Solids)/S1-SltCk (Solid)	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E	1.65 E
241-U-111	Salt Cake (Liquids)/S2-SltSlr (Liquid)	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S
241-U-111	Salt Cake (Liquids)/S1-SltCk (Liquid)	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S	1.40 S
241-U-112	Sludge/R1 (Solid)	1.75 E	1.75 E	1.86 S	1.86 S	1.86 S	1.75 E	1.86 S
241-U-112	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.86 S	1.86 S	1.86 S	1.62 E	1.86 S
241-U-112	Sludge/1C (Solid)	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E	1.41 E
241-U-201	Supernatant/CWR1 (Liquid)	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E
241-U-201	Sludge (Solids)/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-U-202	Supernatant/CWR1 (Liquid)	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E
241-U-202	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E
241-U-203	Supernatant/CWR1 (Liquid)	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E
241-U-203	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 S	1.62 E
241-U-204	Supernatant/CWR1 (Liquid)	1.22 E	1.22 E	1.22 E	1.22 E	1.22 E	1.22 S	1.22 E
241-U-204	Sludge/CWR1 (Solid)	1.62 E	1.62 E	1.62 E	1.62 E	1.62 E	1.62 S	1.62 E

Note: E or S means that the data is either best engineering estimate or sampling result

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-AN-101	Total	956	9.51E+04	E	4.67E+01	E	1.11E+04	E	4.11E+04	E	7.18E+04	E	1.15E+03	E
241-AN-101	Supernatant	956	9.51E+04	E	4.67E+01	E	1.11E+04	E	4.11E+04	E	7.18E+04	E	1.15E+03	E
241-AN-102	Total	3990	1.26E+06	S/E	3.88E+05	S/E	6.54E+04	S/E	3.78E+05	S/E	9.55E+05	S/E	1.07E+05	S/E
241-AN-102	Supernatant	3653	1.12E+06	S	3.12E+05	S	5.86E+04	S	3.45E+05	S	8.65E+05	S	9.43E+04	S
241-AN-102	Salt Cake/A2-SltSlr (Solid)	337	1.46E+05	E	7.59E+04	E	6.73E+03	E	3.28E+04	E	9.04E+04	E	1.24E+04	E
241-AN-103	Total	3416	1.90E+06	S	7.40E+03	S	2.18E+05	S	4.93E+05	S	7.23E+05	S	1.05E+04	S
241-AN-103	Supernatant/A2-SltSlr (Liquid)	1883	1.22E+06	S	3.06E+01	S	5.64E+04	S	3.09E+05	S	3.15E+05	S	4.89E+03	S
241-AN-103	Salt Cake/A2-SltSlr (Solid)	1533	6.79E+05	S	7.37E+03	S	1.62E+05	S	1.84E+05	S	4.08E+05	S	5.59E+03	S
241-AN-104	Total	3819	1.98E+06	S	8.55E+04	S	1.38E+05	S	4.08E+05	S	6.86E+05	S	1.99E+04	S
241-AN-104	Supernatant/A2-SltSlr (Liquid)	2083	1.10E+06	S	1.83E+02	S	8.12E+04	S	2.34E+05	S	3.58E+05	S	6.54E+03	S
241-AN-104	Salt Cake/A2-SltSlr (Solid)	1736	8.88E+05	S	8.53E+04	S	5.69E+04	S	1.75E+05	S	3.28E+05	S	1.34E+04	S
241-AN-105	Total	4179	1.41E+06	S	4.80E+04	S	1.63E+05	S	4.76E+05	S	7 15E+05	S	3.20E+04	S
241-AN-105	Supernatant/A2-SltSlr (Liquid)	2407	7.55E+05	S	8.99E+01	S	9.90E+04	S	2.91E+05	S	3.89E+05	S	8.56E+03	S
241-AN-105	Salt Cake/A2-SltSlr (Solid)	1772	6.53E+05	S	4.79E+04	S	6.42E+04	S	1.85E+05	S	3.26E+05	S	2.35E+04	S
241-AN-106	Total	143	2.07E+04	E	3.51E+03	E	2.71E+03	E	1.01E+04	E	1.64E+04	E	1.20E+03	S/E
241-AN-106	Supernatant	79	5.64E+03	E	2.78E+00	E	2.74E+02	E	1.50E+03	E	5.60E+03	E	3.70E+02	S
241-AN-106	Salt Cake	64	1.51E+04	E	3.51E+03	E	2.44E+03	E	8.63E+03	E	1.08E+04	E	8.34E+02	E
241-AN-107	Total	3940	1.38E+06	S	5.30E+05	S	3.44E+04	S	2.60E+05	S	9.23E+05	S	1.64E+05	S
241-AN-107	Supernatant/A2-SltSlr (Liquid)	3005	1.05E+06	S	2.98E+05	S	8.86E+02	S	1.99E+05	S	7.20E+05	S	1.25E+05	S
241-AN-107	Salt Cake	935	3.25E+05	S	2.32E+05	S	3.35E+04	S	6.07E+04	S	2.03E+05	S	3.89E+04	S
241-AP-101	Total	4216	5.97E+05	S	3.62E+02	S	2.93E+04	S	1.77E+05	S	5.57E+05	S	8.26E+03	S
241-AP-101	Supernatant	4216	5.97E+05	S	3.62E+02	S	2.93E+04	S	1.77E+05	S	5.57E+05	S	8.26E+03	S
241-AP-102	Total	4122	7.85E+05	S	4.96E+03	S	4.76E+04	S	1.57E+05	S	3.23E+05	S	1.41E+04	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-AP-102	Supernatant	4122	7.85E+05	S	4.96E+03	S	4.76E+04	S	1.57E+05	S	3.23E+05	S	1.41E+04	S
241-AP-103	Total	1067	2.61E+05	S	5.72E+02	S	9.12E+03	S	1.15E+05	S	1.46E+05	S	4.14E+03	S
241-AP-103	Supernatant	1067	2.61E+05	S	5.72E+02	S	9.12E+03	S	1.15E+05	S	1.46E+05	S	4.14E+03	S
241-AP-104	Total	4198	7.86E+05	E	2.18E+04	E	7.26E+04	E	2.49E+05	E	4.37E+05	E	2.16E+04	E
241-AP-104	Supernatant	4198	7.86E+05	E	2.18E+04	E	7.26E+04	E	2.49E+05	E	4.37E+05	E	2.16E+04	E
241-AP-105	Total	4296	8.73E+05	E	2.75E+04	E	8.73E+04	S/E	4.20E+05	S/E	1.01E+06	S/E	1.43E+04	S/E
241-AP-105	Supernatant/A2-SltSlr (Liquid)	3959	8.02E+05	E	1.09E+04	E	8.27E+04	E	4.04E+05	E	9.46E+05	E	1.14E+04	E
241-AP-105	Salt Cake/A2-SltSlr (Solid)	337	7.13E+04	E	1.66E+04	E	4.59E+03	S	1.62E+04	S	6.31E+04	S	2.94E+03	S
241-AP-106	Total	2358	4.25E+05	E	5.37E+03	E	3.40E+04	E	1.37E+05	E	2.18E+05	E	1.00E+04	E
241-AP-106	Supernatant	2358	4.25E+05	E	5.37E+03	E	3.40E+04	E	1.37E+05	E	2.18E+05	E	1.00E+04	E
241-AP-107	Total	3708	6.21E+05	S	9.49E+03	S	5.78E+04	S	2.07E+05	S	4.91E+05	S	1.46E+04	S
241-AP-107	Supernatant	3708	6.21E+05	S	9.49E+03	S	5.78E+04	S	2.07E+05	S	4.91E+05	S	1.46E+04	S
241-AP-108	Total	121	1.08E+04	S	2.23E+01	S	1.16E+03	S	3.47E+03	S	9.65E+03	S	1.17E+02	S
241-AP-108	Supernatant	121	1.08E+04	S	2.23E+01	S	1.16E+03	S	3.47E+03	S	9.65E+03	S	1.17E+02	S
241-AW-101	Total	4172	1.72E+06	S	8.75E+04	S	1.25E+05	S	4.56E+05	S	7.80E+05	S	2.64E+04	S
241-AW-101	Supernatant/A2-SltSlr (Liquid)	2798	1.23E+06	S	1.12E+03	S	9.21E+04	S	3.36E+05	S	4.76E+05	S	1.12E+04	S
241-AW-101	Salt Cake/A2-SltSlr (Solid)	1374	4.98E+05	S	8.64E+04	S	3.27E+04	S	1.20E+05	S	3.04E+05	S	1.52E+04	S
241-AW-102	Total	322	1.19E+04	S/E	8.80E+04	S/E	2.38E+04	E	1.52E+03	E	2.35E+03	E	9.10E+02	S/E
241-AW-102	Supernatant	208	3.82E+02	E	8.21E-01	E	2.62E+01	E	2.02E+02	E	9.53E+02	E	4.95E+01	E
241-AW-102	Sludge/CWP1 (Solid)	114	1.15E+04	S	8.80E+04	S	2.38E+04	E	1.31E+03	E	1.40E+03	E	8.61E+02	S
241-AW-103	Total	4170	4.17E+05	S/E	1.37E+04	S/E	4.81E+04	S/E	1.57E+05	S/E	4.51E+05	S/E	1.06E+04	S/E
241-AW-103	Supernatant	2986	3.76E+05	E	3.94E+02	E	3.52E+04	E	1.19E+05	E	3.70E+05	E	6.36E+03	E
241-AW-103	Sludge/CWZr2 (Solid)	1033	3.56E+04	S	1.16E+04	S	3.59E+03	S	2.01E+04	S	4.22E+04	S	1.89E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-AW-103	Salt Cake/A1-SltCk (Solid)	151	5.20E+03	S	1.70E+03	S	9.26E+03	S	1.86E+04	S	3.88E+04	S	2.31E+03	S
241-AW-104	Total	1195	2.21E+05	S/E	5.25E+03	S/E	2.23E+04	S	6.62E+04	S	1.01E+05	S	6.52E+03	S/E
241-AW-104	Supernatant/A2-SltSlr (Liquid)	352	1.50E+03	S	1.90E+00	S	4.78E+01	S	7.76E+02	S	4.08E+03	S	2.50E+02	S
241-AW-104	Sludge (Solids)/PL2 (Solid)	188	0.00E+00	E	0.00E+00	E	2.57E+03	S	5.82E+03	S	1.02E+04	S	1.11E+02	E
241-AW-104	Salt Cake (Solids)/A2-SltSlr (Solid)	62	1.59E+04	E	1.31E+03	E	1.02E+03	S	4.32E+03	S	7.25E+03	S	1.14E+03	E
241-AW-104	Sludge (Liquids)/PL2 (Liquid)	457	1.63E+05	S	6.00E+02	S	1.46E+04	S	4.17E+04	S	5.97E+04	S	4.51E+03	S
241-AW-104	Salt Cake (Liquids)/A2-SltSlr (Liquid)	136	4.06E+04	E	3.34E+03	E	4.04E+03	S	1.36E+04	S	2.03E+04	S	5.14E+02	S
241-AW-105	Total	1616	4.42E+04	S	7.36E+04	S	3.69E+03	S	1.06E+04	S	5.45E+04	S	7.08E+03	S
241-AW-105	Supernatant	651	6.65E+03	S	1.48E+01	S	1.49E+02	S	1.55E+03	S	2.23E+04	S	6.11E+02	S
241-AW-105	Sludge/CWZr2 (Solid)	965	3.76E+04	S	7.36E+04	S	3.54E+03	S	9.00E+03	S	3.22E+04	S	6.47E+03	S
241-AW-106	Total	1131	2.47E+05	E	4.97E+04	E	3.80E+04	E	1.34E+05	E	1.90E+05	E	1.24E+04	E
241-AW-106	Supernatant	226	3.46E+04	E	3.92E+01	E	3.55E+03	E	1.18E+04	E	3.68E+04	E	5.81E+02	E
241-AW-106	Salt Cake/A1-SltCk (Solid)	905	2.13E+05	E	4.96E+04	E	3.45E+04	E	1.22E+05	E	1.53E+05	E	1.18E+04	E
241-AY-101	Total	694	7.18E+04	S/E	1.39E+06	S/E	2.80E+04	S/E	2.74E+04	S	3.19E+03	S	5.90E+03	S
241-AY-101	Supernatant	329	1.34E+04	E	2.61E+02	E	7.98E+02	S	1.03E+04	S	1.68E+03	S	4.37E+02	S
241-AY-101	Sludge (Solids)	310	5.32E+04	S	1.39E+06	S	2.72E+04	E	1.35E+04	S	1.14E+03	S	5.30E+03	S
241-AY-101	Sludge (Liquids)	55	5.17E+03	S	4.56E+01	S	2.91E+01	S	3.59E+03	S	3.71E+02	S	1.62E+02	S
241-AY-102	Total	2403	2.17E+05	S/E	5.29E+06	S/E	4.14E+04	S	1.05E+04	S	7.78E+02	S	7.54E+03	S
241-AY-102	Supernatant/BL (Liquid)	1757	5.54E+04	S	3.08E+03	S	2.60E+03	S	1.05E+04	S	7.20E+02	S	2.88E+03	S
241-AY-102	Sludge (Solids)/BL (Solid)	549	1.62E+05	S	5.28E+06	S	3.88E+04	S	5.17E+01	S	2.91E+01	S	4.46E+03	S
241-AY-102	Sludge (Liquids)/BL (Liquid)	97	0.00E+00	E	1.19E+03	E	9.72E+00	S	2.22E+01	S	2.86E+01	S	2.06E+02	S
241-AZ-101	Total	3574	6.01E+06	S	4.77E+06	S	4.46E+04	S/E	2.32E+05	S	2.27E+05	S	1.97E+03	S
241-AZ-101	Supernatant	3377	5.65E+06	S	3.03E+03	S	2.58E+04	S	2.19E+05	S	2.15E+05	S	1.09E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-AZ-101	Sludge/P3 (Solid)	197	3.61E+05	S	4.77E+06	S	1.88E+04	E	1.29E+04	S	1.18E+04	S	8.81E+02	S
241-AZ-102	Total	3774	3.78E+06	S	2.17E+06	S	2.76E+04	S	1.29E+05	S	6.17E+04	S	4.37E+03	S
241-AZ-102	Supernatant	3377	3.41E+06	S	7.12E+03	S	2.09E+03	S	1.11E+05	S	5.80E+04	S	3.54E+03	S
241-AZ-102	Sludge	397	3.67E+05	S	2.16E+06	S	2.55E+04	S	1.79E+04	S	3.68E+03	S	8.31E+02	S
241-SY-101	Total	3611	8.90E+05	S	7.11E+04	S	1.15E+05	S	3.04E+05	S	4.77E+05	S	4.35E+04	S
241-SY-101	Supernatant/S2-SltSlr (Liquid)	2627	6.79E+05	S	9.66E+03	S	3.52E+04	S	2.31E+05	S	3.70E+05	S	1.62E+04	S
241-SY-101	Salt Cake/S2-SltSlr (Solid)	984	2.11E+05	S	6.14E+04	S	7.95E+04	S	7.37E+04	S	1.07E+05	S	2.73E+04	S
241-SY-102	Total	3914	1.43E+06	S/E	5.36E+04	S/E	7.73E+04	S/E	2.32E+05	S/E	3.88E+05	S/E	1.20E+04	S/E
241-SY-102	Supernatant	3645	1.39E+06	E	2.86E+04	E	6.49E+04	E	2.21E+05	E	3.52E+05	E	4.70E+03	E
241-SY-102	Sludge/Z (Solid)	269	4.49E+04	S	2.50E+04	S	1.24E+04	S	1.09E+04	S	3.58E+04	S	7.34E+03	S
241-SY-103	Total	2756	1.17E+06	S	7.33E+04	S	1.30E+05	S	3.99E+05	S	5.09E+05	S	2.67E+04	S
241-SY-103	Supernatant/S2-SltSlr (Liquid)	1543	7.15E+05	S	4.37E+03	S	5.80E+04	S	2.35E+05	S	2.59E+05	S	9.50E+03	S
241-SY-103	Salt Cake/S2-SltSlr (Solid)	1213	4.60E+05	S	6.89E+04	S	7.15E+04	S	1.64E+05	S	2.50E+05	S	1.72E+04	S
241-A-101	Total	3377	1.18E+06	S/E	1.74E+05	S/E	1.64E+05	S/E	5.09E+05	S/E	7.92E+05	S/E	2.40E+04	S/E
241-A-101	Supernatant/A1-SltCk (Liquid)	1872	7.00E+05	S	1.40E+02	S	9.69E+04	S	3.09E+05	S	4.37E+05	S	7.01E+03	S
241-A-101	Sludge/P2 (Solid)	11	1.68E+03	E	8.80E+04	E	2.95E+03	E	3.63E+01	E	9.27E+02	E	0.00E+00	E
241-A-101	Salt Cake (Solids)/A1-SltCk (Solid)	1494	4.81E+05	S	8.60E+04	S	6.40E+04	S	1.99E+05	S	3.54E+05	S	1.70E+04	S
241-A-102	Total	146	4.23E+04	S/E	8.55E+04	S/E	7.33E+03	S/E	1.48E+04	S/E	2.14E+04	S/E	3.04E+03	S/E
241-A-102	Supernatant/A1-SltCk (Liquid)	7	3.72E+03	E	8.38E+00	E	2.87E+02	E	1.39E+01	E	9.03E+02	E	8.75E+01	E
241-A-102	Salt Cake (Solids)/A1-SltCk (Solid)	104	2.00E+04	S	8.54E+04	S	5.60E+03	S	1.47E+04	S	1.60E+04	S	2.51E+03	S
241-A-102	Salt Cake (Liquids)/A1-SltCk (Liquid)	35	1.86E+04	E	4.19E+01	E	1.44E+03	E	6.93E+01	E	4.52E+03	E	4.38E+02	E
241-A-103	Total	1405	3.10E+05	E	1.23E+05	E	4.43E+04	E	1.52E+05	E	2.29E+05	E	1.39E+04	E
241-A-103	Supernatant/A1-SltCk (Liquid)	17	4.67E+03	E	3.37E+01	E	9.89E+02	E	1.63E+03	E	3.26E+03	E	1.34E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-A-103	Sludge/AR (Solid)	8	5.70E+03	E	7.34E+04	E	1.53E+01	E	2.35E+02	E	8.05E-07	E	0.00E+00	E
241-A-103	Salt Cake (Solids)/A1-SltCk (Solid)	1035	2.05E+05	E	4.89E+04	E	2.32E+04	E	1.17E+05	E	1.59E+05	E	1.10E+04	E
241-A-103	Salt Cake (Liquids)/A1-SltCk (Liquid)	345	9.47E+04	E	6.84E+02	E	2.01E+04	E	3.30E+04	E	6.62E+04	E	2.72E+03	E
241-A-104	Total	106	6.63E+04	S	2.49E+06	S	8.07E+03	S	3.01E+03	E	4.10E+02	E	0.00E+00	E
241-A-104	Sludge/P1 (Solids)	4	2.50E+03	S	9.38E+04	S	3.04E+02	S	1.60E+01	E	4.10E+02	E	0.00E+00	E
241-A-104	Sludge/AR (Solids)	102	6.38E+04	S	2.39E+06	S	7.76E+03	S	3.00E+03	E	1.03E-05	E	0.00E+00	E
241-A-105	Total	139	1.15E+05	S	3.12E+06	S	8.28E+03	S	5.57E+02	E	1.42E+04	E	0.00E+00	E
241-A-105	Sludge/P2 (solids)	139	1.15E+05	S	3.12E+06	S	8.28E+03	S	5.57E+02	E	1.42E+04	E	0.00E+00	E
241-A-106	Total	299	6.88E+04	E	5.28E+05	E	1.47E+04	E	4.23E+04	E	5.03E+04	E	4.31E+03	E
241-A-106	Sludge/SRR (solids)	110	2.53E+04	E	1.94E+05	E	5.39E+03	E	1.56E+04	S	1.85E+04	E	1.59E+03	E
241-A-106	Sludge/AR (Solids)	79	1.82E+04	E	1.40E+05	E	3.87E+03	E	1.12E+04	S	1.33E+04	E	1.14E+03	E
241-A-106	Salt Cake (Solids)/A1-SltCk (solids)	110	2.53E+04	E	1.94E+05	E	5.39E+03	E	1.56E+04	S	1.85E+04	E	1.59E+03	E
241-AX-101	Total	2535	8.74E+05	S/E	1.61E+05	S/E	1.13E+05	S/E	3.78E+05	S/E	6.60E+05	S/E	1.58E+04	S/E
241-AX-101	Supernatant/A1-SltCk (Liquid)	1177	4.30E+05	S	2.88E+02	S	5.92E+04	S	2.04E+05	S	3.20E+05	S	4.68E+03	S
241-AX-101	Sludge/SRR (Solid)	11	1.66E+03	E	8.90E+04	E	0.00E+00	E	2.82E+02	E	2.64E-04	E	5.78E+02	E
241-AX-101	Salt Cake/A1-SltCk (Solid)	1347	4.42E+05	S	7.17E+04	S	5.34E+04	S	1.74E+05	S	3.40E+05	S	1.06E+04	S
241-AX-102	Total	114	4.08E+04	S/E	2.32E+05	S/E	4.62E+03	E	5.42E+03	S/E	3.26E+04	S/E	7.60E+03	S/E
241-AX-102	Sludge/BL (Solid)	23	8.70E+03	S	2.18E+05	S	1.93E+03	E	6.41E+02	E	1.27E-02	E	9.26E+01	E
241-AX-102	Salt Cake/A1-SltCk (Solid)	91	3.21E+04	E	1.40E+04	E	2.69E+03	E	4.78E+03	S	3.26E+04	S	7.51E+03	S
241-AX-103	Total	410	1.12E+05	E	4.84E+05	E	1.52E+04	S/E	5.30E+04	S/E	6.47E+04	S/E	4.37E+03	S/E
241-AX-103	Sludge/P2 (Solid)	30	1.72E+04	E	4.67E+05	E	1.53E+03	E	1.21E+02	S	2.25E+03	E	0.00E+00	E
241-AX-103	Salt Cake (Solids)/A1-SltCk (Solid)	285	6.36E+04	E	1.48E+04	E	1.02E+04	S	4.27E+04	S	4.95E+04	S	2.14E+03	S
241-AX-103	Salt Cake (Liquids)/A1-SltCk (Liquid)	95	3.13E+04	E	2.58E+03	E	3.40E+03	E	1.02E+04	E	1.29E+04	E	2.24E+03	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-AX-104	Total	28	5.33E+04	S	2.21E+06	S	2.67E+03	S	1.13E+02	S	2.30E+03	S	0.00E+00	E
241-AX-104	Sludge/P2 (Solid)	28	5.33E+04	S	2.21E+06	S	2.67E+03	S	1.13E+02	S	2.30E+03	S	0.00E+00	E
241-B-101	Total	411	1.03E+04	E	9.58E+05	E	2.46E+04	E	3.31E+04	S	1.18E+05	S	9.41E+02	S/E
241-B-101	Sludge/MW (Solid)	11	1.09E+03	E	1.64E+01	E	0.00E+00	E	7.60E+02	S	2.98E+03	S	3.08E+01	S
241-B-101	Sludge/BL (Solid)	76	0.00E+00	E	5.56E+05	E	7.28E+03	E	5.25E+03	S	2.06E+04	S	2.13E+02	S
241-B-101	Sludge/B (Solid)	19	1.08E+03	E	3.98E+05	E	1.87E+03	E	1.31E+03	S	5.15E+03	S	5.32E+01	S
241-B-101	Salt Cake (Solids)/B-SltCk (Solid)	230	6.10E+03	E	6.64E+02	E	1.54E+04	E	1.59E+04	S	6.23E+04	S	6.44E+02	S
241-B-101	Salt Cake (Liquids)/B-SltCk (Liquid)	75	2.07E+03	E	2.69E+03	E	1.10E+02	E	9.86E+03	S	2.67E+04	S	7.29E-05	E
241-B-102	Total	121	2.72E+03	E	9.42E+02	E	5.52E+03	E	1.77E+03	E	2.02E+04	E	8.16E+02	S/E
241-B-102	Supernatant/B-SltCk (Liquid)	15	1.98E+02	E	2.58E+02	E	1.05E+01	E	2.73E+02	E	2.61E+03	E	6.97E-06	E
241-B-102	Salt Cake (Solids)/B-SltCk (Solid)	80	2.18E+03	E	2.37E+02	E	5.49E+03	E	1.02E+03	E	1.30E+04	E	8.16E+02	S
241-B-102	Salt Cake (Liquids)/B-SltCk (Liquid)	26	3.43E+02	E	4.47E+02	E	1.83E+01	E	4.73E+02	E	4.52E+03	E	1.21E-05	E
241-B-103	Total	211	5.44E+03	E	1.36E+03	E	1.07E+04	E	3.07E+03	E	3.46E+04	E	1.88E+02	S/E
241-B-103	Sludge/MW (Solid)	4	5.34E+02	E	8.02E+00	E	0.00E+00	E	1.35E+02	E	3.06E+02	E	4.56E+00	E
241-B-103	Salt Cake (Solids)/B-SltCk (Solid)	155	4.22E+03	E	4.59E+02	E	1.06E+04	E	1.99E+03	E	2.53E+04	E	1.84E+02	S
241-B-103	Salt Cake (Liquids)/B-SltCk (Liquid)	52	6.86E+02	E	8.94E+02	E	3.66E+01	E	9.46E+02	E	9.05E+03	E	2.42E-05	E
241-B-104	Total	1417	8.13E+04	E	4.24E+04	E	3.48E+03	E	5.33E+03	S/E	5.49E+05	S/E	2.62E+03	E
241-B-104	Sludge/2C (Solid)	697	6.06E+04	E	3.71E+04	E	1.74E+03	E	2.35E+03	S	2.74E+05	S	1.94E+03	E
241-B-104	Sludge/1C (Solid)	473	1.63E+04	E	4.17E+03	E	1.18E+03	E	1.59E+03	S	1.86E+05	S	4.99E+02	E
241-B-104	Salt Cake (Solids)/B-SltCk (Solid)	210	3.93E+03	E	4.27E+02	E	5.26E+02	E	7.08E+02	S	8.26E+04	S	1.87E+02	E
241-B-104	Salt Cake (Liquids)/B-SltCk (Liquid)	37	4.88E+02	E	6.36E+02	E	2.60E+01	E	6.73E+02	E	6.44E+03	E	1.72E-05	E
241-B-105	Total	1098	3.09E+04	E	6.57E+03	E	6.42E+04	E	1.45E+04	E	1.78E+05	E	1.34E+03	E
241-B-105	Sludge/2C (Solid)	60	3.64E+03	E	2.23E+03	E	1.53E+02	E	7.92E+02	E	8.15E+03	E	1.17E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-B-105	Sludge/1C (Solid)	45	1.28E+03	E	3.27E+02	E	9.83E+02	E	5.91E+02	E	7.36E+03	E	3.91E+01	E
241-B-105	Salt Cake (Solids)/B-SltCk (Solid)	918	2.50E+04	E	2.72E+03	E	6.30E+04	E	1.18E+04	E	1.50E+05	E	1.19E+03	E
241-B-105	Salt Cake (Liquids)/B-SltCk (Liquid)	75	9.89E+02	E	1.29E+03	E	5.27E+01	E	1.37E+03	E	1.31E+04	E	3.49E-05	E
241-B-106	Total	464	1.04E+04	S/E	3.30E+04	S/E	3.79E+03	S/E	4.67E+03	S/E	1.15E+05	S/E	2.67E+02	S/E
241-B-106	Supernatant/B-SltCk (Liquid)	4	5.27E+01	E	6.87E+01	E	2.81E+00	E	7.28E+01	E	6.96E+02	E	1.86E-06	E
241-B-106	Sludge/TBP (Solid)	297	7.91E+03	S	3.18E+04	S	6.11E+02	S	3.06E+03	S	7.48E+04	S	2.18E+02	S
241-B-106	Sludge/1C (Solid)	163	2.47E+03	S	1.20E+03	S	3.18E+03	S	1.54E+03	S	3.94E+04	S	4.81E+01	S
241-B-107	Total	611	2.29E+04	E	1.22E+05	E	1.61E+04	S	3.47E+03	S	1.57E+05	S	7.52E+02	E
241-B-107	Sludge/CWP2 (Solid)	42	2.41E+03	E	1.16E+05	E	1.11E+03	S	5.54E+01	S	1.76E+03	S	6.42E+01	E
241-B-107	Sludge/1C (Solid)	285	1.28E+04	E	3.27E+03	E	9.77E+03	S	2.10E+03	S	9.65E+04	S	3.91E+02	E
241-B-107	Salt Cake (Solids)/B-SltCk (Solid)	213	6.25E+03	E	6.80E+02	E	5.18E+03	S	8.50E+02	S	3.52E+04	S	2.97E+02	E
241-B-107	Salt Cake (Liquids)/B-SltCk (Liquid)	71	1.44E+03	E	1.88E+03	E	1.43E+00	S	4.62E+02	S	2.35E+04	S	5.09E-05	E
241-B-108	Total	349	7.81E+03	S/E	2.16E+03	S/E	3.29E+04	S	8.05E+03	S	4.66E+04	S	4.10E+02	S/E
241-B-108	Sludge/CWP2 (Solid)	104	3.40E+03	S	7.49E+02	S	2.55E+04	S	2.42E+03	S	9.09E+03	S	1.54E+02	S
241-B-108	Salt Cake (Solids)/B-SltCk (Solid)	184	3.77E+03	S	5.85E+02	E	7.42E+03	S	2.35E+03	S	1.45E+04	S	2.56E+02	E
241-B-108	Salt Cake (Liquids)/B-SltCk (Liquid)	61	6.33E+02	E	8.25E+02	E	5.48E+01	S	3.28E+03	S	2.30E+04	S	2.23E-05	E
241-B-109	Total	473	1.53E+04	E	3.84E+05	E	4.21E+04	S/E	5.65E+03	S/E	8.78E+04	S/E	1.07E+03	S/E
241-B-109	Sludge/CWP2 (Solid)	189	7.94E+03	E	3.82E+05	E	3.63E+04	S	2.13E+03	S	1.21E+04	S	9.18E+02	S
241-B-109	Salt Cake (Solids)/B-SltCk (Solid)	213	6.40E+03	E	6.96E+02	E	5.73E+03	S	2.22E+03	S	6.33E+04	S	1.51E+02	S
241-B-109	Salt Cake (Liquids)/B-SltCk (Liquid)	71	9.36E+02	E	1.22E+03	E	4.99E+01	E	1.29E+03	E	1.24E+04	E	3.30E-05	E
241-B-110	Total	929	1.46E+04	E	1.05E+05	E	1.42E+03	E	1.30E+04	E	2.35E+05	E	4.79E+02	E
241-B-110	Supernatant	4	0.00E+00	E	0.00E+00	E	0.00E+00	E	4.44E+00	E	3.90E+01	E	0.00E+00	E
241-B-110	Sludge/P2 (Solid)	11	1.74E+02	E	1.25E+03	E	1.69E+01	E	1.54E+02	E	2.80E+03	E	5.70E+00	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-B-110	Sludge/2C (Solid)	914	1.45E+04	E	1.04E+05	E	1.40E+03	E	1.28E+04	E	2.32E+05	E	4.74E+02	E
241-B-111	Total	914	1.44E+05	S/E	2.24E+05	S/E	9.73E+02	S/E	4.87E+04	S/E	8.88E+04	S/E	1.16E+03	S/E
241-B-111	Supernatant	4	0.00E+00	E	0.00E+00	E	0.00E+00	E	4.44E+00	E	3.90E+01	E	0.00E+00	E
241-B-111	Sludge/P2 (Solid)	101	1.59E+04	S	2.48E+04	S	1.08E+02	S	5.41E+03	S	9.86E+03	S	1.29E+02	S
241-B-111	Sludge/2C (Solid)	809	1.28E+05	S	1.99E+05	S	8.65E+02	S	4.33E+04	S	7.89E+04	S	1.03E+03	S
241-B-112	Total	132	1.25E+04	E	5.17E+03	E	2.61E+03	E	4.58E+03	E	3.17E+04	E	6.50E+02	E
241-B-112	Supernatant	11	0.00E+00	E	0.00E+00	E	0.00E+00	E	1.22E+01	E	1.07E+02	E	0.00E+00	E
241-B-112	Sludge/2C (Solid)	56	6.19E+03	E	3.79E+03	E	2.60E+02	E	1.35E+03	E	1.38E+04	E	1.98E+02	E
241-B-112	Salt Cake (Solids)/BY-SltCk (Solid)	49	4.64E+03	E	9.19E+02	E	1.66E+03	E	1.63E+03	E	1.50E+04	E	3.02E+02	E
241-B-112	Salt Cake (Liquids)/BY-SltCk (Liquid)	16	1.66E+03	E	4.61E+02	E	6.91E+02	E	1.59E+03	E	2.78E+03	E	1.50E+02	E
241-B-201	Total	115	2.11E+01	S	2.67E+02	S	1.57E+02	S	1.28E+02	S	7.32E+03	S	3.43E+02	S
241-B-201	Sludge/224 Pre-1949 (Solid)	115	2.11E+01	S	2.67E+02	S	1.57E+02	S	1.28E+02	S	7.32E+03	S	3.43E+02	S
241-B-202	Total	111	1.11E+01	S	4.37E+02	S	2.32E+02	S	1.48E+02	S	8.32E+03	S	4.00E+02	S
241-B-202	Sludge/224 Post-1949 (Solid)	111	1.11E+01	S	4.37E+02	S	2.32E+02	S	1.48E+02	S	8.32E+03	S	4.00E+02	S
241-B-203	Total	195	7.65E+00	E	3.44E+02	E	1.19E+01	S/E	1.66E+02	S	1.44E+04	S	1.68E+01	S
241-B-203	Supernatant/224 (Liquid)	2	2.93E-01	E	2.57E-01	E	0.00E+00	E	3.14E+00	S	1.13E+02	S	1.92E-01	S
241-B-203	Sludge/224 Post-1949 (Solid)	193	7.36E+00	E	3.44E+02	E	1.19E+01	S	1.62E+02	S	1.43E+04	S	1.66E+01	S
241-B-204	Total	192	6.67E+00	S/E	3.15E+02	E	1.31E+01	S/E	1.34E+02	S	1.12E+04	S	1.65E+02	E
241-B-204	Supernatant/224 (Liquid)	3	3.56E-01	E	3.12E-01	E	0.00E+00	E	4.09E+00	S	1.04E+02	S	2.28E-05	E
241-B-204	Sludge/224 Post-1949 (Solid)	189	6.31E+00	S	3.14E+02	E	1.31E+01	S	1.29E+02	S	1.11E+04	S	1.65E+02	E
241-BX-101	Total	180	6.35E+03	E	2.86E+05	E	3.04E+04	E	4.04E+03	E	1.89E+04	E	1.96E+02	E
241-BX-101	Sludge/TBP (Solid)	47	6.28E+02	E	1.12E+04	E	1.57E+02	E	1.28E+03	E	1.32E+04	E	4.31E+01	E
241-BX-101	Sludge/CWP2 (Solid)	133	5.73E+03	E	2.75E+05	E	3.02E+04	E	2.75E+03	E	5.66E+03	E	1.53E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-BX-102	Total	424	7.19E+03	E	3.46E+05	E	3.86E+04	E	3.46E+03	E	7.11E+03	E	1.92E+02	E
241-BX-102	Sludge/DE	257	0.00E+00	E	0.00E+00	E	5.74E+02	E	0.00E+00	E	0.00E+00	E	0.00E+00	E
241-BX-102	Sludge/CWP2 (solids)	167	7.19E+03	E	3.46E+05	E	3.80E+04	E	3.46E+03	E	7.11E+03	E	1.92E+02	E
241-BX-103	Total	277	5.79E+03	E	2.41E+05	E	2.56E+04	E	5.05E+03	E	2.86E+04	E	3.56E+03	S
241-BX-103	Supernatant/CWP2 (Liquid)	42	1.25E+02	E	1.08E+02	E	9.00E+02	E	7.04E+02	E	2.24E+03	E	1.82E+02	S
241-BX-103	Sludge/TBP (Solid)	78	1.04E+03	E	1.85E+04	E	2.59E+02	E	2.12E+03	E	2.18E+04	E	1.12E+03	S
241-BX-103	Sludge/CWP2 (Solid)	157	4.62E+03	E	2.22E+05	E	2.44E+04	E	2.22E+03	E	4.57E+03	E	2.26E+03	S
241-BX-104	Total	379	4.17E+04	S	1.29E+05	S	8.30E+04	S	1.47E+04	S	2.99E+04	S	2.72E+03	S
241-BX-104	Supernatant/CWR1 (Liquid)	11	1.46E+03	S	2.01E+01	S	3.12E+01	S	7.01E+02	S	1.47E+03	S	3.51E+01	S
241-BX-104	Sludge/MW (Solid)	155	1.70E+04	S	5.45E+04	S	3.50E+04	S	5.91E+03	S	1.20E+04	S	1.13E+03	S
241-BX-104	Sludge/CWR1 (Solid)	162	1.77E+04	S	5.69E+04	S	3.65E+04	S	6.17E+03	S	1.25E+04	S	1.18E+03	S
241-BX-104	Sludge/CWP2 (Solid)	51	5.58E+03	S	1.79E+04	S	1.15E+04	S	1.94E+03	S	3.94E+03	S	3.72E+02	S
241-BX-105	Total	271	2.24E+04	E	5.13E+04	E	8.18E+03	E	8.63E+03	E	1.70E+04	E	8.25E+02	S/E
241-BX-105	Supernatant/CWP1 (Liquid)	18	2.30E+03	E	1.46E+02	E	1.07E+02	E	1.41E+03	E	2.11E+03	E	1.70E+02	E
241-BX-105	Sludge/TBP (Solid)	73	4.94E+03	E	1.24E+04	E	4.18E+03	E	3.55E+03	E	4.10E+03	E	2.05E+02	S
241-BX-105	Sludge/MW (Solid)	33	4.41E+03	E	6.61E+01	E	0.00E+00	E	1.11E+03	E	2.53E+03	E	3.76E+01	E
241-BX-105	Sludge/CWP1 (Solid)	147	1.07E+04	E	3.87E+04	E	3.90E+03	E	2.56E+03	E	8.22E+03	E	4.13E+02	S
241-BX-106	Total	142	1.33E+04	E	3.32E+04	E	1.12E+04	E	4.43E+03	E	1.10E+04	E	9.21E+02	E
241-BX-106	Sludge/TBP (Solid)	71	6.63E+03	E	1.66E+04	E	5.61E+03	E	2.22E+03	S	5.51E+03	E	4.60E+02	E
241-BX-106	Sludge/CWP1 (Solid)	71	6.63E+03	E	1.66E+04	E	5.61E+03	E	2.22E+03	S	5.51E+03	E	4.60E+02	E
241-BX-107	Total	1313	2.72E+04	S	1.53E+04	S	2.70E+04	S	1.54E+04	S	2.59E+05	S	1.13E+03	S
241-BX-107	Sludge/1C (Solid)	1313	2.72E+04	S	1.53E+04	S	2.70E+04	S	1.54E+04	S	2.59E+05	S	1.13E+03	S
241-BX-108	Total	119	3.73E+03	E	2.95E+04	E	2.0E+03	E	4.3E+03	E	4.6E+04	E	1.76E+02	E

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Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-BX-108	Sludge/TBP (Solid)	81	1.63E+03	E	2.89E+04	E	4.1E+02	E	3.3E+03	E	3.4E+04	E	1.12E+02	E
241-BX-108	Sludge/1C (Solid)	38	2.10E+03	E	5.38E+02	E	1.6E+03	E	9.7E+02	E	1.2E+04	E	6.44E+01	E
241-BX-109	Total	731	1.28E+04	S	1.28E+05	S	2.22E+03	S	2.00E+04	S	2.17E+05	S	7.84E+02	S
241-BX-109	Sludge/TBP (Solid)	731	1.28E+04	S	1.28E+05	S	2.22E+03	S	2.00E+04	S	2.17E+05	S	7.84E+02	S
241-BX-110	Total	776	7.32E+04	E	1.63E+04	E	2.77E+04	S/E	1.97E+04	S/E	4.40E+05	S/E	3.07E+03	S/E
241-BX-110	Supernatant/BY-SltCk (Liquid)	5	5.07E+02	E	1.41E+02	E	2.20E+01	S	2.61E+02	S	2.06E+03	S	4.59E+01	E
241-BX-110	Sludge/1C (Solid)	94	5.08E+03	E	1.30E+03	E	3.96E+03	S	3.77E+03	E	6.45E+04	S	2.50E+02	E
241-BX-110	Sludge/1C (Solid)	151	8.16E+03	E	2.09E+03	E	6.27E+03	E	1.74E+03	S	4.69E+04	E	3.08E+02	S
241-BX-110	Salt Cake (Solids)/BY-SltCk (Solid)	400	4.67E+04	E	9.26E+03	E	1.69E+04	S	7.39E+03	S	2.75E+05	S	1.31E+03	S
241-BX-110	Salt Cake (Liquids)/BY-SltCk (Liquid)	126	1.28E+04	E	3.54E+03	E	5.54E+02	S	6.57E+03	S	5.20E+04	S	1.16E+03	E
241-BX-111	Total	714	7.68E+04	E	1.59E+04	E	1.66E+04	S/E	1.81E+04	S/E	4.01E+05	S/E	1.15E+03	S/E
241-BX-111	Sludge/1C (Solid)	121	3.44E+03	E	8.80E+02	E	2.64E+03	E	1.59E+03	E	1.98E+04	E	1.05E+02	E
241-BX-111	Salt Cake (Solids)/BY-SltCk (Solid)	531	6.67E+04	E	1.32E+04	E	1.09E+04	S	9.97E+03	S	3.70E+05	S	9.39E+02	S
241-BX-111	Salt Cake (Liquids)/BY-SltCk (Liquid)	62	6.59E+03	E	1.83E+03	E	3.02E+03	S	6.58E+03	S	1.15E+04	S	1.05E+02	S
241-BX-112	Total	622	3.53E+04	S/E	5.21E+03	S/E	1.00E+04	S	2.24E+04	S	6.19E+04	S	4.70E+02	S/E
241-BX-112	Supernatant/1C2 (Liquid)	5	1.73E+02	E	1.52E+02	E	2.39E-01	S	1.76E+02	S	4.93E+02	S	0.00E+00	E
241-BX-112	Sludge/1C (Solid)	617	3.51E+04	S	5.06E+03	S	1.00E+04	S	2.22E+04	S	6.14E+04	S	4.70E+02	S
241-BY-101	Total	1400	2.92E+05	E	2.65E+05	E	5.42E+04	S/E	1.93E+04	S/E	8.64E+05	S/E	6.37E+03	S/E
241-BY-101	Sludge/TFeCN (Solid)	140	1.02E+05	E	2.27E+05	E	5.98E+03	E	9.76E+03	E	1.16E+04	E	5.17E+02	E
241-BY-101	Salt Cake (Solids)/BY-SltCk (Solid)	1189	1.82E+05	E	3.61E+04	E	4.52E+04	S	2.44E+03	S	8.40E+05	S	5.19E+03	S
241-BY-101	Salt Cake (Liquids)/BY-SltCk (Liquid)	71	7.37E+03	E	2.04E+03	E	3.07E+03	E	7.05E+03	E	1.24E+04	E	6.67E+02	E
241-BY-102	Total	1048	1.22E+05	E	2.55E+04	E	4.99E+04	S	3.57E+04	S	1.82E+05	S	6.45E+03	S
241-BY-102	Salt Cake (Solids)/BY-SltCk (Solid)	897	1.06E+05	E	2.10E+04	E	4.14E+04	S	2.31E+04	S	1.59E+05	S	6.22E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-BY-102	Salt Cake (Liquids)/BY-SltCk (Liquid)	151	1.63E+04	E	4.52E+03	E	8.54E+03	S	1.27E+04	S	2.23E+04	S	2.34E+02	S
241-BY-103	Total	1575	2.04E+05	S/E	1.05E+05	S/E	7.95E+04	S/E	2.78E+04	S/E	5.59E+05	S/E	3.21E+04	S/E
241-BY-103	Sludge/CWP2 (Solid)	34	1.46E+03	E	7.04E+04	E	7.73E+03	E	7.03E+02	E	1.45E+03	E	3.90E+01	E
241-BY-103	Salt Cake (Solids)/BY-SltCk (Solid)	1327	1.76E+05	E	3.49E+04	E	6.29E+04	E	1.56E+04	S	5.22E+05	S	3.17E+04	S
241-BY-103	Salt Cake (Liquids)/BY-SltCk (Liquid)	214	2.64E+04	S	2.09E+01	S	8.86E+03	S	1.15E+04	S	3.62E+04	S	4.08E+02	S
241-BY-104	Total	1356	2.07E+05	S/E	3.61E+05	S/E	6.55E+04	S	9.44E+04	S/E	5.04E+05	S/E	1.56E+04	S
241-BY-104	Sludge/PFeCN (Solid)	172	1.70E+04	S	1.71E+05	S	1.70E+04	S	1.20E+04	S	3.58E+04	S	3.23E+03	S
241-BY-104	Salt Cake (Solids)/BY-SltCk (Solid)	1018	1.71E+05	S	1.85E+05	S	3.66E+04	S	6.46E+04	S	4.37E+05	S	1.19E+04	S
241-BY-104	Salt Cake (Liquids)/BY-SltCk (Liquid)	166	1.86E+04	E	5.16E+03	E	1.20E+04	S	1.78E+04	E	3.12E+04	E	3.94E+02	S
241-BY-105	Total	1903	1.93E+05	S/E	1.59E+05	S/E	7.49E+04	S/E	5.13E+04	S/E	1.37E+06	S/E	8.80E+03	S/E
241-BY-105	Sludge/Portland Cement (Solid)	30	0.00E+00	E	0.00E+00	E	1.57E+03	E	0.00E+00	E	0.00E+00	E	0.00E+00	E
241-BY-105	Sludge/PFeCN (Solid)	151	4.64E+04	S	1.43E+05	S	5.97E+03	S	7.19E+03	S	4.38E+04	S	4.15E+03	S
241-BY-105	Salt Cake (Solids)/BY-SltCk (Solid)	1412	8.38E+04	S	1.51E+04	S	5.53E+04	S	2.28E+04	S	1.26E+06	S	3.89E+03	S
241-BY-105	Salt Cake (Liquids)/BY-SltCk (Liquid)	310	6.25E+04	S	3.22E+01	S	1.21E+04	S	2.13E+04	S	6.18E+04	S	7.53E+02	S
241-BY-106	Total	2124	4.10E+05	S	1.47E+05	S	7.29E+04	S	1.15E+05	S/E	9.35E+05	S/E	1.19E+04	S
241-BY-106	Sludge/PFeCN (Solid)	120	9.18E+04	S	1.37E+05	S	6.21E+03	S	8.13E+03	E	2.02E+04	E	4.11E+03	S
241-BY-106	Salt Cake (Solids)/BY-SltCk (Solid)	1530	2.30E+05	S	9.95E+03	S	4.78E+04	S	6.94E+04	S	8.62E+05	S	6.49E+03	S
241-BY-106	Salt Cake (Liquids)/BY-SltCk (Liquid)	474	8.82E+04	S	1.60E+01	S	1.89E+04	S	3.70E+04	S	5.23E+04	S	1.27E+03	S
241-BY-107	Total	1028	2.10E+05	S/E	8.24E+04	S/E	6.07E+04	S	7.56E+04	S	3.22E+05	S	6.37E+03	S
241-BY-107	Sludge/PFeCN (Solid)	57	3.37E+04	E	4.94E+04	E	4.74E+03	S	4.13E+03	S	9.68E+03	S	8.39E+02	S
241-BY-107	Salt Cake (Solids)/BY-SltCk (Solid)	822	1.60E+05	S	2.83E+04	S	4.83E+04	S	5.40E+04	S	2.93E+05	S	5.17E+03	S
241-BY-107	Salt Cake (Liquids)/BY-SltCk (Liquid)	149	1.68E+04	E	4.66E+03	E	7.62E+03	S	1.75E+04	S	1.96E+04	S	3.58E+02	S
241-BY-108	Total	841	5.16E+04	S/E	1.42E+05	E	8.49E+04	S	3.81E+04	S	2.29E+05	S	5.58E+03	S

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Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-BY-108	Sludge/PFeCN (Solid)	151	2.15E+04	S	1.25E+05	E	5.41E+03	S	9.87E+03	S	1.94E+04	S	2.32E+03	S
241-BY-108	Salt Cake (Solids)/BY-SltCk (Solid)	587	1.62E+04	S	1.34E+04	E	7.57E+04	S	2.01E+04	S	1.79E+05	S	3.01E+03	S
241-BY-108	Salt Cake (Liquids)/BY-SltCk (Liquid)	103	1.39E+04	E	3.84E+03	E	3.74E+03	S	8.09E+03	S	3.03E+04	S	2.44E+02	S
241-BY-109	Total	1047	1.03E+05	E	2.39E+05	E	7.22E+04	S	5.03E+04	S	1.29E+05	S	9.67E+03	S/E
241-BY-109	Sludge/CWP2 (Solid)	89	4.54E+03	E	2.18E+05	E	3.52E+04	S	3.03E+03	S	9.08E+03	S	1.21E+02	E
241-BY-109	Salt Cake (Solids)/BY-SltCk (Solid)	812	8.27E+04	E	1.64E+04	E	3.13E+04	S	3.52E+04	S	9.20E+04	S	9.28E+03	S
241-BY-109	Salt Cake (Liquids)/BY-SltCk (Liquid)	146	1.55E+04	E	4.29E+03	E	5.66E+03	S	1.21E+04	S	2.78E+04	S	2.75E+02	S
241-BY-110	Total	1384	1.99E+05	S/E	1.73E+05	S/E	4.67E+04	S	7.97E+04	S	2.43E+05	S	1.32E+04	S/E
241-BY-110	Sludge/PFeCN (Solid)	162	3.67E+04	S	1.17E+05	S	8.81E+03	S	1.19E+04	S	3.04E+04	S	2.64E+03	S
241-BY-110	Salt Cake (Solids)/BY-SltCk (Solid)	1164	1.55E+05	S	5.42E+04	S	3.41E+04	S	6.07E+04	S	2.06E+05	S	9.89E+03	S
241-BY-110	Salt Cake (Liquids)/BY-SltCk (Liquid)	58	7.54E+03	E	2.09E+03	E	3.81E+03	S	7.19E+03	S	7.20E+03	S	6.83E+02	E
241-BY-111	Total	1144	1.31E+05	E	2.66E+04	E	4.75E+04	S	3.09E+04	S	2.73E+05	S	1.12E+04	S
241-BY-111	Salt Cake (Solids)/BY-SltCk (Solid)	1076	1.25E+05	E	2.47E+04	E	4.57E+04	S	2.86E+04	S	2.65E+05	S	1.11E+04	S
241-BY-111	Salt Cake (Liquids)/BY-SltCk (Liquid)	68	6.70E+03	E	1.86E+03	E	1.75E+03	S	2.24E+03	S	8.25E+03	S	8.69E+01	S
241-BY-112	Total	1083	1.39E+05	E	2.81E+04	E	3.91E+04	S/E	5.19E+04	S/E	1.44E+05	S/E	1.51E+04	S/E
241-BY-112	Sludge/MW (Solid)	8	1.07E+03	E	1.60E+01	E	0.00E+00	E	2.69E+02	E	6.12E+02	E	9.11E+00	E
241-BY-112	Salt Cake (Solids)/BY-SltCk (Solid)	1003	1.30E+05	E	2.58E+04	E	3.51E+04	S	4.16E+04	S	1.30E+05	S	1.50E+04	S
241-BY-112	Salt Cake (Liquids)/BY-SltCk (Liquid)	72	8.19E+03	E	2.27E+03	E	3.99E+03	S	1.01E+04	S	1.37E+04	S	1.24E+02	S
241-C-101	Total	333	3.64E+04	E	2.86E+05	E	6.53E+04	E	9.18E+03	E	6.14E+04	E	1.19E+03	E
241-C-101	Sludge/TBP (Solid)	125	2.74E+03	E	4.87E+04	E	6.84E+02	E	5.60E+03	E	5.76E+04	E	1.88E+02	E
241-C-101	Sludge/CWP1 (Solid)	208	3.36E+04	E	2.37E+05	E	6.46E+04	E	3.57E+03	E	3.80E+03	E	1.00E+03	E
241-C-102	Total	1196	2.98E+04	E	5.94E+05	E	8.25E+04	E	1.69E+04	E	7.32E+04	E	1.57E+03	E
241-C-102	Sludge/TH1 (Solid)	98	5.51E+02	E	5.96E+02	E	1.87E+03	E	6.86E+02	E	1.48E+04	E	2.49E+01	E

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Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-C-102	Sludge/TBP (Solid)	61	8.15E+02	E	1.45E+04	E	2.04E+02	E	1.67E+03	E	1.71E+04	E	5.60E+01	E
241-C-102	Sludge/MW (Solid)	19	2.54E+03	E	3.81E+01	E	0.00E+00	E	6.39E+02	E	1.45E+03	E	2.16E+01	E
241-C-102	Sludge/CWZr1 (Solid)	38	5.27E+02	E	2.47E+02	E	2.31E+03	E	5.31E+02	E	1.63E+03	E	4.54E+01	E
241-C-102	Sludge/CWP2 (Solid)	855	1.18E+04	E	4.83E+05	E	5.21E+04	E	1.20E+04	E	3.66E+04	E	1.02E+03	E
241-C-102	Sludge/CWP1 (Solid)	125	1.36E+04	E	9.55E+04	E	2.61E+04	E	1.44E+03	E	1.53E+03	E	4.04E+02	E
241-C-103	Total	750	1.08E+05	S/E	3.03E+06	S/E	1.36E+05	S/E	1.68E+04	S	1.65E+03	S	7.66E+03	S
241-C-103	Supernatant/SRR (Liquid)	276	2.48E+04	E	1.63E+04	E	2.93E+00	E	5.42E+03	S	5.42E+02	S	1.83E+03	S
241-C-103	Sludge/CWP1 (Solid)	283	4.98E+04	S	1.80E+06	S	8.14E+04	S	6.77E+03	S	6.59E+02	S	3.48E+03	S
241-C-103	Sludge/AR (Solid)	191	3.36E+04	S	1.21E+06	S	5.49E+04	S	4.57E+03	S	4.45E+02	S	2.35E+03	S
241-C-104	Total	980	9.55E+04	S	4.84E+05	S	9.01E+04	S	3.65E+04	S	1.96E+04	S	1.42E+04	S
241-C-104	Sludge/TH2 (Solid)	80	7.80E+03	S	3.95E+04	S	7.36E+03	S	2.98E+03	S	1.60E+03	S	1.16E+03	S
241-C-104	Sludge/OWW3 (Solid)	103	1.00E+04	S	5.09E+04	S	9.47E+03	S	3.84E+03	S	2.06E+03	S	1.49E+03	S
241-C-104	Sludge/CWZr1 (Solid)	88	8.57E+03	S	4.35E+04	S	8.09E+03	S	3.28E+03	S	1.76E+03	S	1.27E+03	S
241-C-104	Sludge/CWP2 (Solid)	227	2.21E+04	S	1.12E+05	S	2.09E+04	S	8.46E+03	S	4.53E+03	S	3.28E+03	S
241-C-104	Sludge/CWP1 (Solid)	332	3.24E+04	S	1.64E+05	S	3.05E+04	S	1.24E+04	S	6.63E+03	S	4.80E+03	S
241-C-104	Sludge	150	1.46E+04	S	7.41E+04	S	1.38E+04	S	5.59E+03	S	3.00E+03	S	2.17E+03	S
241-C-105	Total	500	8.18E+04	E	4.76E+05	E	1.72E+05	S	8.42E+03	E	8.14E+03	E	4.74E+03	S
241-C-105	Sludge/TBP (Solid)	50	8.18E+03	E	4.76E+04	E	1.72E+04	S	1.89E+03	E	8.14E+02	E	4.74E+02	S
241-C-105	Sludge/CWP1 (Solid)	450	7.36E+04	E	4.28E+05	E	1.55E+05	S	6.54E+03	E	7.32E+03	E	4.26E+03	S
241-C-106	Total	138	1.75E+04	E	2.82E+05	E	2.06E+03	E	1.53E+03	E	7.69E+01	E	5.25E+02	E
241-C-106	Supernatant/AR (Liquid)	115	6.16E+03	S	3.43E+02	S	2.29E+02	S	1.45E+03	S	6.51E+01	S	3.58E+02	S
241-C-106	Sludge/AR (Solid)	23	1.14E+04	S	2.82E+05	S	1.83E+03	S	8.08E+01	S	1.18E+01	S	1.67E+02	S
241-C-107	Total	940	3.69E+04	E	1.95E+06	S	4.38E+04	E	3.28E+04	S/E	4.95E+04	S/E	5.46E+02	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-C-107	Sludge/SRR (Solid)	339	1.80E+04	E	1.54E+06	S	1.93E+04	E	1.24E+04	E	6.94E+03	E	1.06E+02	S
241-C-107	Sludge/CWP2 (Solid)	90	2.21E+03	E	6.12E+04	S	1.17E+04	E	3.06E+03	S	6.38E+03	S	6.60E+01	S
241-C-107	Sludge/1C (Solid)	511	1.67E+04	E	3.47E+05	S	1.28E+04	E	1.73E+04	S	3.62E+04	S	3.74E+02	S
241-C-108	Total	250	8.15E+04	S	8.44E+03	S	1.89E+04	S	8.74E+03	S	1.57E+04	S	3.43E+02	S
241-C-108	Sludge/TFeCN (Solid)	45	1.47E+04	S	1.52E+03	S	3.40E+03	S	1.57E+03	S	2.83E+03	S	6.17E+01	S
241-C-108	Sludge/TBP (Solid)	95	3.10E+04	S	3.21E+03	S	7.17E+03	S	3.32E+03	S	5.98E+03	S	1.30E+02	S
241-C-108	Sludge/1C (Solid)	110	3.59E+04	S	3.71E+03	S	8.31E+03	S	3.84E+03	S	6.92E+03	S	1.51E+02	S
241-C-109	Total	240	1.71E+05	S/E	2.51E+05	S/E	2.34E+04	S/E	1.22E+04	S/E	1.80E+04	S/E	7.60E+02	S/E
241-C-109	Sludge/TFeCN (Solid)	90	7.57E+04	S	1.12E+05	S	1.00E+04	S	5.22E+03	S	5.26E+03	S	3.24E+02	S
241-C-109	Sludge/HS (Solid)	26	2.19E+04	S	3.23E+04	S	2.90E+03	S	1.51E+03	S	1.52E+03	S	9.35E+01	S
241-C-109	Sludge/CWP1 (Solid)	86	7.23E+04	S	1.07E+05	S	9.60E+03	S	4.99E+03	S	5.02E+03	S	3.09E+02	S
241-C-109	Sludge/1C (Solid)	38	1.08E+03	E	2.76E+02	E	8.30E+02	E	4.99E+02	E	6.22E+03	E	3.31E+01	E
241-C-110	Total	674	1.44E+04	S	3.72E+03	S	1.31E+04	S	6.53E+03	S	9.80E+04	S	5.22E+02	S/E
241-C-110	Supernatant/1C1 (Liquid)	4	1.60E+01	S	9.12E-02	S	8.34E-01	S	1.84E+01	S	2.41E+02	S	2.32E+00	S
241-C-110	Sludge/1C (Solid)	670	1.44E+04	S	3.72E+03	S	1.31E+04	S	6.51E+03	S	9.77E+04	S	5.20E+02	E
241-C-111	Total	217	1.96E+04	E	8.90E+05	E	2.86E+04	E	9.49E+03	E	1.73E+04	E	2.44E+02	E
241-C-111	Sludge/TFeCN (Solid)	89	9.64E+03	E	4.71E+05	E	1.46E+04	E	7.15E+03	E	8.46E+03	E	1.07E+02	E
241-C-111	Sludge/HS (Solid)	19	2.06E+03	E	1.01E+05	E	3.12E+03	E	9.49E+02	E	3.33E-05	E	2.28E+01	E
241-C-111	Sludge/CWP1 (Solid)	60	6.50E+03	E	3.18E+05	E	9.85E+03	E	7.47E+02	E	7.93E+02	E	7.21E+01	E
241-C-111	Sludge/1C (Solid)	49	1.39E+03	E	3.56E+02	E	1.07E+03	E	6.43E+02	E	8.01E+03	E	4.26E+01	E
241-C-112	Total	393	2.85E+05	S	6.48E+05	S	1.24E+04	S	2.78E+04	S	3.72E+04	S	2.42E+03	S
241-C-112	Sludge/TFeCN (Solid)	272	1.97E+05	S	4.49E+05	S	8.55E+03	S	1.92E+04	S	2.57E+04	S	1.67E+03	S
241-C-112	Sludge/CWP1 (Solid)	64	4.64E+04	S	1.06E+05	S	2.01E+03	S	4.53E+03	S	6.05E+03	S	3.94E+02	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-C-112	Sludge/1C (Solid)	57	4.13E+04	S	9.40E+04	S	1.79E+03	S	4.03E+03	S	5.39E+03	S	3.51E+02	S
241-C-201	Total	4	7.87E+01	E	4.13E+02	E	2.74E+01	E	4.18E+01	S	2.27E+02	S	2.50E+02	E
241-C-201	Sludge/HS (Solid)	4	7.87E+01	E	4.13E+02	E	2.74E+01	E	4.18E+01	S	2.27E+02	S	2.50E+02	E
241-C-202	Total	4	8.22E+01	E	4.31E+02	E	2.86E+01	E	2.14E+02	S	6.39E+02	S	2.15E+02	S
241-C-202	Sludge/HS (Solid)	4	8.22E+01	E	4.31E+02	E	2.86E+01	E	2.14E+02	S	6.39E+02	S	2.15E+02	S
241-C-203	Total	10	1.57E+02	E	8.23E+02	E	5.46E+01	E	2.45E+02	E	8.38E+02	E	4.54E+02	E
241-C-203	Sludge/HS (Solid)	10	1.57E+02	E	8.23E+02	E	5.46E+01	E	2.45E+02	E	8.38E+02	E	4.54E+02	E
241-C-204	Total	10	1.01E+02	E	5.32E+02	E	3.53E+01	E	1.58E+02	E	5.41E+02	E	2.93E+02	E
241-C-204	Sludge/HS (Solid)	10	1.01E+02	E	5.32E+02	E	3.53E+01	E	1.58E+02	E	5.41E+02	E	2.93E+02	E
241-S-101	Total	1606	3.47E+05	S	6.06E+05	S/E	1.87E+05	S	1.39E+05	S	4.02E+05	S	4.45E+03	S/E
241-S-101	Sludge/R1 (Solid)	353	5.28E+04	S	2.84E+05	E	7.49E+04	S	2.33E+04	S	7.74E+04	S	9.13E+02	E
241-S-101	Sludge/CWR1 (Solid)	111	1.66E+04	S	1.59E+03	E	2.36E+04	S	7.33E+03	S	2.43E+04	S	2.11E+02	E
241-S-101	Salt Cake (Solids)/S2-SltSlr (Solid)	242	5.46E+04	S	9.04E+04	S	2.27E+04	S	2.16E+04	S	6.75E+04	S	7.96E+02	S
241-S-101	Salt Cake (Solids)/S1-Sltck (Solid)	353	7.96E+04	S	1.32E+05	S	3.31E+04	S	3.14E+04	S	9.85E+04	S	1.16E+03	S
241-S-101	Salt Cake (Solids)/R1-Sltck (Solid)	262	5.91E+04	S	9.78E+04	S	2.45E+04	S	2.33E+04	S	7.31E+04	S	8.62E+02	S
241-S-101	Salt Cake (Liquids)/S2-SltSlr (Liquid)	81	2.39E+04	S	3.34E+00	S	2.42E+03	S	9.14E+03	S	1.73E+04	S	1.45E+02	S
241-S-101	Salt Cake (Liquids)/S1-Sltck (Liquid)	117	3.45E+04	S	4.82E+00	S	3.50E+03	S	1.32E+04	S	2.50E+04	S	2.09E+02	S
241-S-101	Salt Cake (Liquids)/R1-Sltck (Liquid)	87	2.57E+04	S	3.58E+00	S	2.60E+03	S	9.81E+03	S	1.86E+04	S	1.56E+02	S
241-S-102	Total	1249	2.55E+05	S/E	9.29E+04	S/E	3.56E+04	S	8.84E+04	S	5.07E+05	S	7.86E+03	S
241-S-102	Sludge/R1 (Solid)	61	9.33E+03	E	6.27E+04	E	4.79E+03	S	4.09E+03	S	5.55E+03	S	9.12E+02	S
241-S-102	Salt Cake (Solids)/S2-SltSlr (Solid)	556	9.96E+04	S	1.88E+04	S	1.14E+04	S	3.19E+04	S	2.86E+05	S	3.53E+03	S
241-S-102	Salt Cake (Solids)/S1-SltCk (Solid)	333	5.97E+04	S	1.13E+04	S	6.83E+03	S	1.91E+04	S	1.71E+05	S	2.11E+03	S
241-S-102	Salt Cake (Liquids)/S2-SltSlr (Liquid)	185	5.33E+04	S	5.09E+01	S	7.75E+03	S	2.06E+04	S	2.79E+04	S	8.07E+02	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-S-102	Salt Cake (Liquids)/S1-SltCk (Liquid)	114	3.28E+04	S	3.13E+01	S	4.77E+03	S	1.27E+04	S	1.72E+04	S	4.97E+02	S
241-S-103	Total	897	2.17E+05	S/E	4.10E+04	S/E	3.43E+04	S/E	8.52E+04	S/E	3.30E+05	S/E	6.08E+03	S/E
241-S-103	Supernatant/S1 saltcake (liquid)	4	1.39E+03	S	1.59E+00	S	1.28E+02	S	5.88E+02	S	8.64E+02	S	1.87E+01	S
241-S-103	Sludge/R1	34	4.69E+03	E	3.15E+04	E	8.51E+03	E	2.29E+03	E	6.25E+03	E	1.01E+02	E
241-S-103	Salt Cake (Solids)/S2 Saltcake (solids)	301	7.29E+04	E	1.64E+03	E	8.90E+03	E	2.33E+04	E	1.23E+05	E	2.61E+03	E
241-S-103	Salt Cake (Solids)/S1 saltcake (solids)	347	6.53E+04	E	7.80E+03	E	1.00E+04	E	2.81E+04	E	1.54E+05	E	2.36E+03	E
241-S-103	Salt Cake (Liquids)/S2 Saltcake (liquid)	95	3.29E+04	S	3.78E+01	S	3.04E+03	S	1.40E+04	S	2.05E+04	S	4.44E+02	S
241-S-103	Salt Cake (Liquids)/S1 saltcake (liquid)	116	4.02E+04	S	4.61E+01	S	3.72E+03	S	1.70E+04	S	2.51E+04	S	5.43E+02	S
241-S-104	Total	1090	8.26E+04	S	4.28E+05	S	1.96E+05	S	4.61E+04	S/E	4.19E+05	S/E	1.81E+03	S/E
241-S-104	Sludge/R1 (Solid)	409	3.29E+04	S	1.84E+05	S	8.37E+04	S	1.65E+04	S	1.65E+05	S	1.07E+03	E
241-S-104	Sludge/CWR1 (Solid)	91	7.31E+03	S	4.10E+04	S	1.86E+04	S	3.66E+03	S	3.67E+04	S	1.62E+02	E
241-S-104	Salt Cake (Solids)/R-SltCk (Solid)	450	3.30E+04	S	2.03E+05	S	9.21E+04	S	2.06E+04	E	1.79E+05	E	5.16E+02	E
241-S-104	Salt Cake (Liquids)/R-SltCk (Liquid)	140	9.46E+03	S	6.05E-01	S	1.68E+03	S	5.35E+03	S	3.76E+04	S	5.55E+01	S
241-S-105	Total	1536	3.00E+05	E	4.17E+04	E	4.82E+04	E	1.27E+05	E	6.30E+05	E	1.15E+04	E
241-S-105	Sludge/R1 (Solid)	8	1.10E+03	E	7.41E+03	E	2.00E+03	E	5.39E+02	E	1.47E+03	E	2.38E+01	E
241-S-105	Salt Cake (Solids)/S1-SltCk (Solid)	1371	2.58E+05	E	3.08E+04	E	3.96E+04	E	1.11E+05	E	6.09E+05	E	9.32E+03	E
241-S-105	Salt Cake (Liquids)/S1-SltCk (Liquid)	157	4.13E+04	E	3.44E+03	E	6.58E+03	E	1.53E+04	E	1.97E+04	E	2.12E+03	E
241-S-106	Total	1723	2.90E+05	S	3.91E+04	S	5.15E+04	S	7.75E+04	S	9.84E+05	S	6.33E+03	S
241-S-106	Salt Cake (Solids)/S1-SltCk (Solid)	1624	2.66E+05	S	3.91E+04	S	4.78E+04	S	6.73E+04	S	9.61E+05	S	6.13E+03	S
241-S-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	99	2.46E+04	S	5.22E+00	S	3.76E+03	S	1.03E+04	S	2.34E+04	S	1.96E+02	S
241-S-107	Total	1423	1.87E+05	S	3.43E+05	S	1.19E+05	S	8.08E+04	S	1.51E+05	S	4.02E+03	S
241-S-107	Supernatant	53	6.57E+03	S	3.63E+00	S	5.69E+02	S	3.77E+03	S	6.06E+03	S	6.26E+01	S
241-S-107	Sludge/R1 (Solid)	484	6.56E+04	S	1.27E+05	S	4.39E+04	S	2.78E+04	S	5.23E+04	S	1.22E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-S-107	Sludge/CWZr1 (Solid)	95	1.29E+04	S	2.49E+04	S	8.62E+03	S	5.46E+03	S	1.03E+04	S	2.40E+02	S
241-S-107	Sludge/CWR2 (Solid)	223	3.02E+04	S	5.85E+04	S	2.02E+04	S	1.28E+04	S	2.41E+04	S	5.63E+02	S
241-S-107	Sludge/CWR1 (Solid)	469	6.35E+04	S	1.23E+05	S	4.26E+04	S	2.69E+04	S	5.07E+04	S	1.19E+03	S
241-S-107	Salt Cake (Solids)/T2-SltCk (Solid)	27	1.96E+03	S	3.37E+03	S	8.76E+02	S	8.30E+02	S	1.79E+03	S	2.56E+02	S
241-S-107	Salt Cake (Solids)/S2-SltSlr (Solid)	15	1.09E+03	S	1.87E+03	S	4.86E+02	S	4.61E+02	S	9.93E+02	S	1.42E+02	S
241-S-107	Salt Cake (Solids)/S1-SltCk (Solid)	34	2.47E+03	S	4.25E+03	S	1.10E+03	S	1.04E+03	S	2.25E+03	S	3.22E+02	S
241-S-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	8	9.91E+02	S	5.48E-01	S	8.59E+01	S	5.69E+02	S	9.15E+02	S	9.45E+00	S
241-S-107	Salt Cake (Liquids)/S2-SltSlr (Liquid)	4	4.96E+02	S	2.74E-01	S	4.29E+01	S	2.84E+02	S	4.57E+02	S	4.72E+00	S
241-S-107	Salt Cake (Liquids)/S1-SltCk (Liquid)	11	1.36E+03	S	7.54E-01	S	1.18E+02	S	7.82E+02	S	1.26E+03	S	1.30E+01	S
241-S-108	Total	2082	3.92E+05	E	6.40E+04	E	6.45E+04	E	1.68E+05	E	9.15E+05	E	1.42E+04	E
241-S-108	Sludge/R1 (Solid)	19	2.62E+03	E	1.76E+04	E	4.75E+03	E	1.28E+03	E	3.49E+03	E	5.65E+01	E
241-S-108	Salt Cake (Solids)/S1-SltCk (Solid)	2049	3.85E+05	E	4.61E+04	E	5.92E+04	E	1.66E+05	E	9.09E+05	E	1.39E+04	E
241-S-108	Salt Cake (Liquids)/S1-SltCk (Liquid)	14	3.68E+03	E	3.07E+02	E	5.87E+02	E	1.36E+03	E	1.75E+03	E	1.89E+02	E
241-S-109	Total	2017	4.76E+04	S/E	6.05E+04	S/E	2.06E+04	S/E	2.33E+04	S/E	1.91E+06	S/E	2.24E+03	S/E
241-S-109	Sludge/R1 (Solid)	49	6.75E+03	E	4.54E+04	E	1.23E+04	E	3.30E+03	E	9.00E+03	E	1.46E+02	E
241-S-109	Salt Cake (Solids)/S1-SltCk (Solid)	1905	2.17E+04	S	1.51E+04	S	5.44E+03	S	1.46E+04	S	1.90E+06	S	2.02E+03	S
241-S-109	Salt Cake (Liquids)/S1-SltCk (Liquid)	63	1.92E+04	S	1.64E+01	S	2.89E+03	S	5.35E+03	S	8.29E+03	S	7.02E+01	S
241-S-110	Total	1473	1.78E+05	S/E	2.48E+05	S/E	1.24E+05	S	5.39E+04	S	9.04E+05	S	5.49E+03	S
241-S-110	Sludge/R1 (Solid)	288	4.09E+04	S	1.57E+05	S	8.48E+04	S	1.39E+04	S	5.05E+04	S	1.84E+02	S
241-S-110	Sludge/CWR1 (Solid)	76	1.08E+04	S	4.15E+04	S	2.24E+04	S	3.66E+03	S	1.33E+04	S	4.86E+01	S
241-S-110	Salt Cake (Solids)/S1-Sltck (Solid)	994	9.54E+04	S	4.65E+04	S	1.28E+04	S	2.65E+04	S	8.15E+05	S	4.99E+03	S
241-S-110	Salt Cake (Liquids)/S1-Sltck (Liquid)	115	3.09E+04	E	2.58E+03	E	3.56E+03	S	9.87E+03	S	2.50E+04	S	2.62E+02	S
241-S-111	Total	1766	3.58E+05	S	4.84E+05	S/E	1.51E+05	S	9.78E+04	S	5.57E+05	S	4.54E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-S-111	Supernatant/S1-SltCk (Liquid)	180	5.79E+04	S	2.19E+01	S	6.55E+03	S	1.50E+04	S	3.46E+04	S	2.69E+02	S
241-S-111	Sludge/R1 (Solid)	242	3.22E+04	S	2.29E+05	E	8.71E+04	S	9.92E+03	S	1.61E+04	S	3.70E+02	S
241-S-111	Sludge/CWR1 (Solid)	46	6.12E+03	S	7.70E+02	E	1.66E+04	S	1.89E+03	S	3.07E+03	S	7.03E+01	S
241-S-111	Salt Cake (Solids)/S1-SltCk (Solid)	973	1.57E+05	S	2.54E+05	S	2.90E+04	S	4.38E+04	S	4.41E+05	S	3.34E+03	S
241-S-111	Salt Cake (Liquids)/S1-SltCk (Liquid)	325	1.05E+05	S	3.95E+01	S	1.18E+04	S	2.71E+04	S	6.25E+04	S	4.86E+02	S
241-S-112	Total	1950	3.88E+05	E	6.45E+04	E	6.52E+04	E	1.62E+05	E	7.66E+05	E	1.51E+04	E
241-S-112	Sludge/R1 (Solid)	23	3.17E+03	E	2.13E+04	E	5.76E+03	E	1.55E+03	E	4.23E+03	E	6.84E+01	E
241-S-112	Salt Cake (Solids)/S1-SltCk (Solid)	1633	3.07E+05	E	3.67E+04	E	4.72E+04	E	1.32E+05	E	7.25E+05	E	1.11E+04	E
241-S-112	Salt Cake (Liquids)/S1-SltCk (Liquid)	294	7.73E+04	E	6.44E+03	E	1.23E+04	E	2.86E+04	E	3.68E+04	E	3.98E+03	E
241-SX-101	Total	1612	3.30E+05	S	6.51E+05	S/E	1.60E+05	S	7.27E+04	S	7.15E+05	S	4.65E+03	S
241-SX-101	Sludge/R1 (Solid)	545	9.27E+04	S	4.79E+05	E	5.63E+04	S	2.14E+04	S	2.78E+05	S	1.85E+03	S
241-SX-101	Salt Cake (Solids)/S2-SltSlr (Solid)	140	2.38E+04	S	3.01E+04	S	1.45E+04	S	5.49E+03	S	7.14E+04	S	4.75E+02	S
241-SX-101	Salt Cake (Solids)/S1-SltCk (Solid)	246	4.18E+04	S	5.28E+04	S	2.54E+04	S	9.64E+03	S	1.26E+05	S	8.35E+02	S
241-SX-101	Salt Cake (Solids)/R-SltCk (Solid)	413	7.02E+04	S	8.87E+04	S	4.26E+04	S	1.62E+04	S	2.11E+05	S	1.40E+03	S
241-SX-101	Salt Cake (Liquids)/S2-SltSlr (Liquid)	45	1.70E+04	S	3.37E+00	S	3.60E+03	S	3.37E+03	S	4.85E+03	S	1.51E+01	S
241-SX-101	Salt Cake (Liquids)/S1-SltCk (Liquid)	83	3.13E+04	S	6.22E+00	S	6.65E+03	S	6.21E+03	S	8.95E+03	S	2.78E+01	S
241-SX-101	Salt Cake (Liquids)/R-SltCk (Liquid)	140	5.28E+04	S	1.05E+01	S	1.12E+04	S	1.05E+04	S	1.51E+04	S	4.69E+01	S
241-SX-102	Total	1915	5.29E+05	S	2.43E+05	S	8.49E+04	S	2.45E+05	S	6.62E+05	S	1.12E+04	S
241-SX-102	Sludge/R1 (Solid)	208	4.92E+04	S	3.39E+04	S	9.15E+03	S	2.52E+04	S	8.31E+04	S	1.47E+03	S
241-SX-102	Salt Cake (Solids)/S2-SltSlr (Solid)	122	2.89E+04	S	1.99E+04	S	5.36E+03	S	1.48E+04	S	4.87E+04	S	8.62E+02	S
241-SX-102	Salt Cake (Solids)/S1-SltCk (Solid)	1158	2.74E+05	S	1.89E+05	S	5.09E+04	S	1.40E+05	S	4.63E+05	S	8.18E+03	S
241-SX-102	Salt Cake (Liquids)/S2-SltSlr (Liquid)	41	1.70E+04	S	9.04E-01	S	1.87E+03	S	6.20E+03	S	6.46E+03	S	6.19E+01	S
241-SX-102	Salt Cake (Liquids)/S1-SltCk (Liquid)	386	1.60E+05	S	8.51E+00	S	1.76E+04	S	5.83E+04	S	6.08E+04	S	5.83E+02	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-SX-103	Total	1927	4.50E+05	S/E	3.90E+05	S/E	9.2E+04	S	1.8E+05	S	1.0E+06	S	1.19E+04	S/E
241-SX-103	Sludge/R1 (Solid)	30	3.83E+03	S	2.90E+04	S	4.1E+03	S	1.9E+03	S	1.7E+04	S	1.46E+02	S
241-SX-103	Salt Cake (Solids)/S2-SltSlr (Solid)	1402	3.12E+05	S	1.05E+05	S	4.2E+04	S	1.3E+05	S	8.4E+05	S	9.66E+03	S
241-SX-103	Salt Cake (Solids)/S1-SltCk (Solid)	265	3.39E+04	S	2.56E+05	S	3.6E+04	S	1.6E+04	S	1.5E+05	S	1.29E+03	S
241-SX-103	Salt Cake (Liquids)/S2-SltSlr (Liquid)	193	8.38E+04	E	1.71E+01	E	8.6E+03	S	3.0E+04	S	3.0E+04	S	6.52E+02	E
241-SX-103	Salt Cake (Liquids)/S1-SltCk (Liquid)	37	1.61E+04	E	3.28E+00	E	1.6E+03	S	5.8E+03	S	5.8E+03	S	1.25E+02	E
241-SX-104	Total	1688	2.93E+05	S/E	5.34E+05	S/E	1.77E+05	S/E	1.30E+05	S/E	6.08E+05	S/E	8.34E+03	S/E
241-SX-104	Sludge/R1 (Solid)	515	7.10E+04	E	4.77E+05	E	1.29E+05	E	3.47E+04	E	9.46E+04	E	1.53E+03	E
241-SX-104	Salt Cake (Solids)/S1-SltCk (Solid)	943	1.77E+05	E	2.12E+04	E	2.72E+04	E	7.62E+04	E	4.19E+05	E	6.41E+03	E
241-SX-104	Salt Cake (Solids)/R-SltCk (Solid)	129	1.96E+04	E	3.57E+04	E	1.74E+04	E	7.48E+03	E	6.50E+04	E	1.87E+02	E
241-SX-104	Salt Cake (Liquids)/S1-SltCk (Liquid)	38	9.34E+03	S	3.24E+00	S	1.35E+03	S	4.46E+03	S	1.10E+04	S	8.07E+01	S
241-SX-104	Salt Cake (Liquids)/R-SltCk (Liquid)	63	1.55E+04	S	5.36E+00	S	2.24E+03	S	7.39E+03	S	1.83E+04	S	1.34E+02	S
241-SX-105	Total	1258	2.40E+05	S/E	1.76E+05	S/E	8.16E+04	S	1.44E+05	S	4.26E+05	S	5.90E+03	S
241-SX-105	Sludge/R1 (Solid)	172	2.32E+04	E	1.56E+05	E	4.08E+04	S	1.57E+04	S	4.08E+04	S	4.83E+02	S
241-SX-105	Salt Cake (Solids)/S1-SltCk (Solid)	942	1.64E+05	E	1.97E+04	E	3.45E+04	S	1.08E+05	S	3.62E+05	S	4.94E+03	S
241-SX-105	Salt Cake (Liquids)/S1-SltCk (Liquid)	144	5.24E+04	S	2.18E+01	S	6.35E+03	S	2.06E+04	S	2.37E+04	S	4.69E+02	S
241-SX-106	Total	1501	3.44E+05	S/E	1.05E+04	S/E	4.93E+04	S	1.69E+05	S	5.52E+05	S	8.24E+03	S
241-SX-106	Salt Cake (Solids)/S2-SltSlr (Solid)	1108	2.51E+05	E	5.63E+03	E	3.76E+04	S	1.21E+05	S	4.23E+05	S	6.37E+03	S
241-SX-106	Salt Cake (Solids)/S1-SltCk (Solid)	244	4.05E+04	E	4.84E+03	E	8.29E+03	S	2.66E+04	S	9.31E+04	S	1.40E+03	S
241-SX-106	Salt Cake (Liquids)/S2-SltSlr (Liquid)	122	4.35E+04	S	3.92E+01	S	2.76E+03	S	1.82E+04	S	2.99E+04	S	3.83E+02	S
241-SX-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	27	9.63E+03	S	8.67E+00	S	6.12E+02	S	4.02E+03	S	6.61E+03	S	8.48E+01	S
241-SX-107	Total	357	5.24E+04	E	2.89E+05	E	8.11E+04	E	2.43E+04	E	7.95E+04	E	9.52E+02	E
241-SX-107	Sludge/R1 (Solid)	298	4.11E+04	E	2.76E+05	E	7.46E+04	E	2.01E+04	E	5.48E+04	E	8.87E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-SX-107	Salt Cake (Solids)/R-SltCk (Solid)	44	6.70E+03	E	1.22E+04	E	5.92E+03	E	2.55E+03	E	2.22E+04	E	6.38E+01	E
241-SX-107	Salt Cake (Liquids)/R-SltCk (Liquid)	15	4.63E+03	E	4.32E+02	E	6.48E+02	E	1.65E+03	E	2.61E+03	E	1.73E+00	E
241-SX-108	Total	276	8.54E+04	S	1.34E+06	S	1.84E+04	S	7.56E+03	S	1.80E+05	S	3.08E+02	S
241-SX-108	Sludge/R1 (Solid)	276	8.54E+04	S	1.34E+06	S	1.84E+04	S	7.56E+03	S	1.80E+05	S	3.08E+02	S
241-SX-109	Total	913	1.36E+05	E	3.95E+05	E	1.48E+05	E	5.50E+04	E	3.90E+05	E	1.66E+03	E
241-SX-109	Sludge/R1 (Solid)	219	3.02E+04	E	2.03E+05	E	5.48E+04	E	1.48E+04	E	4.02E+04	E	6.52E+02	E
241-SX-109	Salt Cake (Solids)/R-SltCk (Solid)	694	1.06E+05	E	1.92E+05	E	9.33E+04	E	4.02E+04	E	3.50E+05	E	1.01E+03	E
241-SX-110	Total	212	3.07E+04	E	1.29E+05	E	4.11E+04	E	1.33E+04	E	7.19E+04	E	4.74E+02	E
241-SX-110	Sludge/R1 (Solid)	109	1.50E+04	E	1.01E+05	E	2.73E+04	E	7.34E+03	E	2.00E+04	E	3.24E+02	E
241-SX-110	Salt Cake (Solids)/R-SltCk (Solid)	103	1.57E+04	E	2.85E+04	E	1.39E+04	E	5.97E+03	E	5.19E+04	E	1.49E+02	E
241-SX-111	Total	436	6.80E+04	E	2.99E+05	E	8.87E+04	E	2.99E+04	E	1.15E+05	E	1.02E+03	E
241-SX-111	Sludge/R1 (Solid)	289	3.98E+04	E	2.68E+05	E	7.23E+04	E	1.95E+04	E	5.31E+04	E	8.60E+02	E
241-SX-111	Salt Cake (Solids)/R-SltCk (Solid)	110	1.67E+04	E	3.04E+04	E	1.48E+04	E	6.38E+03	E	5.54E+04	E	1.59E+02	E
241-SX-111	Salt Cake (Liquids)/R-SltCk (Liquid)	37	1.14E+04	E	1.06E+03	E	1.60E+03	E	4.07E+03	E	6.44E+03	E	4.26E+00	E
241-SX-112	Total	283	4.28E+04	E	2.11E+05	E	6.10E+04	E	1.93E+04	E	6.88E+04	E	7.10E+02	E
241-SX-112	Sludge/R1 (Solid)	212	2.92E+04	E	1.96E+05	E	5.31E+04	E	1.43E+04	E	3.90E+04	E	6.31E+02	E
241-SX-112	Salt Cake (Solids)/R-SltCk (Solid)	53	8.06E+03	E	1.47E+04	E	7.13E+03	E	3.07E+03	E	2.67E+04	E	7.68E+01	E
241-SX-112	Salt Cake (Liquids)/R-SltCk (Liquid)	18	5.56E+03	E	5.18E+02	E	7.78E+02	E	1.98E+03	E	3.13E+03	E	2.07E+00	E
241-SX-113	Total	71	3.15E+03	E	6.88E+03	E	2.28E+03	E	2.34E+02	E	6.38E+02	E	1.03E+01	E
241-SX-113	Sludge/R1 (Solid)	8	4.79E+02	E	3.21E+03	E	8.69E+02	E	2.34E+02	E	6.38E+02	E	1.03E+01	E
241-SX-113	Sludge/DE (Solid)	63	2.67E+03	E	3.67E+03	E	1.42E+03	E	0.00E+00	E	0.00E+00	E	0.00E+00	E
241-SX-114	Total	594	1.05E+05	E	2.40E+05	E	8.82E+04	E	4.16E+04	E	2.13E+05	E	9.57E+02	E
241-SX-114	Sludge/R1 (Solid)	158	2.18E+04	E	1.46E+05	E	3.95E+04	E	1.06E+04	E	2.90E+04	E	4.70E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-SX-114	Salt Cake (Solids)/R-SltCk (Solid)	327	4.98E+04	E	9.05E+04	E	4.40E+04	E	1.90E+04	E	1.65E+05	E	4.74E+02	E
241-SX-114	Salt Cake (Liquids)/R-SltCk (Liquid)	109	3.37E+04	E	3.14E+03	E	4.71E+03	E	1.20E+04	E	1.90E+04	E	1.25E+01	E
241-SX-115	Total	14	2.30E+03	E	3.63E+05	S	1.19E+03	S	5.15E+01	S	3.07E+03	E	2.74E+01	S/E
241-SX-115	Sludge/R1 (Solid)	14	2.30E+03	E	3.63E+05	S	1.19E+03	S	5.15E+01	S	3.07E+03	E	2.74E+01	S
241-T-101	Total	376	4.62E+04	E	1.05E+04	E	3.58E+04	E	1.65E+04	E	1.20E+05	E	1.98E+03	E
241-T-101	Sludge/CWR2	140	8.01E+03	E	2.19E+03	E	2.84E+04	E	2.95E+03	E	5.44E+03	E	2.90E+02	E
241-T-101	Salt Cake (Solids)/T2-SltCk (solids)	177	2.27E+04	E	6.71E+03	E	5.20E+03	E	7.86E+03	E	1.05E+05	E	1.05E+03	E
241-T-101	Salt Cake (Liquids)/T2-SltCk (liquid)	59	1.55E+04	E	1.60E+03	E	2.21E+03	E	5.68E+03	E	9.79E+03	E	6.37E+02	E
241-T-102	Total	121	6.85E+03	S/E	2.29E+04	S/E	3.33E+04	S/E	2.31E+03	S/E	9.96E+03	S/E	1.06E+02	S/E
241-T-102	Supernatant/CSR (Liquid)	49	2.71E+03	E	5.14E+01	E	4.08E+02	E	1.13E+03	E	5.34E+03	E	2.20E+01	E
241-T-102	Sludge/MW (Solid)	8	1.07E+03	E	1.60E+01	E	0.00E+00	E	2.69E+02	E	6.12E+02	E	9.11E+00	E
241-T-102	Sludge/CWP2 (Solid)	64	3.08E+03	S	2.29E+04	S	3.29E+04	S	9.16E+02	S	4.01E+03	S	7.50E+01	S
241-T-103	Total	102	4.75E+03	E	1.34E+05	E	1.86E+04	E	2.42E+03	E	4.95E+03	E	1.17E+02	E
241-T-103	Supernatant/CSR (Liquid)	11	3.72E+02	E	6.43E+02	E	1.34E+02	E	5.52E+02	E	9.76E+02	E	5.41E-03	E
241-T-103	Supernatant/BL (Liquid)	4	0.00E+00	E	1.15E+02	E	2.82E+01	E	9.80E+00	E	2.06E+02	E	2.36E-03	E
241-T-103	Sludge/MW (Solid)	4	5.34E+02	E	8.02E+00	E	0.00E+00	E	1.35E+02	E	3.06E+02	E	4.56E+00	E
241-T-103	Sludge/CWR1 (Solid)	19	1.09E+03	E	2.97E+02	E	3.85E+03	E	4.00E+02	E	7.39E+02	E	3.94E+01	E
241-T-103	Sludge/CWP2 (Solid)	64	2.76E+03	E	1.32E+05	E	1.46E+04	E	1.32E+03	E	2.73E+03	E	7.34E+01	E
241-T-104	Total	1199	2.57E+02	S	3.38E+03	S	2.51E+04	S	6.55E+03	S	8.97E+04	S	8.81E+02	S/E
241-T-104	Sludge/1C (Solid)	1199	2.57E+02	S	3.38E+03	S	2.51E+04	S	6.55E+03	S	8.97E+04	S	8.81E+02	S
241-T-105	Total	371	2.84E+04	S/E	4.44E+04	S/E	2.43E+04	S	1.76E+04	S	1.25E+04	S	1.33E+03	S/E
241-T-105	Sludge/R1 (Solid)	45	2.46E+03	S	1.39E+04	S	6.97E+03	S	1.92E+03	S	1.35E+03	S	2.73E+02	S
241-T-105	Sludge/CWR1 (Solid)	46	2.51E+03	S	1.42E+04	S	7.12E+03	S	1.96E+03	S	1.38E+03	S	2.79E+02	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-T-105	Sludge/2C (Solid)	273	2.30E+04	E	1.41E+04	E	9.17E+03	S	1.34E+04	S	9.52E+03	S	7.36E+02	E
241-T-105	Sludge/1C (Solid)	7	3.82E+02	S	2.16E+03	S	1.08E+03	S	2.99E+02	S	2.10E+02	S	4.24E+01	S
241-T-106	Total	82	4.83E+03	E	1.28E+03	E	1.12E+04	E	1.98E+03	E	1.41E+04	E	1.63E+02	E
241-T-106	Sludge/CWR1 (Solid)	44	2.71E+03	E	7.42E+02	E	9.60E+03	E	9.99E+02	E	1.84E+03	E	9.84E+01	E
241-T-106	Sludge/1C (Solid)	38	2.12E+03	E	5.42E+02	E	1.63E+03	E	9.80E+02	E	1.22E+04	E	6.49E+01	E
241-T-107	Total	655	1.61E+04	S	1.11E+05	S	3.83E+04	S	1.13E+04	S	7.21E+04	S	8.82E+02	S
241-T-107	Sludge/TBP (Solid)	64	1.58E+03	S	1.08E+04	S	3.74E+03	S	1.10E+03	S	7.04E+03	S	8.62E+01	S
241-T-107	Sludge/CWP2 (Solid)	32	7.88E+02	S	5.41E+03	S	1.87E+03	S	5.52E+02	S	3.52E+03	S	4.31E+01	S
241-T-107	Sludge/1C (Solid)	559	1.38E+04	S	9.45E+04	S	3.27E+04	S	9.65E+03	S	6.15E+04	S	7.53E+02	S
241-T-108	Total	60	8.03E+02	S/E	3.31E+02	E	5.48E+02	S/E	7.34E+02	S/E	2.32E+04	S/E	1.74E+01	E
241-T-108	Sludge/1C (Solid)	20	5.69E+02	E	1.45E+02	E	4.37E+02	E	2.63E+02	E	3.27E+03	E	1.74E+01	E
241-T-108	Salt Cake (Solids)/T1-SltCk (Solid)	30	8.21E+01	S	4.96E+00	E	1.06E+02	S	2.87E+02	S	1.82E+04	S	4.86E-02	E
241-T-108	Salt Cake (Liquids)/T1-SltCk (Liquid)	10	1.52E+02	E	1.80E+02	E	4.65E+00	E	1.84E+02	E	1.74E+03	E	4.45E-06	E
241-T-109	Total	235	1.31E+03	E	1.08E+03	E	3.54E+02	S/E	1.22E+03	S/E	1.44E+04	S/E	1.75E-01	E
241-T-109	Salt Cake (Solids)/T1-SltCk (Solid)	176	4.09E+02	E	1.78E+01	E	3.27E+02	S	1.34E+02	S	4.09E+03	S	1.75E-01	E
241-T-109	Salt Cake (Liquids)/T1-SltCk (Liquid)	59	8.98E+02	E	1.06E+03	E	2.74E+01	E	1.09E+03	E	1.03E+04	E	2.63E-05	E
241-T-110	Total	1400	5.00E+04	S/E	3.07E+04	S/E	2.11E+03	E	1.09E+04	S/E	1.15E+05	S/E	1.64E+03	S/E
241-T-110	Supernatant/2C1 (Liquid)	3	9.40E-03	S	1.45E-03	S	0.00E+00	E	1.77E-01	S	5.49E+01	S	1.35E-01	S
241-T-110	Sludge/2C (Solid)	1360	5.00E+04	E	3.06E+04	E	2.10E+03	E	1.09E+04	E	1.12E+05	E	1.60E+03	E
241-T-110	Sludge/224 Post-1949 (Solid)	37	1.49E+00	E	6.98E+01	E	6.28E+00	E	2.50E+01	E	2.70E+03	E	3.66E+01	E
241-T-111	Total	1692	2.29E+02	S	9.23E+03	S	7.36E+02	S	1.57E+03	S	1.22E+05	S	7.26E+03	S
241-T-111	Sludge/2C (Solid)	934	1.26E+02	S	5.09E+03	S	4.06E+02	S	8.67E+02	S	6.72E+04	S	4.01E+03	S
241-T-111	Sludge/224 Post-1949 (Solid)	758	1.02E+02	S	4.13E+03	S	3.30E+02	S	7.04E+02	S	5.45E+04	S	3.25E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-T-112	Total	252	5.15E+03	E	3.37E+03	E	1.48E+03	S/E	9.13E+03	S	5.62E+03	S	2.81E+02	E
241-T-112	Supernatant/2C2 (Liquid)	26	5.98E+01	E	5.21E+01	E	0.00E+00	E	1.01E+03	S	6.06E+02	S	1.14E+01	E
241-T-112	Sludge/2C (Solid)	127	5.09E+03	E	3.12E+03	E	8.31E+02	S	4.56E+03	S	2.82E+03	S	1.63E+02	E
241-T-112	Sludge/224 Post-1949 (Solid)	99	4.36E+00	E	2.04E+02	E	6.48E+02	S	3.56E+03	S	2.20E+03	S	1.07E+02	E
241-T-201	Total	118	4.40E+00	S/E	1.13E+01	S/E	1.18E+01	S/E	6.06E+01	S	6.67E+03	S	2.88E+01	S/E
241-T-201	Supernatant/224 (Liquid)	8	9.81E-01	E	8.61E-01	E	0.00E+00	E	2.68E+00	S	3.69E+02	S	6.29E-05	E
241-T-201	Sludge/224 Pre-1949 (Solid)	110.00	3.42E+00	S	1.04E+01	S	1.18E+01	S	5.79E+01	S	6.30E+03	S	2.88E+01	S
241-T-202	Total	81	2.61E+00	S/E	2.30E-01	S	7.02E+00	S	6.11E+01	S	5.89E+03	S	3.48E+01	S
241-T-202	Sludge/224 Post-1949 (Solid)	81	2.61E+00	S	2.30E-01	S	7.02E+00	S	6.11E+01	S	5.89E+03	S	3.48E+01	S
241-T-203	Total	140	2.87E+00	S/E	4.07E-01	S	9.69E+00	S	5.71E+01	S	1.00E+04	S	7.24E+01	S
241-T-203	Sludge/224 Post-1949 (Solid)	140	2.87E+00	S	4.07E-01	S	9.69E+00	S	5.71E+01	S	1.00E+04	S	7.24E+01	S
241-T-204	Total	140	1.21E+00	S	7.18E-01	S	9.08E+00	S	4.80E+01	S	9.34E+03	S	5.29E+01	S
241-T-204	Sludge/224 Post-1949 (Solid)	140	1.21E+00	S	7.18E-01	S	9.08E+00	S	4.80E+01	S	9.34E+03	S	5.29E+01	S
241-TX-101	Total	344	4.83E+04	E	2.48E+05	E	6.95E+04	E	2.19E+04	E	8.10E+04	E	1.26E+03	E
241-TX-101	Sludge/Z	4	0.00E+00	E	0.00E+00	E	1.18E+03	E	1.43E+00	E	3.53E+02	E	0.00E+00	E
241-TX-101	Sludge/R1	265	3.65E+04	E	2.45E+05	E	6.63E+04	E	1.79E+04	E	4.87E+04	E	7.88E+02	E
241-TX-101	Sludge/MW	11	1.47E+03	E	2.20E+01	E	0.00E+00	E	3.70E+02	E	8.42E+02	E	1.25E+01	E
241-TX-101	Salt Cake (Solids)/T2-SltCk (solids)	48	6.16E+03	E	1.82E+03	E	1.41E+03	E	2.13E+03	E	2.85E+04	E	2.85E+02	E
241-TX-101	Salt Cake (Liquids)/T2-SltCk (liquid)	16	4.19E+03	E	4.33E+02	E	5.98E+02	E	1.54E+03	E	2.66E+03	E	1.73E+02	E
241-TX-102	Total	821	1.22E+05	E	2.95E+04	E	2.49E+04	E	4.26E+04	E	4.31E+05	E	5.43E+03	E
241-TX-102	Sludge/MW	8	1.07E+03	E	1.60E+01	E	0.00E+00	E	2.69E+02	E	6.12E+02	E	9.11E+00	E
241-TX-102	Salt Cake (Solids)/T2-SltCk (solids)	692	8.88E+04	E	2.62E+04	E	2.03E+04	E	3.07E+04	E	4.10E+05	E	4.11E+03	E
241-TX-102	Salt Cake (Liquids)/T2-SltCk (liquid)	121	3.17E+04	E	3.28E+03	E	4.53E+03	E	1.16E+04	E	2.01E+04	E	1.31E+03	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-TX-103	Total	548	7.77E+04	E	1.96E+04	E	1.63E+04	E	2.74E+04	E	2.93E+05	E	3.51E+03	E
241-TX-103	Salt Cake (Solids)/T2 Saltcake (solids)	470	6.03E+04	E	1.78E+04	E	1.38E+04	E	2.09E+04	E	2.79E+05	E	2.79E+03	E
241-TX-103	Salt Cake (Solids)/T1-SltCk (solids)	9	3.11E+01	E	1.36E+00	E	2.46E+01	E	9.96E+01	E	2.96E+03	E	1.33E-02	E
241-TX-103	Salt Cake (Liquids)/T2-SltCk (liquid)	66	1.73E+04	E	1.79E+03	E	2.47E+03	E	6.35E+03	E	1.10E+04	E	7.13E+02	E
241-TX-103	Salt Cake (Liquids)/T1-SltCk (liquid)	3	4.57E+01	E	5.41E+01	E	1.40E+00	E	5.52E+01	E	5.22E+02	E	1.34E-06	E
241-TX-104	Total	262	3.31E+04	E	9.93E+04	E	4.14E+04	S	1.16E+04	S	1.07E+05	S	5.66E+02	S
241-TX-104	Supernatant/T2-SltCk (Liquid)	9	2.28E+03	E	2.36E+02	E	2.87E+01	S	8.48E+02	S	3.19E+03	S	1.22E+01	S
241-TX-104	Sludge/R1 (Solid)	130	1.42E+04	E	9.57E+04	E	3.84E+04	S	3.05E+03	S	4.92E+04	S	1.77E+02	S
241-TX-104	Salt Cake (Solids)/T2-SltCk (Solid)	92	8.66E+03	E	2.56E+03	E	2.89E+03	S	4.75E+03	S	4.37E+04	S	3.35E+02	S
241-TX-104	Salt Cake (Liquids)/T2-SltCk (Liquid)	31	7.87E+03	E	8.14E+02	E	9.89E+01	S	2.92E+03	S	1.10E+04	S	4.21E+01	S
241-TX-105	Total	2181	2.94E+05	E	8.04E+04	E	6.40E+04	E	1.02E+05	E	1.23E+06	E	1.33E+04	E
241-TX-105	Sludge/MW (Solid)	31	4.14E+03	E	6.21E+01	E	0.00E+00	E	1.04E+03	E	2.37E+03	E	3.53E+01	E
241-TX-105	Salt Cake (Solids)/T2-SltCk (Solid)	2044	2.62E+05	E	7.74E+04	E	6.01E+04	E	9.08E+04	E	1.21E+06	E	1.22E+04	E
241-TX-105	Salt Cake (Liquids)/T2-SltCk (Liquid)	106	2.78E+04	E	2.87E+03	E	3.96E+03	E	1.02E+04	E	1.76E+04	E	1.14E+03	E
241-TX-106	Total	1318	1.89E+05	E	6.24E+04	E	4.34E+04	E	6.67E+04	E	7.08E+05	E	8.50E+03	E
241-TX-106	Sludge/R1 (Solid)	16	2.21E+03	E	1.48E+04	E	4.00E+03	E	1.08E+03	E	2.94E+03	E	4.76E+01	E
241-TX-106	Sludge/MW (Solid)	4	5.34E+02	E	8.02E+00	E	0.00E+00	E	1.35E+02	E	3.06E+02	E	4.56E+00	E
241-TX-106	Salt Cake (Solids)/T2-SltCk (Solid)	1147	1.47E+05	E	4.35E+04	E	3.37E+04	E	5.10E+04	E	6.80E+05	E	6.82E+03	E
241-TX-106	Salt Cake (Liquids)/T2-SltCk (Liquid)	151	3.96E+04	E	4.09E+03	E	5.65E+03	E	1.45E+04	E	2.51E+04	E	1.63E+03	E
241-TX-107	Total	112	2.10E+04	E	1.00E+04	E	6.42E+03	E	7.52E+03	E	6.14E+04	E	7.03E+02	E
241-TX-107	Salt Cake (Solids)/T2-SltCk (Solid)	61	9.76E+03	E	2.88E+03	E	2.24E+03	E	3.38E+03	E	4.51E+04	E	4.52E+02	E
241-TX-107	Salt Cake (Solids)/R-SltCk (Solid)	23	3.50E+03	E	6.36E+03	E	3.09E+03	E	1.33E+03	E	1.16E+04	E	3.33E+01	E
241-TX-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	20	5.24E+03	E	5.42E+02	E	7.48E+02	E	1.92E+03	E	3.32E+03	E	2.16E+02	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-TX-107	Salt Cake (Liquids)/R-SltCk (Liquid)	8	2.47E+03	E	2.30E+02	E	3.46E+02	E	8.80E+02	E	1.39E+03	E	9.20E-01	E
241-TX-108	Total	489	6.53E+04	E	2.18E+04	E	1.40E+04	E	2.32E+04	E	2.66E+05	E	2.96E+03	E
241-TX-108	Sludge/TBP (Solid)	19	2.54E+02	E	4.52E+03	E	6.34E+01	E	5.19E+02	E	5.34E+03	E	1.74E+01	E
241-TX-108	Sludge/MW (Solid)	5	6.68E+02	E	1.00E+01	E	0.00E+00	E	1.68E+02	E	3.83E+02	E	5.70E+00	E
241-TX-108	Salt Cake (Solids)/T2-SltCk (Solid)	430	5.52E+04	E	1.63E+04	E	1.26E+04	E	1.91E+04	E	2.55E+05	E	2.56E+03	E
241-TX-108	Salt Cake (Liquids)/T2-SltCk (Liquid)	35	9.17E+03	E	9.48E+02	E	1.31E+03	E	3.37E+03	E	5.81E+03	E	3.78E+02	E
241-TX-109	Total	1375	3.91E+04	E	9.99E+03	E	3.01E+04	E	1.80E+04	E	2.25E+05	E	1.20E+03	E
241-TX-109	Sludge/1C (Solid)	1375	3.91E+04	E	9.99E+03	E	3.01E+04	E	1.80E+04	E	2.25E+05	E	1.20E+03	E
241-TX-110	Total	1767	2.17E+05	E	6.23E+04	E	5.11E+04	E	7.58E+04	E	9.73E+05	E	9.95E+03	E
241-TX-110	Sludge/1C (Solid)	140	3.98E+03	E	1.02E+03	E	3.06E+03	E	1.84E+03	E	2.29E+04	E	1.22E+02	E
241-TX-110	Salt Cake (Solids)/T2-SltCk (Solid)	1594	2.04E+05	E	6.04E+04	E	4.69E+04	E	7.08E+04	E	9.45E+05	E	9.48E+03	E
241-TX-110	Salt Cake (Liquids)/T2-SltCk (Liquid)	33	8.65E+03	E	8.94E+02	E	1.23E+03	E	3.17E+03	E	5.48E+03	E	3.56E+02	E
241-TX-111	Total	1383	1.63E+05	E	4.73E+04	E	3.95E+04	E	5.70E+04	E	7.45E+05	E	7.46E+03	E
241-TX-111	Sludge/1C (Solid)	162	4.61E+03	E	1.18E+03	E	3.54E+03	E	2.13E+03	E	2.65E+04	E	1.41E+02	E
241-TX-111	Salt Cake (Solids)/T2-SltCk (Solid)	1208	1.55E+05	E	4.58E+04	E	3.55E+04	E	5.37E+04	E	7.16E+05	E	7.18E+03	E
241-TX-111	Salt Cake (Liquids)/T2-SltCk (Liquid)	13	3.41E+03	E	3.52E+02	E	4.86E+02	E	1.25E+03	E	2.16E+03	E	1.40E+02	E
241-TX-112	Total	2398	3.09E+05	E	8.67E+04	E	6.88E+04	E	1.08E+05	E	1.36E+06	E	1.42E+04	E
241-TX-112	Salt Cake (Solids)/T2-SltCk (Solid)	2215	2.84E+05	E	8.39E+04	E	6.51E+04	E	9.84E+04	E	1.31E+06	E	1.32E+04	E
241-TX-112	Salt Cake (Solids)/T1-SltCk (Solid)	75	2.59E+02	E	1.13E+01	E	2.05E+02	E	8.30E+02	E	2.46E+04	E	1.11E-01	E
241-TX-112	Salt Cake (Liquids)/T2-SltCk (Liquid)	93	2.44E+04	E	2.52E+03	E	3.48E+03	E	8.95E+03	E	1.54E+04	E	1.00E+03	E
241-TX-112	Salt Cake (Liquids)/T1-SltCk (Liquid)	15	2.28E+02	E	2.70E+02	E	6.98E+00	E	2.76E+02	E	2.61E+03	E	6.68E-06	E
241-TX-113	Total	2416	3.37E+04	S/E	6.39E+03	S/E	1.70E+04	S/E	1.50E+04	S/E	1.68E+06	S/E	1.58E+03	S/E
241-TX-113	Sludge/1C (Solid)	351	9.98E+03	E	2.55E+03	E	7.67E+03	E	4.61E+03	E	5.74E+04	E	3.05E+02	E

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Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-TX-113	Salt Cake (Solids)/T2-SltCk (Solid)	2044	1.83E+04	S	3.27E+03	S	8.55E+03	S	8.36E+03	S	1.62E+06	S	1.05E+03	S
241-TX-113	Salt Cake (Liquids)/T2-SltCk (Liquid)	21	5.50E+03	E	5.69E+02	E	7.85E+02	E	2.02E+03	E	3.49E+03	E	2.27E+02	E
241-TX-114	Total	2015	2.34E+05	E	6.81E+04	E	5.34E+04	E	8.35E+04	E	1.11E+06	E	1.07E+04	E
241-TX-114	Sludge/1C (Solid)	15	4.26E+02	E	1.09E+02	E	3.28E+02	E	1.97E+02	E	2.45E+03	E	1.30E+01	E
241-TX-114	Salt Cake (Solids)/T2-SltCk (Solid)	1753	2.25E+05	E	6.64E+04	E	5.15E+04	E	7.79E+04	E	1.04E+06	E	1.04E+04	E
241-TX-114	Salt Cake (Solids)/T1-SltCk (Solid)	173	5.98E+02	E	2.61E+01	E	4.72E+02	E	1.91E+03	E	5.68E+04	E	2.56E-01	E
241-TX-114	Salt Cake (Liquids)/T2-SltCk (Liquid)	28	7.34E+03	E	7.58E+02	E	1.05E+03	E	2.69E+03	E	4.65E+03	E	3.02E+02	E
241-TX-114	Salt Cake (Liquids)/T1-SltCk (Liquid)	46	7.00E+02	E	8.29E+02	E	2.14E+01	E	8.46E+02	E	8.00E+03	E	2.05E-05	E
241-TX-115	Total	2096	2.79E+05	E	8.45E+04	E	6.16E+04	E	9.79E+04	E	1.19E+06	E	1.28E+04	E
241-TX-115	Sludge/TBP (Solid)	31	4.14E+02	E	7.37E+03	E	1.03E+02	E	8.47E+02	E	8.71E+03	E	2.85E+01	E
241-TX-115	Salt Cake (Solids)/T2-SltCk (Solid)	1962	2.52E+05	E	7.43E+04	E	5.77E+04	E	8.72E+04	E	1.16E+06	E	1.17E+04	E
241-TX-115	Salt Cake (Liquids)/T2-SltCk (Liquid)	103	2.70E+04	E	2.79E+03	E	3.85E+03	E	9.91E+03	E	1.71E+04	E	1.11E+03	E
241-TX-116	Total	2256	1.04E+05	E	9.78E+03	E	6.61E+04	E	3.49E+04	E	1.43E+06	E	7.36E+03	E
241-TX-116	Sludge/DE (Solid)	248	5.36E+04	E	5.54E+03	E	7.65E+03	E	1.97E+04	E	3.40E+04	E	2.21E+03	E
241-TX-116	Salt Cake (Solids)/T2-SltCk (Solid)	877	4.34E+04	E	7.24E+02	E	5.57E+04	E	1.15E+04	E	4.53E+05	E	5.15E+03	E
241-TX-116	Salt Cake (Solids)/T1-SltCk (Solid)	1026	4.29E+03	E	1.54E+02	E	2.75E+03	E	3.18E+02	E	9.14E+05	E	1.81E+00	E
241-TX-116	Salt Cake (Liquids)/T1-SltCk (Liquid)	105	2.83E+03	E	3.35E+03	E	8.65E+01	E	3.42E+03	E	3.24E+04	E	8.28E-05	E
241-TX-117	Total	1819	1.38E+05	E	4.05E+04	E	3.29E+04	E	5.43E+04	E	8.35E+05	E	6.26E+03	E
241-TX-117	Sludge/DE (Solid)	110	0.00E+00	E	0.00E+00	E	2.46E+02	E	0.00E+00	E	0.00E+00	E	0.00E+00	E
241-TX-117	Salt Cake (Solids)/T2-SltCk (Solid)	1053	1.35E+05	E	3.99E+04	E	3.09E+04	E	4.68E+04	E	6.24E+05	E	6.26E+03	E
241-TX-117	Salt Cake (Solids)/T1-SltCk (Solid)	626	2.16E+03	E	9.45E+01	E	1.71E+03	E	6.93E+03	E	2.06E+05	E	9.26E-01	E
241-TX-117	Salt Cake (Liquids)/T1-SltCk (Liquid)	30	4.57E+02	E	5.41E+02	E	1.40E+01	E	5.52E+02	E	5.22E+03	E	1.34E-05	E
241-TX-118	Total	968	6.96E+04	S/E	1.80E+05	S/E	1.54E+04	S/E	2.78E+04	S/E	1.06E+05	S/E	1.45E+04	S/E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-TX-118	Salt Cake (Solids)/T2-SltCk (Solid)	573	2.90E+04	S	6.20E+04	S	4.29E+03	S	1.34E+04	S	7.87E+04	S	3.74E+03	S
241-TX-118	Salt Cake (Solids)	256	4.14E+03	S	1.14E+05	S	5.95E+03	S	1.03E+03	S	4.14E+03	S	9.24E+03	S
241-TX-118	Salt Cake (Liquids)/T2-SltCk (Liquid)	139	3.64E+04	E	3.77E+03	E	5.20E+03	E	1.34E+04	E	2.31E+04	E	1.50E+03	E
241-TY-101	Total	447	1.76E+02	E	6.34E+03	E	2.12E+04	E	9.33E+03	E	1.06E+05	E	4.84E+02	E
241-TY-101	Sludge/1CFeCN (Solid)	273	8.95E+01	E	3.87E+03	E	1.30E+04	E	7.91E+03	E	6.49E+04	E	2.97E+02	E
241-TY-101	Salt Cake (Solids)/T1-SltCk (Solid)	172	5.64E+01	E	2.44E+03	E	8.19E+03	E	1.39E+03	E	4.09E+04	E	1.87E+02	E
241-TY-101	Salt Cake (Liquids)/T1-SltCk (Liquid)	2	3.05E+01	E	3.61E+01	E	9.30E-01	E	3.68E+01	E	3.48E+02	E	8.90E-07	E
241-TY-102	Total	261	1.13E+04	S/E	2.73E+03	S/E	1.59E+03	S/E	9.88E+03	E	1.91E+05	S/E	5.29E+02	S/E
241-TY-102	Salt Cake (Solids)/T2-SltCk (Solid)	106	4.70E+02	S	6.38E+02	S	8.23E+01	S	4.71E+03	E	9.84E+04	S	6.52E+01	S
241-TY-102	Salt Cake (Solids)/T1-SltCk (Solid)	87	3.85E+02	S	5.23E+02	S	6.76E+01	S	9.63E+02	E	8.08E+04	S	5.35E+01	S
241-TY-102	Salt Cake (Liquids)/T2-SltCk (Liquid)	38	9.96E+03	E	1.03E+03	E	1.42E+03	E	3.66E+03	E	6.31E+03	E	4.10E+02	E
241-TY-102	Salt Cake (Liquids)/T1-SltCk (Liquid)	30	4.57E+02	E	5.41E+02	E	1.40E+01	E	5.52E+02	E	5.22E+03	E	1.34E-05	E
241-TY-103	Total	587	2.21E+04	E	7.55E+04	E	4.19E+03	E	4.37E+04	E	1.45E+05	E	1.49E+03	E
241-TY-103	Sludge/TBP (Solid)	220	4.87E+03	E	2.98E+04	E	1.11E+03	E	1.61E+04	E	5.57E+04	E	4.31E+02	E
241-TY-103	Sludge/1CFeCN (Solid)	170	3.76E+03	E	2.30E+04	E	8.59E+02	E	1.24E+04	E	4.30E+04	E	3.33E+02	E
241-TY-103	Salt Cake (Solids)/T2-SltCk (Solid)	159	3.52E+03	E	2.16E+04	E	8.03E+02	E	1.16E+04	E	4.02E+04	E	3.12E+02	E
241-TY-103	Salt Cake (Liquids)/T2-SltCk (Liquid)	38	9.96E+03	E	1.03E+03	E	1.42E+03	E	3.66E+03	E	6.31E+03	E	4.10E+02	E
241-TY-104	Total	167	8.82E+03	E	2.52E+04	E	2.50E+03	E	1.29E+04	E	3.76E+03	E	1.76E+03	S/E
241-TY-104	Supernatant/DW (Liquid)	4	4.91E+01	E	2.61E-01	E	2.28E+00	E	4.52E+01	E	3.96E+02	E	8.44E+00	E
241-TY-104	Sludge/TBP (Solid)	49	2.64E+03	E	7.59E+03	E	7.52E+02	E	3.86E+03	E	1.01E+03	E	5.28E+02	S
241-TY-104	Sludge/1CFeCN (Solid)	114	6.14E+03	E	1.77E+04	E	1.75E+03	E	8.98E+03	E	2.35E+03	E	1.23E+03	S
241-TY-105	Total	874	8.94E+03	S	2.13E+05	S	2.55E+03	S	2.68E+04	E	2.38E+05	S	1.08E+03	S
241-TY-105	Sludge/TBP (Solid)	874	8.94E+03	S	2.13E+05	S	2.55E+03	S	2.68E+04	E	2.38E+05	S	1.08E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-TY-106	Total	62	1.31E+03	E	8.02E+03	E	5.82E+02	E	5.97E+02	E	1.44E+04	E	1.95E+02	E
241-TY-106	Sludge/TBP (Solid)	15	3.16E+02	E	1.94E+03	E	1.41E+02	E	1.44E+02	E	3.49E+03	E	4.71E+01	E
241-TY-106	Sludge/DE (Solid)	47	9.90E+02	E	6.08E+03	E	4.41E+02	E	4.53E+02	E	1.09E+04	E	1.47E+02	E
241-U-101	Total	89	1.14E+04	E	7.68E+04	E	2.08E+04	E	5.59E+03	E	1.52E+04	E	2.47E+02	E
241-U-101	Sludge/R1 (Solid)	89	1.14E+04	E	7.68E+04	E	2.08E+04	E	5.59E+03	E	1.52E+04	E	2.47E+02	E
241-U-102	Total	1109	2.68E+05	S/E	2.07E+05	S/E	6.54E+04	S/E	8.69E+04	S/E	4.82E+05	S/E	1.26E+04	S/E
241-U-102	Sludge/R1 (Solid)	163	2.25E+04	E	1.51E+05	E	4.08E+04	E	1.10E+04	E	3.00E+04	E	4.85E+02	E
241-U-102	Salt Cake (Solids)/T2-SltCk (Solid)	606	1.49E+05	S	3.81E+04	S	1.55E+04	S	4.61E+04	S	3.00E+05	S	7.84E+03	S
241-U-102	Salt Cake (Solids)/S2-SltSlr (Solid)	284	6.96E+04	S	1.78E+04	S	7.25E+03	S	2.16E+04	S	1.41E+05	S	3.67E+03	S
241-U-102	Salt Cake (Liquids)/T2-SltCk (Liquid)	56	2.70E+04	S	4.05E+02	S	1.86E+03	S	8.18E+03	S	1.11E+04	S	6.27E+02	S
241-U-103	Total	1410	3.09E+05	S/E	5.17E+04	S/E	4.86E+04	S	1.24E+05	S	5.04E+05	S	1.91E+04	S
241-U-103	Supernatant/S1-SltCk (Liquid)	2	9.55E+02	S	2.02E+01	S	8.18E+01	S	2.74E+02	S	3.04E+02	S	2.48E+01	S
241-U-103	Sludge/R1 (Solid)	42	4.39E+03	E	2.95E+04	E	8.46E+03	S	3.17E+03	S	6.21E+03	S	6.66E+02	S
241-U-103	Salt Cake (Solids)/S2-SltSlr (Solid)	356	8.68E+04	E	1.95E+03	E	1.01E+04	S	2.98E+04	S	1.37E+05	S	4.84E+03	S
241-U-103	Salt Cake (Solids)/S1-SltCk (Solid)	891	1.60E+05	E	1.91E+04	E	2.52E+04	S	7.45E+04	S	3.42E+05	S	1.21E+04	S
241-U-103	Salt Cake (Liquids)/S1-SltCk (Liquid)	119	5.68E+04	S	1.20E+03	S	4.87E+03	S	1.63E+04	S	1.81E+04	S	1.48E+03	S
241-U-104	Total	462	3.79E+04	E	1.27E+05	E	3.26E+04	E	2.00E+04	E	5.59E+04	E	3.84E+02	E
241-U-104	Sludge/R1Sludge (solids)	129	1.78E+04	E	1.19E+05	E	3.23E+04	E	8.69E+03	E	2.37E+04	E	3.84E+02	E
241-U-104	Sludge/DE (solids)	333	2.01E+04	E	7.84E+03	E	3.16E+02	E	1.13E+04	E	3.22E+04	E	0.00E+00	E
241-U-105	Total	1336	3.27E+05	S	1.97E+04	S/E	6.25E+04	S	1.01E+05	S	6.41E+05	S	4.02E+04	S
241-U-105	Sludge/CWR1 (Solid)	121	1.55E+04	S	1.99E+03	E	3.17E+04	S	4.09E+03	S	3.33E+04	S	2.02E+03	S
241-U-105	Salt Cake (Solids)/T2-SltCk (Solid)	223	5.31E+04	S	8.50E+03	E	5.50E+03	S	1.68E+04	S	1.23E+05	S	7.54E+03	S
241-U-105	Salt Cake (Solids)/S2-SltSlr (Solid)	825	1.96E+05	S	5.19E+03	E	2.03E+04	S	6.23E+04	S	4.54E+05	S	2.79E+04	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-U-105	Salt Cake (Liquids)/T2-SltCk (Liquid)	35	1.31E+04	S	8.48E+02	S	1.04E+03	S	3.78E+03	S	6.34E+03	S	5.74E+02	S
241-U-105	Salt Cake (Liquids)/S2-SltSlr (Liquid)	132	4.93E+04	S	3.20E+03	S	3.93E+03	S	1.43E+04	S	2.39E+04	S	2.16E+03	S
241-U-106	Total	644	1.56E+05	S	6.34E+04	S	1.11E+04	S	5.28E+04	S	2.03E+05	S	2.33E+04	S
241-U-106	Supernatant/S1-SltCk (Liquid)	6	1.81E+03	S	3.55E+02	S	7.22E+01	S	5.94E+02	S	1.49E+03	S	2.57E+02	S
241-U-106	Salt Cake (Solids)/S1-SltCk (Solid)	478	1.06E+05	S	5.36E+04	S	9.10E+03	S	3.63E+04	S	1.62E+05	S	1.62E+04	S
241-U-106	Salt Cake (Liquids)/S1-SltCk (Liquid)	160	4.84E+04	S	9.46E+03	S	1.92E+03	S	1.58E+04	S	3.98E+04	S	6.85E+03	S
241-U-107	Total	1556	2.57E+05	S/E	5.50E+03	S/E	4.98E+04	S/E	1.18E+05	S/E	7.72E+05	S/E	4.68E+03	S/E
241-U-107	Supernatant/S2-SltSlr (Liquid)	136	3.68E+04	S	4.97E+01	S	3.79E+03	S	1.58E+04	S	2.87E+04	S	5.58E+02	S
241-U-107	Sludge/CWR1 (Solid)	57	3.26E+03	E	8.91E+02	E	1.15E+04	E	1.20E+03	E	2.22E+03	E	1.18E+02	E
241-U-107	Salt Cake (Solids)/T2-SltCk (Solid)	40	4.91E+03	S	1.73E+02	S	9.77E+02	S	2.38E+03	S	2.62E+04	S	1.02E+02	S
241-U-107	Salt Cake (Solids)/S2-SltSlr (Solid)	983	1.21E+05	S	4.26E+03	S	2.40E+04	S	5.86E+04	S	6.43E+05	S	2.50E+03	S
241-U-107	Salt Cake (Liquids)/T2-SltCk (Liquid)	13	3.52E+03	S	4.75E+00	S	3.62E+02	S	1.51E+03	S	2.74E+03	S	5.33E+01	S
241-U-107	Salt Cake (Liquids)/S2-SltSlr (Liquid)	327	8.84E+04	S	1.20E+02	S	9.11E+03	S	3.81E+04	S	6.90E+04	S	1.34E+03	S
241-U-108	Total	1772	4.40E+05	S/E	1.96E+04	S/E	6.46E+04	S/E	1.70E+05	S/E	6.86E+05	S/E	1.38E+04	S/E
241-U-108	Supernatant/S2-SltSlr (Liquid)	91	3.33E+04	S	2.75E+01	S	2.78E+03	S	1.22E+04	S	1.67E+04	S	6.43E+02	S
241-U-108	Sludge/CWR2 (Solid)	110	4.32E+02	E	3.79E+02	E	1.74E+04	E	1.24E+03	E	4.46E+03	E	0.00E+00	E
241-U-108	Salt Cake (Solids)/S2-SltSlr (Solid)	522	1.16E+05	S	8.44E+03	S	1.44E+04	S	4.60E+04	S	2.63E+05	S	4.58E+03	S
241-U-108	Salt Cake (Solids)/S1-SltCk (Solid)	655	1.46E+05	S	1.06E+04	S	1.80E+04	S	5.77E+04	S	3.30E+05	S	5.75E+03	S
241-U-108	Salt Cake (Liquids)/S2-SltSlr (Liquid)	174	6.37E+04	S	5.25E+01	S	5.31E+03	S	2.33E+04	S	3.20E+04	S	1.23E+03	S
241-U-108	Salt Cake (Liquids)/S1-SltCk (Liquid)	220	8.05E+04	S	6.64E+01	S	6.71E+03	S	2.95E+04	S	4.05E+04	S	1.56E+03	S
241-U-109	Total	1079	2.13E+05	S	1.35E+04	S	5.13E+04	S	8.49E+04	S	4.70E+05	S	6.99E+03	S
241-U-109	Sludge/CWR1 (Solid)	102	1.21E+04	S	1.81E+03	S	2.97E+04	S	5.15E+03	S	7.71E+03	S	4.80E+02	S
241-U-109	Salt Cake (Solids)/S2-SltSlr (Solid)	402	7.60E+04	S	5.33E+03	S	8.59E+03	S	3.06E+04	S	2.04E+05	S	2.69E+03	S

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-U-109	Salt Cake (Solids)/S1-SltCk (Solid)	472	8.93E+04	S	6.26E+03	S	1.01E+04	S	3.59E+04	S	2.40E+05	S	3.15E+03	S
241-U-109	Salt Cake (Liquids)/S1-SltCk (Liquid)	103	3.59E+04	S	9.11E+01	S	3.01E+03	S	1.32E+04	S	1.91E+04	S	6.73E+02	S
241-U-110	Total	665	2.19E+04	S	1.98E+05	S/E	8.95E+04	S	1.17E+04	S	4.05E+04	S	1.25E+03	S
241-U-110	Sludge/R1 (Solid)	396	1.58E+04	S	1.96E+05	S	6.28E+04	S	1.04E+04	S	3.35E+04	S	9.82E+02	S
241-U-110	Sludge/CWR1 (Solid)	149	7.40E+01	S	1.58E+02	S	1.84E+04	S	1.12E+01	S	2.48E+01	S	1.31E+02	S
241-U-110	Sludge/1C (Solid)	120	6.00E+03	S	1.24E+03	E	8.33E+03	S	1.25E+03	S	7.03E+03	S	1.41E+02	S
241-U-111	Total	1288	3.10E+05	S/E	5.63E+04	S/E	4.95E+04	S/E	1.07E+05	S/E	4.30E+05	S/E	8.68E+03	S/E
241-U-111	Sludge/R1 (Solid)	49	6.75E+03	E	4.54E+04	E	1.23E+04	E	3.30E+03	E	9.00E+03	E	1.46E+02	E
241-U-111	Sludge/1C (Solid)	49	1.39E+03	E	3.56E+02	E	1.07E+03	E	6.43E+02	E	8.01E+03	E	4.26E+01	E
241-U-111	Salt Cake (Solids)/S2-SltSlr (Solid)	580	1.33E+05	E	2.98E+03	E	1.62E+04	E	4.24E+04	E	2.25E+05	E	4.76E+03	E
241-U-111	Salt Cake (Solids)/S1-SltCk (Solid)	312	5.87E+04	E	7.02E+03	E	9.01E+03	E	2.52E+04	E	1.38E+05	E	2.12E+03	E
241-U-111	Salt Cake (Liquids)/S2-SltSlr (Liquid)	194	7.17E+04	S	3.51E+02	S	7.10E+03	S	2.33E+04	S	3.23E+04	S	1.05E+03	S
241-U-111	Salt Cake (Liquids)/S1-SltCk (Liquid)	104	3.84E+04	S	1.88E+02	S	3.81E+03	S	1.25E+04	S	1.73E+04	S	5.62E+02	S
241-U-112	Total	172	1.46E+04	E	6.59E+04	E	4.12E+04	S/E	9.57E+02	S/E	1.82E+04	S/E	3.80E+02	E
241-U-112	Sludge/R1 (Solid)	67	9.61E+03	E	6.45E+04	E	2.15E+04	S	1.82E+02	S	5.61E+03	S	2.07E+02	E
241-U-112	Sludge/CWR1 (Solid)	58	3.65E+03	E	9.97E+02	E	1.86E+04	S	1.58E+02	S	4.86E+03	S	1.32E+02	E
241-U-112	Sludge/1C (Solid)	47	1.34E+03	E	3.42E+02	E	1.03E+03	E	6.17E+02	E	7.69E+03	E	4.09E+01	E
241-U-201	Total	19	8.25E+02	E	2.35E+02	E	3.03E+03	E	6.42E+02	E	8.34E+02	E	2.93E+01	E
241-U-201	Supernatant/CWR1 (Liquid)	4	1.57E+01	E	1.37E+01	E	1.65E+02	E	3.44E+02	E	2.84E+02	E	0.00E+00	E
241-U-201	Sludge (Solids)/CWR1 (Solid)	15	8.09E+02	E	2.21E+02	E	2.86E+03	E	2.98E+02	E	5.50E+02	E	2.93E+01	E
241-U-202	Total	17	7.09E+02	E	2.02E+02	E	2.61E+03	E	5.69E+02	E	7.31E+02	E	2.52E+01	E
241-U-202	Supernatant/CWR1 (Liquid)	4	1.44E+01	E	1.25E+01	E	1.50E+02	E	3.14E+02	E	2.59E+02	E	0.00E+00	E
241-U-202	Sludge/CWR1 (Solid)	13	6.94E+02	E	1.90E+02	E	2.46E+03	E	2.56E+02	E	4.72E+02	E	2.52E+01	E

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Table A-2. Tank Waste Inventory from BBI Detail Report (Nov. 2001) for Hydrogen Generation Rate Calculations. (31 Sheets)

Tank	Waste phase/type	Volume (kL)	^{137}Cs inventory (Ci)		^{90}Sr inventory (Ci)		Al inventory (kg)		NO_2 inventory (kg)		NO_3 inventory (kg)		TOC inventory (kg)	
241-U-203	Total	17	5.91E+02	E	1.71E+02	E	2.20E+03	E	5.61E+02	E	6.79E+02	E	1.68E+00	S/E
241-U-203	Supernatant/CWR1 (Liquid)	4	1.60E+01	E	1.39E+01	E	1.67E+02	E	3.49E+02	E	2.87E+02	E	0.00E+00	E
241-U-203	Sludge/CWR1 (Solid)	13	5.75E+02	E	1.57E+02	E	2.04E+03	E	2.12E+02	E	3.91E+02	E	1.68E+00	S
241-U-204	Total	15	6.08E+02	E	1.70E+02	E	3.94E+03	E	3.76E+02	E	5.36E+02	E	8.69E+00	S
241-U-204	Supernatant/CWR1 (Liquid)	4	7.06E+00	E	6.13E+00	E	2.50E+00	E	1.54E+02	E	1.27E+02	E	3.24E-01	S
241-U-204	Sludge/CWR1 (Solid)	11	6.01E+02	E	1.64E+02	E	3.94E+03	E	2.21E+02	E	4.08E+02	E	8.37E+00	S

Note: E or S means that the data is either best engineering estimate or sampling result

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Table A-3. Tanks with Retained Gas Estimates in the BBI Derivation Document.

Tank	Waste phase	Current Published BBI Data			Previously Published Data*		
		Waste phase volume (kL)	Effective date	Published date	Waste phase volume (kL)	Effective date	Published date
241-A-101	retained gas	328	7/1/01	11/7/01			
241-AN-103	retained gas	203	1/1/01	11/30/01	203	1/1/01	10/31/01
241-AN-104	retained gas	163	1/1/01	11/8/01			
241-AN-105	retained gas	91	1/1/01	6/26/01	91	1/1/01	see note
241-AW-101	retained gas	94	1/1/01	11/30/01	94	1/1/01	6/18/01
241-AX-101	retained gas	166	10/1/01	11/13/01			
241-S-102	retained gas	443	1/1/01	9/13/01			
241-S-111	retained gas	280	1/1/01	11/8/01			
241-SX-105	retained gas	173	10/1/01	11/15/01	64	7/1/01	11/7/01
241-SY-101	retained gas	56	1/1/01	6/18/01			
241-SY-103	retained gas	82	7/1/01	9/4/01			
241-U-103	retained gas	168	1/1/01	9/24/01			
241-U-109	retained gas	479	10/1/01	11/15/01	381	4/1/01	11/13/01

* If the current BBI was published after 11/13/01, the retained gas from the previous BBI is also provided.

APPENDIX B

HYDROGEN GENERATION RATE CALCULATIONS FROM EMPIRICAL RATE EQUATION MODEL FOR 177 HANFORD TANKS

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-AN-101	1.20E+03	4.30E+04	7.51E+04	1.16E+04	4.18E-02	8.50E+01	1.17	956	0.7	24	25
Supernatant	1.20E+03	4.30E+04	7.51E+04	1.16E+04	4.18E-02	8.50E+01	1.17	956	0.7	24	25
Solid Layer	na	na	na	na	na	na	na	0	0.0	24	25
241-AN-102	2.58E+04	9.44E+04	2.37E+05	1.60E+04	6.75E+01	2.20E+02	1.44	3,990	0.5	33	31
Supernatant	2.58E+04	9.44E+04	2.37E+05	1.60E+04	5.97E+01	2.14E+02	1.43	3,653	0.5	33	31
Solid Layer	2.58E+04	9.44E+04	2.37E+05	1.60E+04	1.44E+02	2.78E+02	1.56	337*	0.4	33	31
241-AN-103	2.60E+03	1.64E+05	1.67E+05	3.00E+04	1.36E+00	3.50E+02	1.59	3,416	0.4	40	31
Supernatant	2.60E+03	1.64E+05	1.67E+05	3.00E+04	1.10E-02	4.38E+02	1.48	1,883	0.5	40	31
Solid Layer	2.60E+03	1.64E+05	1.67E+05	3.00E+04	2.80E+00	2.58E+02	1.72	1,533	0.3	40	31
241-AN-104	3.14E+03	1.12E+05	1.72E+05	3.90E+04	1.51E+01	3.50E+02	1.49	3,819	0.5	41	33
Supernatant	3.14E+03	1.12E+05	1.72E+05	3.90E+04	6.28E-02	3.77E+02	1.40	2,083	0.5	41	33
Solid Layer	3.14E+03	1.12E+05	1.72E+05	3.90E+04	3.09E+01	3.22E+02	1.59	1,736	0.5	41	33
241-AN-105	3.56E+03	1.21E+05	1.62E+05	4.11E+04	7.63E+00	2.24E+02	1.50	4,179	0.5	38	32
Supernatant	3.56E+03	1.21E+05	1.62E+05	4.11E+04	2.63E-02	2.21E+02	1.42	2,407	0.5	38	32
Solid Layer	3.56E+03	1.21E+05	1.62E+05	4.11E+04	1.67E+01	2.27E+02	1.62	1,772	0.4	38	32
241-AN-106	4.68E+03	1.90E+04	7.09E+04	3.47E+03	1.81E+01	1.07E+02	1.36	143	0.5	22	23
Supernatant	4.68E+03	1.90E+04	7.09E+04	3.47E+03	2.98E-02	6.05E+01	1.18	79	0.6	22	23
Solid Layer	4.68E+03	1.90E+04	7.09E+04	3.47E+03	3.47E+01	1.49E+02	1.58	64	0.4	22	23
241-AN-107	4.16E+04	6.62E+04	2.40E+05	2.95E+02	9.51E+01	2.47E+02	1.42	3,940	0.5	32	29
Supernatant	4.16E+04	6.62E+04	2.40E+05	2.95E+02	7.24E+01	2.55E+02	1.37	3,005	0.5	32	29
Solid Layer	4.16E+04	6.62E+04	2.40E+05	2.95E+02	1.59E+02	2.23E+02	1.56	935	0.4	32	29
241-AP-101	1.96E+03	4.20E+04	1.32E+05	6.95E+03	6.55E-02	1.08E+02	1.31	4,216	0.6	23	23
Supernatant	1.96E+03	4.20E+04	1.32E+05	6.95E+03	6.55E-02	1.08E+02	1.31	4,216	0.6	23	23
Solid Layer	na	na	na	na	na	na	na	0	0.0	23	23

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Al in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-AP-102	3.42E+03	3.81E+04	7.84E+04	1.15E+04	1.00E+00	1.59E+02	1.20	4,122	0.7	24	24
Supernatant	3.42E+03	3.81E+04	7.84E+04	1.15E+04	1.00E+00	1.59E+02	1.20	4,122	0.7	24	24
Solid Layer	na	na	na	na	na	na	na	0	0.0	24	24
241-AP-103	3.88E+03	1.08E+05	1.37E+05	8.55E+03	4.09E-01	1.87E+02	1.31	1,067	1.0	24	24
Supernatant	3.88E+03	1.08E+05	1.37E+05	8.55E+03	4.09E-01	1.87E+02	1.31	1,067	1.0	24	24
Solid Layer	na	na	na	na	na	na	na	0	0.0	24	24
241-AP-104	5.15E+03	5.93E+04	1.04E+05	1.73E+04	4.15E+00	1.50E+02	1.25	4,198	1.0	25	24
Supernatant	5.15E+03	5.93E+04	1.04E+05	1.73E+04	4.15E+00	1.50E+02	1.25	4,198	1.0	25	24
Solid Layer	na	na	na	na	na	na	na	0	0.0	25	24
241-AP-105	2.88E+03	1.02E+05	2.39E+05	2.09E+04	4.68E+00	1.49E+02	1.37	4,296	0.6	24	19
Supernatant	2.88E+03	1.02E+05	2.39E+05	2.09E+04	2.04E+00	1.50E+02	1.35	3,959	0.6	24	19
Solid Layer	2.88E+03	1.02E+05	2.39E+05	2.09E+04	3.12E+01	1.34E+02	1.58	337	0.5	24	19
241-AP-106	4.24E+03	5.81E+04	9.25E+04	1.44E+04	1.81E+00	1.43E+02	1.26	2,358	0.9	24	24
Supernatant	4.24E+03	5.81E+04	9.25E+04	1.44E+04	1.81E+00	1.43E+02	1.26	2,358	0.9	24	24
Solid Layer	na	na	na	na	na	na	na	0	0.0	24	24
241-AP-107	3.94E+03	5.58E+04	1.32E+05	1.56E+04	2.05E+00	1.34E+02	1.25	3,708	0.9	29	26
Supernatant	3.94E+03	5.58E+04	1.32E+05	1.56E+04	2.05E+00	1.34E+02	1.25	3,708	0.9	29	26
Solid Layer	na	na	na	na	na	na	na	0	0.0	na	na
241-AP-108	9.67E+02	2.87E+04	7.98E+04	9.59E+03	1.47E-01	7.14E+01	1.25	121	0.8	23	23
Supernatant	9.67E+02	2.87E+04	7.98E+04	9.59E+03	1.47E-01	7.14E+01	1.25	121	0.8	23	23
Solid Layer	na	na	na	na	na	na	na	0	0.0	23	23
241-AW-101	4.00E+03	1.20E+05	1.70E+05	3.29E+04	1.39E+01	2.74E+02	1.51	4,172	0.5	38	30
Supernatant	4.00E+03	1.20E+05	1.70E+05	3.29E+04	2.72E-01	2.99E+02	1.47	2,798	0.5	38	30
Solid Layer	4.00E+03	1.20E+05	1.70E+05	3.29E+04	3.95E+01	2.28E+02	1.59	1,374	0.4	38	30

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-AW-102	2.38E+02	9.71E+02	4.58E+03	1.26E+02	2.32E+02	3.13E+01	1.18	322	0.6	24	23
Supernatant	2.38E+02	9.71E+02	4.58E+03	1.26E+02	3.91E-03	1.82E+00	1.01	208	0.9	24	23
Solid Layer	2.38E+02	9.71E+02	4.58E+03	1.26E+02	5.18E+02	6.77E+01	1.49	114	0.4	24	23
241-AW-103	2.13E+03	3.99E+04	1.24E+05	1.18E+04	2.50E+00	7.61E+01	1.31	4,170	0.6	24	26
Supernatant	2.13E+03	3.99E+04	1.24E+05	1.18E+04	1.06E-01	1.02E+02	1.24	2,986	0.9	24	26
Solid Layer	2.13E+03	3.99E+04	1.24E+05	1.18E+04	7.50E+00	2.30E+01	1.50	1,184	0.5	24	26
241-AW-104	7.27E+03	7.92E+04	1.16E+05	2.66E+04	3.22E+00	1.35E+02	1.37	1,195	0.7	27	22
Supernatant	7.10E+02	2.20E+03	1.16E+04	1.36E+02	5.04E-03	3.98E+00	1.07	352	0.8	27	22
Solid Layer	8.47E+03	9.33E+04	1.35E+05	3.14E+04	4.18E+00	1.75E+02	1.49	843	0.5	27	22
241-AW-105	9.39E+02	2.38E+03	3.43E+04	2.29E+02	3.76E+01	2.26E+01	1.21	1,616	0.7	20	21
Supernatant	9.39E+02	2.38E+03	3.43E+04	2.29E+02	2.12E-02	9.55E+00	1.07	651	0.9	20	21
Solid Layer	9.39E+02	2.38E+03	3.43E+04	2.29E+02	5.84E+01	2.98E+01	1.31	965	0.7	20	21
241-AW-106	2.57E+03	5.22E+04	1.63E+05	1.57E+04	2.87E+01	1.43E+02	1.53	1,131	0.6	41	33
Supernatant	2.57E+03	5.22E+04	1.63E+05	1.57E+04	1.31E-01	1.16E+02	1.32	226	0.6	41	33
Solid Layer	2.57E+03	5.22E+04	1.63E+05	1.57E+04	3.47E+01	1.49E+02	1.58	905	0.6	41	33
241-AY-101	2.21E+03	4.97E+04	6.00E+03	1.40E+03	1.45E+03	7.50E+01	1.38	694	0.6	43	41
Supernatant	1.33E+03	3.13E+04	5.11E+03	2.43E+03	6.50E-01	3.34E+01	1.22	329	0.8	43	41
Solid Layer	2.95E+03	6.53E+04	6.75E+03	5.29E+02	2.50E+03	1.05E+02	1.52	310	0.5	43	41
241-AY-102	1.71E+03	5.13E+03	3.93E+02	1.28E+03	1.81E+03	7.44E+01	1.22	2,403	0.8	52	44
Supernatant	1.64E+03	5.98E+03	4.10E+02	1.48E+03	1.52E+00	2.74E+01	1.15	1,757	0.9	45	44
Solid Layer	2.12E+03	2.29E+02	2.95E+02	1.00E+02	5.85E+03	1.79E+02	1.40	646	0.4	72	44
241-AZ-101	3.23E+02	6.49E+04	6.37E+04	7.64E+03	1.06E+03	1.33E+03	1.26	3,574	0.7	75	64
Supernatant	3.23E+02	6.49E+04	6.37E+04	7.64E+03	7.24E-01	1.35E+03	1.24	3,377	0.7	64	64
Solid Layer	3.23E+02	6.49E+04	6.37E+04	7.64E+03	1.49E+04	1.13E+03	1.62	197	0.6	75	64

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-AZ-102	1.05E+03	3.29E+04	1.72E+04	6.19E+02	4.93E+02	8.59E+02	1.17	3,774	0.8	72	46
Supernatant	1.05E+03	3.29E+04	1.72E+04	6.19E+02	1.85E+00	8.86E+02	1.14	3,377	0.8	72	46
Solid Layer	1.05E+03	3.29E+04	1.72E+04	6.19E+02	3.94E+03	6.70E+02	1.38	397	0.6	72	46
241-SY-101	6.17E+03	8.79E+04	1.41E+05	1.34E+04	1.40E+01	1.76E+02	1.40	3,611	0.6	37	31
Supernatant	6.17E+03	8.79E+04	1.41E+05	1.34E+04	2.70E+00	1.90E+02	1.36	2,627	0.6	37	31
Solid Layer	6.17E+03	8.79E+04	1.41E+05	1.34E+04	4.13E+01	1.42E+02	1.51	984	0.5	37	31
241-SY-102	1.29E+03	6.06E+04	9.66E+04	1.78E+04	1.08E+01	2.90E+02	1.26	3,914	0.8	41	41
Supernatant	1.29E+03	6.06E+04	9.66E+04	1.78E+04	6.28E+00	3.05E+02	1.25	3,645	0.9	41	41
Solid Layer	1.29E+03	6.06E+04	9.66E+04	1.78E+04	6.45E+01	1.16E+02	1.44	269	0.5	41	41
241-SY-103	6.16E+03	1.52E+05	1.68E+05	3.76E+04	1.74E+01	2.78E+02	1.53	2,756	0.4	35	31
Supernatant	6.16E+03	1.52E+05	1.68E+05	3.76E+04	1.93E+00	3.15E+02	1.47	1,543	0.5	35	31
Solid Layer	6.16E+03	1.52E+05	1.68E+05	3.76E+04	3.53E+01	2.36E+02	1.61	1,213	0.3	35	31
241-A-101	3.74E+03	1.65E+05	2.33E+05	5.18E+04	3.27E+01	2.22E+02	1.57	2,525	0.4	62	40
Supernatant	3.74E+03	1.65E+05	2.33E+05	5.18E+04	5.02E-02	2.51E+02	1.49	1,022	0.5	62	40
Solid Layer	3.74E+03	1.65E+05	2.33E+05	5.18E+04	6.88E+01	1.91E+02	1.68	1,503	0.4	62	40
241-A-102	1.25E+04	1.99E+03	1.29E+05	4.10E+04	3.52E+02	1.74E+02	1.66	146	0.4	33	32
Supernatant	1.25E+04	1.99E+03	1.29E+05	4.10E+04	7.63E-01	3.38E+02	1.57	7	0.6	33	32
Solid Layer	1.25E+04	1.98E+03	1.29E+05	4.11E+04	3.69E+02	1.67E+02	1.67	139	0.3	33	32
241-A-103	7.88E+03	9.57E+04	1.92E+05	5.83E+04	6.37E+01	1.60E+02	1.38	1,405	0.4	50	35
Supernatant	7.88E+03	9.59E+04	1.92E+05	5.82E+04	1.37E+00	1.89E+02	1.45	17	0.8	50	35
Solid Layer	7.88E+03	9.57E+04	1.92E+05	5.83E+04	6.45E+01	1.60E+02	1.37	1,388	0.4	50	35
241-A-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.43E+04	3.81E+02	1.64	106	0.4	76	34
Supernatant	na	na	na	na	na	na	na	0	0.8	76	34
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.43E+04	3.81E+02	1.64	106	0.4	76	34

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-A-105	NA	NA	NA	NA	1.46E+04	5.37E+02	1.54	139	na	na	na
Supernatant	na	na	na	na	na	na	na	0	na	na	na
Solid Layer	NA	NA	NA	NA	1.46E+04	5.37E+02	1.54	139	na	na	na
241-A-106	1.10E+04	3.60E+04	7.96E+04	4.94E+03	1.14E+03	1.48E+02	1.55	299	0.4	54	45
Supernatant	na	na	na	na	na	na	na	0	0.8	54	45
Solid Layer	1.10E+04	3.60E+04	7.96E+04	4.94E+03	1.14E+03	1.48E+02	1.55	299	0.4	54	45
241-AX-101	3.98E+03	1.73E+05	2.72E+05	5.03E+04	3.95E+01	2.14E+02	1.61	2,535	0.4	54	37
Supernatant	3.98E+03	1.73E+05	2.72E+05	5.03E+04	1.60E-01	2.39E+02	1.53	1,176	0.5	54	37
Solid Layer	3.98E+03	1.73E+05	2.72E+05	5.03E+04	7.06E+01	1.95E+02	1.68	1,359	0.4	54	37
241-AX-102	2.30E+04	1.07E+05	1.76E+05	2.75E+04	1.34E+03	2.35E+02	1.52	114	0.3	24	26
Supernatant	na	na	na	na	na	na	na	0	0.5	24	26
Solid Layer	2.30E+04	1.07E+05	1.76E+05	2.75E+04	1.34E+03	2.35E+02	1.52	114	0.3	24	26
241-AX-103	2.36E+04	1.07E+05	1.36E+05	3.58E+04	7.29E+02	1.69E+02	1.62	410	0.4	43	34
Supernatant	na	na	na	na	na	na	na	0	0.5	43	34
Solid Layer	2.36E+04	1.07E+05	1.36E+05	3.58E+04	7.29E+02	1.69E+02	1.62	410	0.4	43	34
241-AX-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.38E+04	1.06E+03	1.80	28	0.1	32	32
Supernatant	na	na	na	na	na	na	na	0	0.8	32	32
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.38E+04	1.06E+03	1.80	28	0.1	32	32
241-B-101	9.72E-04	1.31E+05	3.56E+05	1.47E+03	1.56E+03	1.69E+01	1.49	411	0.3	39	31
Supernatant	na	na	na	na	na	na	na	0	0.5	39	31
Solid Layer	9.72E-04	1.31E+05	3.56E+05	1.47E+03	1.56E+03	1.69E+01	1.49	411	0.3	39	31
241-B-102	4.65E-04	1.82E+04	1.74E+05	7.00E+02	4.99E+00	1.44E+01	1.56	121	0.2	18	21
Supernatant	4.65E-04	1.82E+04	1.74E+05	7.00E+02	1.45E+01	1.11E+01	1.19	15	0.5	18	21
Solid Layer	4.65E-04	1.82E+04	1.74E+05	7.04E+02	4.00E+00	1.48E+01	1.61	106	0.2	18	21

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-B-103	4.65E-04	1.82E+04	1.74E+05	7.04E+02	4.00E+00	1.60E+01	1.61	211	0.4	17	20
Supernatant	na	na	na	na	na	na	na	0	0.5	17	20
Solid Layer	4.65E-04	1.82E+04	1.74E+05	7.04E+02	4.00E+00	1.60E+01	1.61	211	0.4	17	20
241-B-104	4.65E-04	1.82E+04	1.74E+05	7.03E+02	2.20E+01	4.23E+01	1.36	1,417	0.5	20	19
Supernatant	na	na	na	na	na	na	na	0	0.5	20	19
Solid Layer	4.65E-04	1.82E+04	1.74E+05	7.03E+02	2.20E+01	4.23E+01	1.36	1,417	0.5	20	19
241-B-105	4.65E-04	1.83E+04	1.75E+05	7.03E+02	3.58E+00	1.68E+01	1.67	1,098	0.3	18	19
Supernatant	na	na	na	na	na	na	na	0	0.5	18	19
Solid Layer	4.65E-04	1.83E+04	1.75E+05	7.03E+02	3.58E+00	1.68E+01	1.67	1,098	0.3	18	19
241-B-106	4.65E-04	1.82E+04	1.74E+05	7.03E+02	5.17E+01	1.63E+01	1.38	464	0.6	18	19
Supernatant	4.65E-04	1.82E+04	1.74E+05	7.03E+02	1.44E+01	1.11E+01	1.19	4	0.7	18	19
Solid Layer	4.65E-04	1.82E+04	1.74E+05	7.03E+02	5.19E+01	1.63E+01	1.38	460	0.6	18	19
241-B-107	7.17E-04	6.51E+03	3.31E+05	2.01E+01	1.23E+02	2.30E+01	1.63	611	0.4	16	15
Supernatant	na	na	na	na	na	na	na	0	0.6	16	15
Solid Layer	7.17E-04	6.51E+03	3.31E+05	2.01E+01	1.23E+02	2.30E+01	1.63	611	0.4	16	15
241-B-108	3.66E-04	5.38E+04	3.77E+05	8.98E+02	3.70E+00	1.34E+01	1.67	349	0.3	18	19
Supernatant	na	na	na	na	na	na	na	0	0.8	18	19
Solid Layer	3.66E-04	5.38E+04	3.77E+05	8.98E+02	3.70E+00	1.34E+01	1.67	349	0.3	18	19
241-B-109	4.65E-04	1.82E+04	1.75E+05	7.03E+02	4.59E+02	1.83E+01	1.77	473	0.4	18	19
Supernatant	na	na	na	na	na	na	na	0	0.6	18	19
Solid Layer	4.65E-04	1.82E+04	1.75E+05	7.03E+02	4.59E+02	1.83E+01	1.77	473	0.4	18	19
241-B-110	0.00E+00	1.11E+03	9.75E+03	0.00E+00	8.34E+01	1.16E+01	1.36	929	0.4	21	21
Supernatant	0.00E+00	1.11E+03	9.75E+03	0.00E+00	0.00E+00	0.00E+00	1.01	4	0.8	21	21
Solid Layer	0.00E+00	1.11E+03	9.75E+03	0.00E+00	8.37E+01	1.17E+01	1.36	925	0.4	21	21

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Al in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-B-111	0.00E+00	1.11E+03	9.75E+03	0.00E+00	2.06E+02	1.32E+02	1.19	914	0.4	24	24
Supernatant	0.00E+00	1.11E+03	9.75E+03	0.00E+00	0.00E+00	0.00E+00	1.01	4	0.8	24	24
Solid Layer	0.00E+00	1.11E+03	9.75E+03	0.00E+00	2.07E+02	1.33E+02	1.19	910	0.4	24	24
241-B-112	9.38E+03	9.94E+04	1.74E+05	4.32E+04	2.74E+01	6.63E+01	1.43	132	0.5	17	19
Supernatant	0.00E+00	1.11E+03	9.73E+03	0.00E+00	0.00E+00	0.00E+00	1.01	11	0.8	17	19
Solid Layer	9.38E+03	9.94E+04	1.74E+05	4.32E+04	2.92E+01	7.04E+01	1.47	121	0.4	17	19
241-B-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.84E+00	1.46E-01	1.26	115	0.5	16	18
Supernatant	na	na	na	na	na	na	na	0	0.8	16	18
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.84E+00	1.46E-01	1.26	115	0.4	16	18
241-B-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.23E+00	8.20E-02	1.22	111	0.7	21	21
Supernatant	na	na	na	na	na	na	na	0	0.8	21	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.23E+00	8.20E-02	1.22	111	0.7	21	21
241-B-203	9.60E+01	1.57E+03	5.65E+04	0.00E+00	1.49E+00	3.30E-02	1.19	195	0.8	18	12
Supernatant	9.60E+01	1.57E+03	5.65E+04	0.00E+00	1.22E-01	1.40E-01	1.05	2	0.9	18	12
Solid Layer	9.60E+01	1.57E+03	5.65E+04	0.00E+00	1.50E+00	3.20E-02	1.19	193	0.8	18	12
241-B-204	7.60E-03	1.36E+03	3.47E+04	0.00E+00	1.38E+00	2.92E-02	1.19	192	0.4	18	18
Supernatant	7.60E-03	1.36E+03	3.47E+04	0.00E+00	9.90E-02	1.13E-01	1.05	3	0.9	18	18
Solid Layer	7.60E-03	1.36E+03	3.47E+04	0.00E+00	1.40E+00	2.81E-02	1.19	189	0.4	18	18
241-BX-101	4.98E+03	6.43E+04	1.21E+05	5.17E+03	9.59E+02	2.13E+01	1.66	180	0.2	23	23
Supernatant	na	na	na	na	na	na	na	0	0.8	23	23
Solid Layer	4.98E+03	6.43E+04	1.21E+05	5.17E+03	9.59E+02	2.13E+01	1.66	180	0.2	23	23
241-BX-102	2.98E+03	3.60E+04	7.96E+04	4.94E+03	6.38E+02	1.33E+01	1.28	424	0.4	20	21
Supernatant	na	na	na	na	na	na	na	0	0.8	20	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	6.38E+02	1.33E+01	1.28	424	0.4	20	21

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-BX-103	4.33E+03	1.68E+04	5.33E+04	2.14E+04	5.57E+02	1.34E+01	1.56	277	0.5	21	22
Supernatant	4.33E+03	1.68E+04	5.33E+04	2.14E+04	2.32E+00	2.68E+00	1.11	42	0.8	21	22
Solid Layer	4.33E+03	1.68E+04	5.33E+04	2.14E+04	6.23E+02	1.47E+01	1.64	235	0.5	21	22
241-BX-104	3.19E+03	6.37E+04	1.34E+05	2.84E+03	2.05E+02	6.60E+01	1.67	379	0.4	30	25
Supernatant	3.19E+03	6.37E+04	1.34E+05	2.84E+03	1.43E+00	1.04E+02	1.28	11	0.8	30	25
Solid Layer	3.19E+03	6.37E+04	1.34E+05	2.84E+03	2.09E+02	6.52E+01	1.68	368	0.4	30	25
241-BX-105	9.44E+03	7.83E+04	1.17E+05	5.94E+03	1.17E+02	5.11E+01	1.61	271	0.2	20	21
Supernatant	9.44E+03	7.83E+04	1.17E+05	5.94E+03	6.29E+00	9.91E+01	1.29	18	0.8	20	21
Solid Layer	9.44E+03	7.83E+04	1.17E+05	5.94E+03	1.23E+02	4.84E+01	1.64	253	0.1	20	21
241-BX-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.38E+02	5.53E+01	1.69	142	0.4	20	21
Supernatant	na	na	na	na	na	na	na	0	0.8	20	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.38E+02	5.53E+01	1.69	142	0.4	20	21
241-BX-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	8.09E+00	1.44E+01	1.44	1,313	0.5	21	21
Supernatant	na	na	na	na	na	na	na	0	0.8	21	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	8.09E+00	1.44E+01	1.44	1,313	0.5	21	21
241-BX-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.67E+02	2.12E+01	1.48	119	0.3	20	20
Supernatant	na	na	na	na	na	na	na	0	0.8	20	20
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.67E+02	2.12E+01	1.48	119	0.3	20	20
241-BX-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.15E+02	1.15E+01	1.52	731	0.5	22	22
Supernatant	na	na	na	na	na	na	na	0	0.7	22	22
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.15E+02	1.15E+01	1.52	731	0.5	22	22
241-BX-110	9.18E+03	5.22E+04	4.12E+05	4.40E+03	1.22E+01	5.45E+01	1.73	776	0.4	20	21
Supernatant	9.18E+03	5.22E+04	4.12E+05	4.40E+03	1.96E+01	7.04E+01	1.44	5	0.5	20	21
Solid Layer	9.21E+03	5.21E+04	4.13E+05	4.40E+03	1.21E+01	5.44E+01	1.73	771	0.4	20	21

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-BX-111	1.69E+03	1.06E+05	1.85E+05	4.87E+04	1.54E+01	7.45E+01	1.44	714	0.2	19	20
Supernatant	na	na	na	na	na	na	na	0	0.5	19	20
Solid Layer	1.69E+03	1.06E+05	1.85E+05	4.87E+04	1.54E+01	7.45E+01	1.44	714	0.2	19	20
241-BX-112	0.00E+00	3.52E+04	9.86E+04	4.78E+01	6.40E+00	4.33E+01	1.31	622	0.6	19	20
Supernatant	0.00E+00	3.52E+04	9.86E+04	4.78E+01	2.58E+01	2.93E+01	1.18	5	0.8	19	20
Solid Layer	0.00E+00	3.52E+04	9.86E+04	4.78E+01	6.26E+00	4.34E+01	1.31	617	0.6	19	20
241-BY-101	9.39E+03	9.93E+04	1.75E+05	4.32E+04	1.05E+02	1.15E+02	1.80	1,400	0.3	27	25
Supernatant	na	na	na	na	na	na	na	0	0.5	27	25
Solid Layer	9.39E+03	9.93E+04	1.75E+05	4.32E+04	1.05E+02	1.15E+02	1.80	1,400	0.3	27	25
241-BY-102	1.80E+03	7.98E+04	1.75E+05	5.08E+04	1.55E+01	7.43E+01	1.57	1,048	0.3	22	22
Supernatant	na	na	na	na	na	na	na	0	0.5	22	22
Solid Layer	1.80E+03	7.98E+04	1.75E+05	5.08E+04	1.55E+01	7.43E+01	1.57	1,048	0.3	22	22
241-BY-103	1.91E+03	5.37E+04	1.69E+05	4.14E+04	4.09E+01	7.91E+01	1.64	1,575	0.3	26	26
Supernatant	na	na	na	na	na	na	na	0	0.6	26	26
Solid Layer	1.91E+03	5.37E+04	1.69E+05	4.14E+04	4.09E+01	7.91E+01	1.64	1,575	0.3	26	26
241-BY-104	2.37E+03	1.07E+05	1.88E+05	7.23E+04	1.57E+02	8.96E+01	1.70	1,356	0.2	50	28
Supernatant	na	na	na	na	na	na	na	0	0.5	50	28
Solid Layer	2.37E+03	1.07E+05	1.88E+05	7.23E+04	1.57E+02	8.96E+01	1.70	1,356	0.2	50	28
241-BY-105	2.43E+03	6.87E+04	1.99E+05	3.90E+04	4.71E+01	5.74E+01	1.77	1,903	0.2	43	39
Supernatant	na	na	na	na	na	na	na	0	0.5	43	39
Solid Layer	2.43E+03	6.87E+04	1.99E+05	3.90E+04	4.71E+01	5.74E+01	1.77	1,903	0.2	43	39
241-BY-106	2.68E+03	7.81E+04	1.10E+05	3.99E+04	4.33E+01	1.21E+02	1.60	2,124	0.3	49	25
Supernatant	na	na	na	na	na	na	na	0	0.6	49	25
Solid Layer	2.68E+03	7.81E+04	1.10E+05	3.99E+04	4.33E+01	1.21E+02	1.60	2,124	0.3	49	25

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-BY-107	2.40E+03	1.17E+05	1.32E+05	5.11E+04	4.75E+01	1.21E+02	1.69	1,028	0.4	38	28
Supernatant	na	na	na	na	na	na	na	0	0.5	38	28
Solid Layer	2.40E+03	1.17E+05	1.32E+05	5.11E+04	4.75E+01	1.21E+02	1.69	1,028	0.4	38	28
241-BY-108	2.37E+03	7.85E+04	2.94E+05	3.63E+04	1.14E+02	4.13E+01	1.48	841	0.3	45	29
Supernatant	na	na	na	na	na	na	na	0	0.3	45	29
Solid Layer	2.37E+03	7.85E+04	2.94E+05	3.63E+04	1.14E+02	4.13E+01	1.48	841	0.3	45	29
241-BY-109	1.88E+03	8.29E+04	1.90E+05	3.88E+04	1.34E+02	5.75E+01	1.71	1,047	0.4	18	17
Supernatant	na	na	na	na	na	na	na	0	0.5	18	17
Solid Layer	1.88E+03	8.29E+04	1.90E+05	3.88E+04	1.34E+02	5.75E+01	1.71	1,047	0.4	18	17
241-BY-110	1.18E+04	1.24E+05	1.24E+05	6.57E+04	7.98E+01	9.18E+01	1.57	1,384	0.3	45	26
Supernatant	na	na	na	na	na	na	na	0	0.4	45	26
Solid Layer	1.18E+04	1.24E+05	1.24E+05	6.57E+04	7.98E+01	9.18E+01	1.57	1,384	0.3	45	26
241-BY-111	1.28E+03	3.29E+04	1.21E+05	2.57E+04	1.38E+01	6.80E+01	1.68	1,144	0.4	30	24
Supernatant	na	na	na	na	na	na	na	0	0.5	30	24
Solid Layer	1.28E+03	3.29E+04	1.21E+05	2.57E+04	1.38E+01	6.84E+01	1.68	1,144	0.4	30	24
241-BY-112	1.72E+03	1.40E+05	1.90E+05	5.54E+04	1.49E+01	7.39E+01	1.74	1,083	0.3	32	25
Supernatant	na	na	na	na	na	na	na	0	0.5	32	25
Solid Layer	1.72E+03	1.40E+05	1.90E+05	5.54E+04	1.49E+01	7.39E+01	1.74	1,083	0.3	32	25
241-C-101	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.73E+02	7.29E+01	1.50	333	0.3	32	33
Supernatant	na	na	na	na	na	na	na	0	0.7	32	33
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.73E+02	7.29E+01	1.50	333	0.3	32	33
241-C-102	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.99E+02	1.50E+01	1.66	1,196	0.4	28	27
Supernatant	na	na	na	na	na	na	na	0	0.8	28	27
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.99E+02	1.50E+01	1.66	1,196	0.4	28	27

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-C-103	6.63E+03	1.96E+04	1.96E+03	1.06E+01	2.99E+03	1.07E+02	1.35	750	0.7	46	39
Supernatant	6.63E+03	1.96E+04	1.96E+03	1.06E+01	5.32E+01	8.10E+01	1.11	276	0.9	46	39
Solid Layer	6.63E+03	1.96E+04	1.96E+03	1.06E+01	4.26E+03	1.18E+02	1.49	474	0.6	46	39
241-C-104	5.60E+03	3.60E+04	7.96E+04	4.94E+03	2.92E+02	5.76E+01	1.69	980	0.5	36	33
Supernatant	na	na	na	na	na	na	na	0	0.8	36	33
Solid Layer	5.60E+03	3.60E+04	7.96E+04	4.94E+03	2.92E+02	5.76E+01	1.69	980	0.5	36	33
241-C-105	2.87E+03	3.70E+04	3.43E+04	9.02E+00	6.14E+02	1.06E+02	1.55	500	0.2	44	40
Supernatant	na	na	na	na	na	na	na	0	0.7	44	40
Solid Layer	2.87E+03	3.70E+04	3.43E+04	9.02E+00	6.14E+02	1.06E+02	1.55	500	0.2	44	40
241-C-106	3.11E+03	1.26E+04	5.66E+02	1.99E+03	1.71E+03	1.06E+02	1.20	138	0.6	30	29
Supernatant	3.11E+03	1.26E+04	5.66E+02	1.99E+03	2.64E+00	4.74E+01	1.13	115	0.7	30	29
Solid Layer	3.11E+03	1.26E+04	5.66E+02	1.99E+03	8.07E+03	3.26E+02	1.52	23	0.3	30	29
241-C-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.47E+03	2.79E+01	1.41	940	0.5	48	43
Supernatant	na	na	na	na	na	na	na	0	0.8	48	43
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.47E+03	2.79E+01	1.41	940	0.5	48	43
241-C-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.33E+01	2.25E+02	1.45	250	0.4	26	26
Supernatant	na	na	na	na	na	na	na	0	0.8	26	26
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.33E+01	2.25E+02	1.45	250	0.4	26	26
241-C-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.26E+02	4.93E+02	1.44	240	0.5	26	26
Supernatant	na	na	na	na	na	na	na	0	0.8	26	26
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.26E+02	4.93E+02	1.44	240	0.4	26	26
241-C-110	5.80E+02	4.60E+03	6.03E+04	2.09E+02	4.12E+00	1.60E+01	1.34	674	0.6	21	23
Supernatant	5.80E+02	4.60E+03	6.03E+04	2.09E+02	2.07E-02	3.64E+00	1.10	4	0.8	21	23
Solid Layer	5.80E+02	4.60E+03	6.03E+04	2.09E+02	4.14E+00	1.60E+01	1.34	670	0.6	21	23

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-C-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.85E+03	6.27E+01	1.44	217	0.2	25	26
Supernatant	na	na	na	na	na	na	na	0	0.8	25	26
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.85E+03	6.27E+01	1.44	217	0.2	25	26
241-C-112	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.03E+03	4.53E+02	1.60	393	0.4	28	28
Supernatant	na	na	na	na	na	na	na	0	0.8	28	28
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.03E+03	4.53E+02	1.60	393	0.4	28	28
241-C-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	6.88E+01	1.31E+01	1.50	4	0.4	16	19
Supernatant	na	na	na	na	na	na	na	0	0.8	16	19
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	6.88E+01	1.31E+01	1.50	4	0.4	16	19
241-C-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.18E+01	1.37E+01	1.50	4	0.1	16	18
Supernatant	na	na	na	na	na	na	na	0	0.8	16	18
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.18E+01	1.37E+01	1.50	4	0.1	16	18
241-C-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.49E+01	1.05E+01	1.50	10	0.4	15	18
Supernatant	na	na	na	na	na	na	na	0	0.8	15	18
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.49E+01	1.05E+01	1.50	10	0.4	15	18
241-C-204	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.55E+01	6.73E+00	1.50	10	0.4	17	16
Supernatant	na	na	na	na	na	na	na	0	0.8	17	16
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.55E+01	6.73E+00	1.50	10	0.4	17	16
241-S-101	1.79E+03	1.13E+05	2.14E+05	2.99E+04	2.32E+02	1.33E+02	1.63	1,606	0.4	46	33
Supernatant	na	na	na	na	na	na	na	0	0.6	46	33
Solid Layer	1.79E+03	1.13E+05	2.14E+05	2.99E+04	2.32E+02	1.33E+02	1.63	1,606	0.4	46	33
241-S-102	4.36E+03	1.11E+05	1.51E+05	4.19E+04	4.69E+01	1.29E+02	1.58	1,249	0.3	38	29
Supernatant	na	na	na	na	na	na	na	0	0.5	38	29
Solid Layer	4.36E+03	1.11E+05	1.51E+05	4.19E+04	4.69E+01	1.29E+02	1.58	1,249	0.3	38	29

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-S-103	4.68E+03	1.47E+05	2.16E+05	3.20E+04	2.88E+01	1.53E+02	1.59	897	0.3	28	26
Supernatant	4.68E+03	1.47E+05	2.16E+05	3.20E+04	2.74E-01	2.40E+02	1.45	4	0.5	28	26
Solid Layer	4.68E+03	1.47E+05	2.16E+05	3.20E+04	2.90E+01	1.52E+02	1.59	893	0.3	28	26
241-S-104	3.96E+02	3.82E+04	2.69E+05	1.20E+04	2.37E+02	4.58E+01	1.66	1,090	0.4	40	32
Supernatant	na	na	na	na	na	na	na	0	0.6	40	32
Solid Layer	3.96E+02	3.82E+04	2.69E+05	1.20E+04	2.37E+02	4.58E+01	1.66	1,090	0.4	40	32
241-S-105	1.35E+04	9.75E+04	1.25E+05	4.19E+04	1.64E+01	1.19E+02	1.65	1,536	0.3	25	25
Supernatant	na	na	na	na	na	na	na	0	0.5	25	25
Solid Layer	1.35E+04	9.75E+04	1.25E+05	4.19E+04	1.64E+01	1.19E+02	1.65	1,536	0.3	25	25
241-S-106	1.98E+03	1.04E+05	2.36E+05	3.80E+04	1.32E+01	9.77E+01	1.72	1,723	0.3	24	23
Supernatant	na	na	na	na	na	na	na	0	0.5	24	23
Solid Layer	1.98E+03	1.04E+05	2.36E+05	3.80E+04	1.32E+01	9.79E+01	1.72	1,723	0.3	24	23
241-S-107	1.18E+03	7.11E+04	1.14E+05	1.07E+04	1.37E+02	7.47E+01	1.76	1,423	0.3	40	29
Supernatant	1.18E+03	7.11E+04	1.14E+05	1.07E+04	5.23E-02	9.46E+01	1.31	53	0.7	40	29
Solid Layer	1.18E+03	7.11E+04	1.14E+05	1.07E+04	1.41E+02	7.41E+01	1.78	1,370	0.3	40	29
241-S-108	1.35E+04	9.71E+04	1.25E+05	4.19E+04	1.86E+01	1.14E+02	1.65	2,082	0.3	28	26
Supernatant	na	na	na	na	na	na	na	0	0.5	28	26
Solid Layer	1.35E+04	9.71E+04	1.25E+05	4.19E+04	1.86E+01	1.14E+02	1.65	2,082	0.3	28	26
241-S-109	1.11E+03	8.49E+04	1.32E+05	4.59E+04	1.81E+01	1.43E+01	1.66	2,017	0.1	29	25
Supernatant	na	na	na	na	na	na	na	0	0.5	29	25
Solid Layer	1.11E+03	8.49E+04	1.32E+05	4.59E+04	1.81E+01	1.43E+01	1.66	2,017	0.1	29	25
241-S-110	2.28E+03	8.58E+04	2.17E+05	3.10E+04	1.01E+02	7.29E+01	1.66	1,473	0.3	44	29
Supernatant	na	na	na	na	na	na	na	0	0.5	44	29
Solid Layer	2.28E+03	8.58E+04	2.17E+05	3.10E+04	1.01E+02	7.29E+01	1.66	1,473	0.3	44	29

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-S-111	1.49E+03	8.33E+04	1.92E+05	3.64E+04	1.78E+02	1.32E+02	1.54	1,766	0.3	32	26
Supernatant	1.49E+03	8.33E+04	1.92E+05	3.64E+04	8.39E-02	2.22E+02	1.45	180	0.5	32	26
Solid Layer	1.50E+03	8.34E+04	1.92E+05	3.63E+04	1.97E+02	1.23E+02	1.55	1,586	0.3	32	26
241-S-112	1.35E+04	9.73E+04	1.25E+05	4.18E+04	2.01E+01	1.21E+02	1.65	1,950	0.3	36	25
Supernatant	na	na	na	na	na	na	na	0	0.5	36	25
Solid Layer	1.35E+04	9.73E+04	1.25E+05	4.18E+04	2.01E+01	1.21E+02	1.65	1,950	0.3	36	25
241-SX-101	3.35E+02	7.49E+04	1.08E+05	8.00E+04	2.44E+02	1.24E+02	1.66	1,612	0.3	57	37
Supernatant	na	na	na	na	na	na	na	0	0.5	57	37
Solid Layer	3.35E+02	7.49E+04	1.08E+05	8.00E+04	2.44E+02	1.24E+02	1.66	1,612	0.3	57	37
241-SX-102	1.51E+03	1.51E+05	1.58E+05	4.56E+04	7.63E+01	1.66E+02	1.66	1,915	0.4	60	35
Supernatant	na	na	na	na	na	na	na	0	0.5	60	35
Solid Layer	1.51E+03	1.51E+05	1.58E+05	4.56E+04	7.63E+01	1.66E+02	1.66	1,915	0.4	60	35
241-SX-103	3.38E+03	1.58E+05	1.57E+05	4.44E+04	1.18E+02	1.36E+02	1.72	1,927	0.3	70	34
Supernatant	na	na	na	na	na	na	na	0	0.5	70	34
Solid Layer	3.38E+03	1.58E+05	1.57E+05	4.44E+04	1.18E+02	1.36E+02	1.72	1,927	0.3	70	34
241-SX-104	2.13E+03	1.17E+05	2.90E+05	3.55E+04	1.89E+02	1.03E+02	1.68	1,688	0.4	59	33
Supernatant	na	na	na	na	na	na	na	0	0.5	59	33
Solid Layer	2.13E+03	1.17E+05	2.90E+05	3.55E+04	1.89E+02	1.03E+02	1.68	1,688	0.4	59	33
241-SX-105	3.25E+03	1.43E+05	1.64E+05	4.40E+04	8.60E+01	1.17E+02	1.62	1,258	0.4	75	37
Supernatant	na	na	na	na	na	na	na	0	0.4	75	37
Solid Layer	3.25E+03	1.43E+05	1.64E+05	4.40E+04	8.60E+01	1.17E+02	1.62	1,258	0.4	75	37
241-SX-106	3.14E+03	1.49E+05	2.45E+05	2.26E+04	4.44E+00	1.45E+02	1.58	1,501	0.4	37	32
Supernatant	na	na	na	na	na	na	na	0	0.5	37	32
Solid Layer	3.14E+03	1.49E+05	2.45E+05	2.26E+04	4.44E+00	1.45E+02	1.58	1,501	0.4	37	32

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-SX-107	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.66E+02	8.47E+01	1.73	357	0.4	75	50
Supernatant	na	na	na	na	na	na	na	0	0.8	75	50
Solid Layer	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.66E+02	8.47E+01	1.73	357	0.4	75	50
241-SX-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.77E+03	1.77E+02	1.75	276	0.0	84	58
Supernatant	na	na	na	na	na	na	na	0	0.8	84	58
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.77E+03	1.77E+02	1.75	276	0.0	84	58
241-SX-109	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.50E+02	8.64E+01	1.73	913	0.3	57	48
Supernatant	na	na	na	na	na	na	na	0	0.5	57	48
Solid Layer	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.50E+02	8.64E+01	1.73	913	0.3	57	48
241-SX-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.52E+02	8.34E+01	1.74	212	0.4	74	64
Supernatant	na	na	na	na	na	na	na	0	0.8	74	64
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.52E+02	8.34E+01	1.74	212	0.4	74	64
241-SX-111	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.00E+02	9.07E+01	1.72	436	0.4	85	56
Supernatant	na	na	na	na	na	na	na	0	0.8	85	56
Solid Layer	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.00E+02	9.07E+01	1.72	436	0.4	85	56
241-SX-112	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.33E+02	8.77E+01	1.73	283	0.4	66	51
Supernatant	na	na	na	na	na	na	na	0	0.8	66	51
Solid Layer	1.15E+02	1.10E+05	1.74E+05	4.32E+04	4.33E+02	8.77E+01	1.73	283	0.4	66	51
241-SX-113	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.14E+01	4.18E+01	1.06	71	0.5	28	28
Supernatant	na	na	na	na	na	na	na	0	0.8	28	28
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.14E+01	4.18E+01	1.06	71	0.5	28	28
241-SX-114	1.15E+02	1.10E+05	1.74E+05	4.32E+04	2.40E+02	1.06E+02	1.68	594	0.4	80	52
Supernatant	na	na	na	na	na	na	na	0	0.8	80	52
Solid Layer	1.15E+02	1.10E+05	1.74E+05	4.32E+04	2.40E+02	1.06E+02	1.68	594	0.4	80	52

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-SX-115	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.48E+04	9.39E+01	1.75	14	0.4	25	25
Supernatant	na	na	na	na	na	na	na	0	0.8	25	25
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.48E+04	9.39E+01	1.75	14	0.4	25	25
241-T-101	1.08E+04	9.63E+04	1.66E+05	3.75E+04	1.72E+01	7.59E+01	1.62	376	0.4	22	22
Supernatant	na	na	na	na	na	na	na	0	0.6	22	22
Solid Layer	1.08E+04	9.63E+04	1.66E+05	3.75E+04	1.72E+01	7.59E+01	1.62	376	0.4	22	22
241-T-102	4.49E+02	2.31E+04	1.09E+05	8.33E+03	1.24E+02	3.71E+01	1.53	121	0.5	18	18
Supernatant	4.49E+02	2.31E+04	1.09E+05	8.33E+03	9.20E-01	4.85E+01	1.14	49	0.8	18	18
Solid Layer	4.49E+02	2.31E+04	1.09E+05	8.33E+03	1.78E+02	3.22E+01	1.79	72	0.4	18	18
241-T-103	1.15E+03	2.37E+04	4.86E+04	1.82E+05	8.06E+02	2.88E+01	1.62	102	0.5	19	20
Supernatant	5.18E-01	3.75E+04	7.88E+04	1.08E+04	4.28E+01	2.10E+01	1.18	15	0.7	19	20
Solid Layer	5.18E-01	3.75E+04	7.88E+04	1.08E+04	8.98E+02	2.98E+01	1.69	87	0.4	19	20
241-T-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.19E+00	1.66E-01	1.29	1,199	0.6	20	21
Supernatant	na	na	na	na	na	na	na	0	0.8	20	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.19E+00	1.66E-01	1.29	1,199	0.6	20	21
241-T-105	2.98E+03	5.42E+04	3.71E+04	3.62E+02	8.20E+01	5.24E+01	1.46	371	0.5	17	16
Supernatant	na	na	na	na	na	na	na	0	0.8	17	16
Solid Layer	2.98E+03	5.42E+04	3.71E+04	3.62E+02	8.19E+01	5.23E+01	1.46	371	0.5	17	16
241-T-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.03E+01	3.87E+01	1.52	82	0.2	20	21
Supernatant	na	na	na	na	na	na	na	0	0.8	20	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.03E+01	3.87E+01	1.52	82	0.2	20	21
241-T-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.16E+02	1.68E+01	1.46	655	0.5	21	22
Supernatant	na	na	na	na	na	na	na	0	0.8	21	22
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.16E+02	1.69E+01	1.46	655	0.5	21	22

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-T-108	4.45E-04	1.84E+04	1.74E+05	4.65E+02	3.81E+00	9.28E+00	1.44	60	0.4	16	22
Supernatant	na	na	na	na	na	na	na	0	0.6	16	22
Solid Layer	4.45E-04	1.84E+04	1.74E+05	4.65E+02	3.81E+00	9.28E+00	1.44	60	0.4	16	22
241-T-109	4.46E-04	1.85E+04	1.75E+05	4.64E+02	3.15E+00	3.83E+00	1.46	235	0.4	19	20
Supernatant	na	na	na	na	na	na	na	0	0.5	19	20
Solid Layer	4.46E-04	1.85E+04	1.75E+05	4.64E+02	3.15E+00	3.82E+00	1.46	235	0.4	19	20
241-T-110	4.50E+01	5.90E+01	1.83E+04	0.00E+00	1.73E+01	2.82E+01	1.27	1,400	0.8	19	21
Supernatant	4.50E+01	5.90E+01	1.83E+04	0.00E+00	4.60E-04	2.98E-03	1.05	3	0.9	19	21
Solid Layer	4.50E+01	5.90E+01	1.83E+04	0.00E+00	1.73E+01	2.82E+01	1.27	1,397	0.8	19	21
241-T-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.39E+00	1.09E-01	1.24	1,692	0.7	21	23
Supernatant	na	na	na	na	na	na	na	0	0.8	21	23
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.39E+00	1.09E-01	1.24	1,692	0.7	21	23
241-T-112	4.38E+02	3.88E+04	2.33E+04	0.00E+00	1.06E+01	1.62E+01	1.26	252	0.8	19	21
Supernatant	4.38E+02	3.88E+04	2.33E+04	0.00E+00	1.82E+00	2.09E+00	1.10	26	0.9	19	21
Solid Layer	4.38E+02	3.88E+04	2.33E+04	0.00E+00	1.15E+01	1.76E+01	1.28	226	0.8	19	21
241-T-201	7.86E-03	3.35E+02	4.61E+04	0.00E+00	7.37E-02	2.88E-02	1.30	118	0.7	19	20
Supernatant	7.86E-03	3.35E+02	4.61E+04	0.00E+00	1.02E-01	1.16E-01	1.06	8	0.9	19	20
Solid Layer	7.86E-03	3.35E+02	4.61E+04	0.00E+00	7.20E-02	2.37E-02	1.31	110	0.7	19	20
241-T-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.29E-03	2.60E-02	1.24	81	0.8	18	20
Supernatant	na	na	na	na	na	na	na	0	0.8	18	20
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.29E-03	2.60E-02	1.24	81	0.8	18	20
241-T-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.38E-03	1.68E-02	1.22	140	0.8	19	20
Supernatant	na	na	na	na	na	na	na	0	0.9	19	20
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.38E-03	1.68E-02	1.22	140	0.8	19	20

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-T-204	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.24E-03	7.14E-03	1.21	140	0.8	19	20
Supernatant	na	na	na	na	na	na	na	0	0.8	19	20
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.24E-03	7.14E-03	1.21	140	0.8	19	20
241-TX-101	1.08E+04	9.63E+04	1.66E+05	3.74E+04	4.16E+02	8.14E+01	1.73	344	0.4	25	23
Supernatant	na	na	na	na	na	na	na	0	0.8	25	23
Solid Layer	1.08E+04	9.63E+04	1.66E+05	3.74E+04	4.16E+02	8.14E+01	1.73	344	0.4	25	23
241-TX-102	1.08E+04	9.59E+04	1.66E+05	3.74E+04	2.19E+01	9.02E+01	1.64	821	0.3	27	27
Supernatant	na	na	na	na	na	na	na	0	0.5	27	27
Solid Layer	1.08E+04	9.59E+04	1.66E+05	3.74E+04	2.19E+01	9.02E+01	1.64	821	0.3	27	27
241-TX-103	1.03E+04	9.28E+04	1.67E+05	3.58E+04	2.18E+01	8.64E+01	1.64	548	0.3	22	22
Supernatant	na	na	na	na	na	na	na	0	0.5	22	22
Solid Layer	1.03E+04	9.28E+04	1.67E+05	3.58E+04	2.18E+01	8.64E+01	1.64	548	0.3	22	22
241-TX-104	1.36E+03	9.42E+04	3.55E+05	3.19E+03	2.20E+02	7.30E+01	1.73	262	0.5	21	21
Supernatant	1.36E+03	9.42E+04	3.54E+05	3.19E+03	1.82E+01	1.76E+02	1.44	9	0.5	21	21
Solid Layer	1.36E+03	9.42E+04	3.55E+05	3.19E+03	2.25E+02	6.99E+01	1.74	253	0.5	21	21
241-TX-105	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.22E+01	8.11E+01	1.66	2,181	0.3	36	23
Supernatant	na	na	na	na	na	na	na	0	0.5	36	23
Solid Layer	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.22E+01	8.11E+01	1.66	2,181	0.3	36	23
241-TX-106	1.08E+04	9.60E+04	1.66E+05	3.74E+04	2.87E+01	8.72E+01	1.65	1,318	0.3	27	25
Supernatant	na	na	na	na	na	na	na	0	0.5	27	25
Solid Layer	1.08E+04	9.60E+04	1.66E+05	3.74E+04	2.87E+01	8.72E+01	1.65	1,318	0.3	27	25
241-TX-107	7.75E+03	1.00E+05	1.68E+05	3.91E+04	5.49E+01	1.15E+02	1.63	112	0.2	22	22
Supernatant	na	na	na	na	na	na	na	0	0.5	22	22
Solid Layer	7.75E+03	1.00E+05	1.68E+05	3.91E+04	5.49E+01	1.15E+02	1.63	112	0.2	22	22

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Al in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-TX-108	1.08E+04	9.63E+04	1.66E+05	3.74E+04	2.70E+01	8.09E+01	1.65	489	0.3	19	20
Supernatant	na	na	na	na	na	na	na	0	0.5	19	20
Solid Layer	1.08E+04	9.63E+04	1.66E+05	3.74E+04	2.70E+01	8.09E+01	1.65	489	0.3	19	20
241-TX-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.15E+00	2.02E+01	1.41	1,375	0.4	24	22
Supernatant	na	na	na	na	na	na	na	0	0.8	24	22
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.15E+00	2.02E+01	1.41	1,375	0.4	24	22
241-TX-110	1.08E+04	9.61E+04	1.66E+05	3.73E+04	2.14E+01	7.45E+01	1.65	1,767	0.3	28	22
Supernatant	na	na	na	na	na	na	na	0	0.5	28	22
Solid Layer	1.08E+04	9.61E+04	1.66E+05	3.73E+04	2.14E+01	7.45E+01	1.65	1,767	0.3	28	22
241-TX-111	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.09E+01	7.20E+01	1.64	1,383	0.3	26	23
Supernatant	na	na	na	na	na	na	na	0	0.5	26	23
Solid Layer	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.09E+01	7.20E+01	1.64	1,383	0.3	26	23
241-TX-112	9.26E+03	8.54E+04	1.67E+05	3.23E+04	2.18E+01	7.78E+01	1.66	2,398	0.3	23	21
Supernatant	na	na	na	na	na	na	na	0	0.5	23	21
Solid Layer	9.26E+03	8.54E+04	1.67E+05	3.23E+04	2.18E+01	7.78E+01	1.66	2,398	0.3	23	21
241-TX-113	1.08E+04	9.62E+04	1.66E+05	3.74E+04	1.62E+00	8.55E+00	1.63	2,416	0.4	23	22
Supernatant	na	na	na	na	na	na	na	0	0.6	23	22
Solid Layer	1.08E+04	9.62E+04	1.66E+05	3.74E+04	1.62E+00	8.58E+00	1.63	2,416	0.4	23	22
241-TX-114	4.08E+03	4.78E+04	1.71E+05	1.45E+04	2.06E+01	7.07E+01	1.64	2,015	0.3	21	18
Supernatant	na	na	na	na	na	na	na	0	0.5	21	18
Solid Layer	4.08E+03	4.78E+04	1.71E+05	1.45E+04	2.06E+01	7.07E+01	1.64	2,015	0.3	21	18
241-TX-115	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.43E+01	8.04E+01	1.66	2,096	0.3	22	21
Supernatant	na	na	na	na	na	na	na	0	0.5	22	21
Solid Layer	1.08E+04	9.62E+04	1.66E+05	3.74E+04	2.43E+01	8.04E+01	1.66	2,096	0.3	22	21

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (µg/mL)	NO_2 in liquid [NO_2] (µg/mL)	NO_3 in liquid [NO_3] (µg/mL)	Al in liquid [Al] (µg/mL)	^{90}Sr in waste [Sr] (µCi/g)	^{137}Cs in waste [Cs] (µCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-TX-116	7.89E-04	3.26E+04	3.09E+05	8.24E+02	2.76E+00	2.94E+01	1.57	2,256	0.3	21	20
Supernatant	na	na	na	na	na	na	na	0	0.5	21	20
Solid Layer	7.89E-04	3.26E+04	3.09E+05	8.24E+02	2.76E+00	2.94E+01	1.57	2,256	0.3	21	20
241-TX-117	4.47E-04	1.84E+04	1.74E+05	4.67E+02	1.41E+01	4.79E+01	1.58	1,819	0.3	21	20
Supernatant	na	na	na	na	na	na	na	0	0.5	21	20
Solid Layer	4.47E-04	1.84E+04	1.74E+05	4.67E+02	1.41E+01	4.79E+01	1.58	1,819	0.3	21	20
241-TX-118	1.08E+04	9.64E+04	1.66E+05	3.74E+04	1.10E+02	4.26E+01	1.69	968	0.5	24	23
Supernatant	na	na	na	na	na	na	na	0	0.5	24	23
Solid Layer	1.08E+04	9.64E+04	1.66E+05	3.74E+04	1.10E+02	4.26E+01	1.69	968	0.5	24	23
241-TY-101	4.45E-04	1.84E+04	1.74E+05	4.65E+02	8.67E+00	2.41E-01	1.64	447	0.4	20	21
Supernatant	na	na	na	na	na	na	na	0	0.6	20	21
Solid Layer	4.45E-04	1.84E+04	1.74E+05	4.65E+02	8.67E+00	2.41E-01	1.64	447	0.4	20	21
241-TY-102	6.03E+03	6.19E+04	1.70E+05	2.11E+04	6.02E+00	2.48E+01	1.74	261	0.3	16	19
Supernatant	na	na	na	na	na	na	na	0	0.5	16	19
Solid Layer	6.03E+03	6.19E+04	1.70E+05	2.11E+04	6.02E+00	2.48E+01	1.74	261	0.3	16	19
241-TY-103	1.08E+04	9.63E+04	1.66E+05	3.74E+04	7.63E+01	2.24E+01	1.69	587	0.4	30	21
Supernatant	na	na	na	na	na	na	na	0	0.8	30	21
Solid Layer	1.08E+04	9.63E+04	1.66E+05	3.74E+04	7.63E+01	2.24E+01	1.69	587	0.4	30	21
241-TY-104	2.11E+03	1.13E+04	9.90E+04	5.70E+02	9.03E+01	3.15E+01	1.68	167	0.5	20	20
Supernatant	2.11E+03	1.13E+04	9.90E+04	5.70E+02	5.53E-02	1.04E+01	1.18	4	0.8	20	20
Solid Layer	2.11E+03	1.13E+04	9.90E+04	5.70E+02	9.18E+01	3.19E+01	1.69	163	0.5	20	20
241-TY-105	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.59E+02	6.69E+00	1.53	874	0.4	26	23
Supernatant	na	na	na	na	na	na	na	0	0.8	26	23
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.59E+02	6.69E+00	1.53	874	0.4	26	23

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-TY-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.44E+01	1.54E+01	1.37	62	0.3	16	19
Supernatant	na	na	na	na	na	na	na	0	0.8	16	19
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.44E+01	1.54E+01	1.37	62	0.3	16	19
241-U-101	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.93E+02	7.32E+01	1.75	89	0.3	19	22
Supernatant	na	na	na	na	na	na	na	0	0.8	19	22
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.93E+02	7.32E+01	1.75	89	0.3	19	22
241-U-102	1.12E+04	1.46E+05	1.98E+05	3.32E+04	1.11E+02	1.44E+02	1.68	1,109	0.4	31	28
Supernatant	na	na	na	na	na	na	na	0	0.5	31	28
Solid Layer	1.12E+04	1.46E+05	1.98E+05	3.32E+04	1.11E+02	1.44E+02	1.68	1,109	0.4	31	28
241-U-103	1.24E+04	1.37E+05	1.52E+05	4.09E+04	2.16E+01	1.29E+02	1.70	1,410	0.4	31	29
Supernatant	1.24E+04	1.37E+05	1.52E+05	4.09E+04	7.01E+00	3.32E+02	1.44	2	0.5	31	29
Solid Layer	1.24E+04	1.37E+05	1.52E+05	4.09E+04	2.16E+01	1.29E+02	1.70	1,408	0.4	31	29
241-U-104	9.58E+03	1.05E+05	2.07E+05	3.21E+04	2.00E+02	5.97E+01	1.38	462	0.4	28	24
Supernatant	na	na	na	na	na	na	na	0	0.6	28	24
Solid Layer	9.58E+03	1.05E+05	2.07E+05	3.21E+04	2.00E+02	5.97E+01	1.38	462	0.4	28	24
241-U-105	1.64E+04	1.08E+05	1.81E+05	2.98E+04	8.84E+00	1.47E+02	1.67	1,336	0.3	32	29
Supernatant	na	na	na	na	na	na	na	0	0.6	32	29
Solid Layer	1.64E+04	1.08E+05	1.81E+05	2.98E+04	8.84E+00	1.47E+02	1.67	1,336	0.3	32	29
241-U-106	4.28E+04	9.90E+04	2.48E+05	1.20E+04	6.36E+01	1.57E+02	1.55	644	0.4	28	27
Supernatant	4.28E+04	9.90E+04	2.48E+05	1.20E+04	4.42E+01	2.25E+02	1.34	6	0.5	28	27
Solid Layer	4.28E+04	9.88E+04	2.49E+05	1.20E+04	6.38E+01	1.56E+02	1.55	638	0.4	28	27
241-U-107	4.10E+03	1.16E+05	2.11E+05	2.79E+04	2.14E+00	1.01E+02	1.65	1,556	0.3	26	25
Supernatant	4.10E+03	1.16E+05	2.11E+05	2.79E+04	2.63E-01	1.95E+02	1.39	136	0.5	26	25
Solid Layer	4.10E+03	1.17E+05	2.11E+05	2.79E+04	2.29E+00	9.31E+01	1.67	1,420	0.3	26	25

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-U-108	7.07E+03	1.34E+05	1.84E+05	3.05E+04	6.75E+00	1.52E+02	1.64	1,772	0.4	30	26
Supernatant	7.07E+03	1.34E+05	1.84E+05	3.05E+04	2.16E-01	2.61E+02	1.40	91	0.5	30	26
Solid Layer	7.08E+03	1.34E+05	1.84E+05	3.05E+04	7.05E+00	1.47E+02	1.65	1,681	0.4	30	26
241-U-109	6.53E+03	1.28E+05	1.85E+05	2.92E+04	7.56E+00	1.19E+02	1.65	1,079	0.3	30	29
Supernatant	na	na	na	na	na	na	na	0	0.5	30	29
Solid Layer	6.53E+03	1.28E+05	1.85E+05	2.92E+04	7.56E+00	1.19E+02	1.65	1,079	0.3	30	29
241-U-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.79E+02	1.98E+01	1.66	665	0.3	26	26
Supernatant	na	na	na	na	na	na	na	0	0.8	26	26
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.79E+02	1.98E+01	1.66	665	0.3	26	26
241-U-111	5.41E+03	1.20E+05	1.66E+05	3.66E+04	2.80E+01	1.54E+02	1.56	1,288	0.3	27	26
Supernatant	na	na	na	na	na	na	na	0	0.5	27	26
Solid Layer	5.41E+03	1.20E+05	1.66E+05	3.66E+04	2.80E+01	1.54E+02	1.56	1,288	0.3	27	26
241-U-112	2.98E+03	3.60E+04	7.96E+04	4 94E+03	2.20E+02	4.89E+01	1.74	172	0.3	21	21
Supernatant	na	na	na	na	na	na	na	0	0.8	21	21
Solid Layer	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.20E+02	4.89E+01	1.74	172	0.3	21	21
241-U-201	0.00E+00	8.60E+04	7.10E+04	4.13E+04	8.05E+00	2.83E+01	1.54	19	0.3	19	19
Supernatant	0.00E+00	8.60E+04	7.10E+04	4.13E+04	2.81E+00	3.22E+00	1.22	4	0.7	19	19
Solid Layer	0.00E+00	8.60E+04	7.10E+04	4.13E+04	9.09E+00	3.33E+01	1.62	15	0.3	19	19
241-U-202	0.00E+00	7.85E+04	6.48E+04	3.75E+04	7.79E+00	2.73E+01	1.53	17	0.4	18	19
Supernatant	0.00E+00	7.85E+04	6.48E+04	3.75E+04	2.56E+00	2.95E+00	1.22	4	0.7	18	19
Solid Layer	0.00E+00	7.85E+04	6.48E+04	3.75E+04	9.02E+00	3.30E+01	1.62	13	0.3	18	19
241-U-203	0.00E+00	8.73E+04	7.18E+04	4.18E+04	6.59E+00	2.28E+01	1.53	17	0.5	18	18
Supernatant	0.00E+00	8.73E+04	7.18E+04	4.18E+04	2.85E+00	3.28E+00	1.22	4	0.7	18	18
Solid Layer	0.00E+00	8.73E+04	7.18E+04	4.18E+04	7.45E+00	2.73E+01	1.62	13	0.4	18	18

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Table B-1. Input Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	TOC in liquid [TOC] (μg/mL)	NO_2 in liquid [NO_2] (μg/mL)	NO_3 in liquid [NO_3] (μg/mL)	Al in liquid [Al] (μg/mL)	^{90}Sr in waste [Sr] (μCi/g)	^{137}Cs in waste [Cs] (μCi/g)	Bulk density D (g/mL)	Waste volume V (kL)	Bulk water [H_2O] (wt%)	Waste temp. T_w (°C)	Dome temp. T_d (°C)
241-U-204	8.10E+01	3.85E+04	3.18E+04	6.25E+02	7.49E+00	2.68E+01	1.51	15	0.4	18	18
Supernatant	8.10E+01	3.85E+04	3.18E+04	6.25E+02	1.26E+00	1.45E+00	1.22	4	0.9	18	18
Solid Layer	8.10E+01	3.85E+04	3.18E+04	6.25E+02	9.20E+00	3.37E+01	1.62	11	0.3	18	18

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AN-101	91.7	1.12E+06	100%	6,218	4.02E-04	4.50E+02	1.21	0.93	0.10	0.99	0.005	0.008
Supernatant	91.7	1.12E+06	100%	6,218	4.02E-04	4.50E+02	1.21	0.93	0.10	0.99	0.005	0.008
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AN-102	382.7	5.75E+06	99%	11,933	1.49E-03	8.58E+03	3.82	2.05	1.81	1.12	0.005	0.091
Supernatant	350.4	5.22E+06	100%	6,880	1.41E-03	7.38E+03	3.82	2.05	1.81	1.12	0.005	0.091
Solid Layer	32.3	5.26E+05	84%	5,053	2.28E-03	1.20E+03	3.82	2.05	1.81	1.12	0.005	0.091
241-AN-103	327.7	5.42E+06	84%	10,852	1.67E-03	9.03E+03	2.70	3.57	0.18	2.02	0.005	0.018
Supernatant	180.6	2.79E+06	100%	3,547	2.07E-03	5.77E+03	2.70	3.57	0.18	2.02	0.005	0.018
Solid Layer	147.1	2.64E+06	66%	7,305	1.24E-03	3.26E+03	2.70	3.57	0.18	2.02	0.005	0.018
241-AN-104	366.3	5.68E+06	95%	11,611	1.76E-03	9.98E+03	2.77	2.44	0.22	2.78	0.005	0.022
Supernatant	199.8	2.92E+06	100%	3,923	1.78E-03	5.20E+03	2.77	2.44	0.22	2.78	0.005	0.022
Solid Layer	166.5	2.76E+06	90%	7,688	1.73E-03	4.77E+03	2.77	2.44	0.22	2.78	0.005	0.022
241-AN-105	400.9	6.29E+06	95%	12,289	1.11E-03	6.98E+03	2.61	2.63	0.25	2.90	0.005	0.021
Supernatant	230.9	3.42E+06	100%	4,533	1.05E-03	3.57E+03	2.61	2.63	0.25	2.90	0.005	0.021
Solid Layer	170.0	2.87E+06	88%	7,755	1.19E-03	3.41E+03	2.61	2.63	0.25	2.90	0.005	0.021
241-AN-106	13.7	1.94E+05	80%	4,687	6.26E-04	1.22E+02	1.14	0.41	0.40	0.29	0.005	0.015
Supernatant	7.6	9.32E+04	100%	149	2.86E-04	2.67E+01	1.14	0.41	0.40	0.29	0.005	0.015
Solid Layer	6.1	1.01E+05	62%	4,538	9.39E-04	9.49E+01	1.14	0.41	0.40	0.29	0.005	0.015
241-AN-107	377.9	5.58E+06	95%	11,839	1.80E-03	1.00E+04	3.86	1.44	3.04	0.02	0.005	0.137
Supernatant	288.2	4.12E+06	100%	5,660	1.69E-03	6.96E+03	3.86	1.44	3.04	0.02	0.005	0.137
Solid Layer	89.7	1.46E+06	80%	6,179	2.12E-03	3.09E+03	3.86	1.44	3.04	0.02	0.005	0.137
241-AP-101	404.4	5.52E+06	100%	12,359	5.12E-04	2.83E+03	2.13	0.91	0.15	0.53	0.005	0.009
Supernatant	404.4	5.52E+06	100%	12,359	5.12E-04	2.83E+03	2.13	0.91	0.15	0.53	0.005	0.009
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AP-102	395.4	4.95E+06	100%	12,181	7.57E-04	3.75E+03	1.26	0.83	0.29	0.96	0.005	0.013
Supernatant	395.4	4.95E+06	100%	12,181	7.57E-04	3.75E+03	1.26	0.83	0.29	0.96	0.005	0.013
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AP-103	102.4	1.40E+06	100%	6,428	8.86E-04	1.24E+03	2.21	2.34	0.30	0.65	0.005	0.013
Supernatant	102.4	1.40E+06	100%	6,428	8.86E-04	1.24E+03	2.21	2.34	0.30	0.65	0.005	0.013
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AP-104	402.7	5.25E+06	100%	12,325	7.36E-04	3.86E+03	1.68	1.29	0.41	1.38	0.005	0.017
Supernatant	402.7	5.25E+06	100%	12,325	7.36E-04	3.86E+03	1.68	1.29	0.41	1.38	0.005	0.017
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AP-105	412.1	5.88E+06	98%	12,509	7.34E-04	4.31E+03	3.85	2.22	0.21	1.55	0.005	0.011
Supernatant	379.8	5.34E+06	100%	7,457	7.23E-04	3.87E+03	3.85	2.22	0.21	1.55	0.005	0.011
Solid Layer	32.3	5.32E+05	73%	5,053	8.42E-04	4.48E+02	3.85	2.22	0.21	1.55	0.005	0.011
241-AP-106	226.2	2.97E+06	100%	8,859	6.89E-04	2.05E+03	1.49	1.26	0.34	1.14	0.005	0.015
Supernatant	226.2	2.97E+06	100%	8,859	6.89E-04	2.05E+03	1.49	1.26	0.34	1.14	0.005	0.015
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AP-107	355.7	4.64E+06	100%	11,402	6.47E-04	3.00E+03	2.14	1.21	0.31	1.25	0.005	0.017
Supernatant	355.7	4.64E+06	100%	11,402	6.47E-04	3.00E+03	2.14	1.21	0.31	1.25	0.005	0.017
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AP-108	11.6	1.51E+05	100%	4,646	3.39E-04	5.12E+01	1.29	0.62	0.08	0.77	0.005	0.007
Supernatant	11.6	1.51E+05	100%	4,646	3.39E-04	5.12E+01	1.29	0.62	0.08	0.77	0.005	0.007
Solid Layer	na	na	na	na	na	na	na	na	na	na	na	na
241-AW-101	400.2	6.30E+06	96%	12,276	1.39E-03	8.76E+03	2.74	2.61	0.34	2.24	0.005	0.026
Supernatant	268.4	4.11E+06	100%	5,270	1.42E-03	5.83E+03	2.74	2.61	0.34	2.24	0.005	0.026
Solid Layer	131.8	2.18E+06	89%	7,006	1.34E-03	2.93E+03	2.74	2.61	0.34	2.24	0.005	0.026

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AW-102	30.9	3.80E+05	76%	5,024	1.70E-03	6.45E+02	0.07	0.02	0.02	0.01	0.096	0.097
Supernatant	20.0	2.10E+05	100%	392	8.63E-06	1.81E+00	0.07	0.02	0.02	0.01	0.096	0.097
Solid Layer	10.9	1.70E+05	46%	4,633	3.79E-03	6.43E+02	0.07	0.02	0.02	0.01	0.096	0.097
241-AW-103	400.0	5.48E+06	87%	12,272	3.77E-04	2.06E+03	2.00	0.87	0.17	0.95	0.005	0.010
Supernatant	286.4	3.70E+06	100%	5,624	4.81E-04	1.78E+03	2.00	0.87	0.17	0.95	0.005	0.010
Solid Layer	113.6	1.77E+06	59%	6,648	1.59E-04	2.82E+02	2.00	0.87	0.17	0.95	0.005	0.010
241-AW-104	114.6	1.63E+06	73%	6,669	6.62E-04	1.08E+03	1.87	1.72	0.07	0.01	0.005	0.007
Supernatant	33.8	3.77E+05	100%	663	1.89E-05	7.11E+00	0.19	0.05	0.07	0.01	0.005	0.007
Solid Layer	80.9	1.26E+06	65%	6,006	8.54E-04	1.07E+03	2.18	2.03	0.07	0.01	0.005	0.007
241-AW-105	155.0	1.96E+06	81%	7,462	3.59E-04	7.02E+02	0.55	0.05	0.09	0.02	0.005	0.007
Supernatant	62.4	6.97E+05	100%	1,226	4.53E-05	3.16E+01	0.55	0.05	0.09	0.02	0.005	0.007
Solid Layer	92.6	1.26E+06	71%	6,235	5.32E-04	6.70E+02	0.55	0.05	0.09	0.02	0.005	0.007
241-AW-106	108.5	1.73E+06	95%	6,548	8.70E-04	1.50E+03	2.63	1.14	0.19	1.19	0.005	0.019
Supernatant	21.7	2.98E+05	100%	426	5.49E-04	1.64E+02	2.63	1.14	0.19	1.19	0.005	0.020
Solid Layer	86.8	1.43E+06	94%	6,122	9.37E-04	1.34E+03	2.63	1.14	0.19	1.19	0.005	0.020
241-AY-101	66.6	8.73E+05	77%	5,725	1.01E-02	8.80E+03	0.10	1.08	0.11	0.20	0.005	0.014
Supernatant	31.6	4.01E+05	100%	620	1.62E-04	6.51E+01	0.08	0.68	0.11	0.20	0.005	0.014
Solid Layer	29.7	4.72E+05	58%	5,002	1.72E-02	8.13E+03	0.11	1.42	0.11	0.20	0.005	0.014
241-AY-102	230.5	2.92E+06	83%	8,944	1.24E-02	3.64E+04	0.01	0.11	0.14	0.13	0.139	0.158
Supernatant	168.5	2.02E+06	100%	3,309	1.40E-04	2.83E+02	0.01	0.13	0.14	0.13	0.127	0.140
Solid Layer	62.0	9.03E+05	44%	5,635	4.00E-02	3.61E+04	0.00	0.00	0.14	0.13	0.282	0.331
241-AZ-101	342.8	4.51E+06	98%	11,149	1.34E-02	6.04E+04	1.03	1.41	0.03	0.62	0.005	0.015
Supernatant	323.9	4.19E+06	100%	6,360	6.39E-03	2.67E+04	1.03	1.41	0.03	0.62	0.005	0.011
Solid Layer	18.9	3.19E+05	76%	4,789	1.05E-01	3.36E+04	1.03	1.41	0.03	0.62	0.005	0.015

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-AZ-102	362.0	4.40E+06	96%	11,526	7.36E-03	3.24E+04	0.28	0.71	0.09	0.05	0.005	0.036
Supernatant	323.9	3.85E+06	100%	6,360	4.20E-03	1.62E+04	0.28	0.71	0.09	0.05	0.005	0.036
Solid Layer	38.1	5.48E+05	66%	5,166	2.95E-02	1.62E+04	0.28	0.71	0.09	0.05	0.005	0.036
241-SY-101	346.4	5.06E+06	96%	11,219	9.26E-04	4.69E+03	2.27	1.91	0.45	0.99	0.005	0.032
Supernatant	252.0	3.57E+06	100%	4,948	9.17E-04	3.28E+03	2.27	1.91	0.45	0.99	0.005	0.031
Solid Layer	94.4	1.49E+06	87%	6,271	9.48E-04	1.41E+03	2.27	1.91	0.45	0.99	0.005	0.031
241-SY-102	375.4	4.94E+06	97%	11,790	1.45E-03	7.15E+03	1.56	1.32	0.10	1.42	0.005	0.013
Supernatant	349.6	4.56E+06	100%	6,865	1.49E-03	6.77E+03	1.56	1.32	0.10	1.42	0.005	0.013
Solid Layer	25.8	3.87E+05	59%	4,925	9.80E-04	3.80E+02	1.56	1.32	0.10	1.42	0.005	0.013
241-SY-103	264.4	4.22E+06	87%	9,609	1.43E-03	6.05E+03	2.71	3.31	0.42	2.56	0.005	0.027
Supernatant	148.0	2.27E+06	100%	2,906	1.50E-03	3.41E+03	2.71	3.31	0.42	2.56	0.005	0.028
Solid Layer	116.4	1.95E+06	71%	6,703	1.35E-03	2.64E+03	2.71	3.31	0.42	2.56	0.005	0.028
241-A-101	242.2	4.04E+06	80%	9,173	1.27E-03	5.14E+03	3.77	3.59	0.25	3.47	0.005	0.036
Supernatant	98.0	1.52E+06	100%	6,343	1.19E-03	1.81E+03	3.77	3.59	0.25	3.47	0.005	0.036
Solid Layer	144.2	2.52E+06	69%	2,830	1.36E-03	3.44E+03	3.77	3.59	0.25	3.47	0.005	0.036
241-A-102	14.0	2.43E+05	64%	4,693	3.18E-03	7.72E+02	2.08	0.04	0.80	2.61	0.005	0.027
Supernatant	0.7	1.10E+04	100%	13	1.61E-03	1.77E+01	2.08	0.04	0.80	2.61	0.005	0.027
Solid Layer	13.3	2.32E+05	62%	4,680	3.25E-03	7.54E+02	2.08	0.04	0.80	2.61	0.005	0.027
241-A-103	134.8	1.93E+06	59%	7,064	1.18E-03	2.29E+03	3.09	2.08	0.54	4.02	0.005	0.042
Supernatant	1.6	2.47E+04	100%	32	9.05E-04	2.23E+01	3.09	2.08	0.54	4.01	0.005	0.042
Solid Layer	133.1	1.91E+06	59%	7,032	1.19E-03	2.27E+03	3.09	2.08	0.54	4.01	0.005	0.042
241-A-104	10.2	1.74E+05	59%	4,618	9.74E-02	1.69E+04	1.28	0.78	0.26	0.42	0.005	0.064
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	10.2	1.74E+05	59%	4,618	9.74E-02	1.69E+04	1.28	0.78	0.26	0.42	0.005	0.064

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Supernatant	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Solid Layer	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	28.7	4.63E+05	59%	4,981	8.32E-03	3.86E+03	1.28	0.78	0.94	0.42	0.005	0.085
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	28.7	4.63E+05	59%	4,981	8.32E-03	3.86E+03	1.28	0.78	0.94	0.42	0.005	0.085
241-AX-101	243.2	4.08E+06	86%	9,192	1.28E-03	5.21E+03	4.39	3.75	0.26	3.29	0.005	0.026
Supernatant	112.8	1.80E+06	100%	2,215	1.13E-03	2.04E+03	4.39	3.75	0.26	3.29	0.005	0.026
Solid Layer	130.4	2.28E+06	74%	6,977	1.39E-03	3.18E+03	4.39	3.75	0.26	3.29	0.005	0.026
241-AX-102	10.9	1.74E+05	66%	4,633	1.00E-02	1.75E+03	2.83	2.33	1.65	1.98	0.005	0.031
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	10.9	1.74E+05	66%	4,633	1.00E-02	1.75E+03	2.83	2.33	1.65	1.98	0.005	0.031
241-AX-103	39.3	6.65E+05	85%	5,190	5.67E-03	3.77E+03	2.19	2.33	1.47	2.24	0.005	0.073
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	39.3	6.65E+05	85%	5,190	5.67E-03	3.77E+03	2.19	2.33	1.47	2.24	0.005	0.073
241-AX-104	2.7	5.04E+04	9%	4,471	2.98E-01	1.50E+04	1.28	0.78	0.26	0.42	0.005	0.011
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	2.7	5.04E+04	9%	4,471	2.98E-01	1.50E+04	1.28	0.78	0.26	0.42	0.005	0.011
241-B-101	39.4	6.12E+05	59%	5,192	1.05E-02	6.45E+03	5.74	2.86	0.00	0.10	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	39.4	6.12E+05	59%	5,192	1.05E-02	6.45E+03	5.74	2.86	0.00	0.10	0.005	0.005
241-B-102	11.6	1.89E+05	42%	4,646	1.02E-04	1.92E+01	2.81	0.40	0.00	0.06	0.005	0.005
Supernatant	1.4	1.79E+04	100%	28	1.49E-04	2.66E+00	2.81	0.40	0.00	0.06	0.005	0.005
Solid Layer	10.2	1.71E+05	36%	4,618	9.66E-05	1.65E+01	2.80	0.40	0.00	0.06	0.005	0.005

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-B-103	20.2	3.40E+05	88%	4,815	1.02E-04	3.48E+01	2.81	0.40	0.00	0.06	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	20.2	3.40E+05	88%	4,815	1.02E-04	3.48E+01	2.81	0.40	0.00	0.06	0.005	0.005
241-B-104	135.9	1.92E+06	89%	7,087	3.48E-04	6.68E+02	2.81	0.40	0.00	0.06	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	135.9	1.92E+06	89%	7,087	3.48E-04	6.68E+02	2.81	0.40	0.00	0.06	0.005	0.005
241-B-105	105.3	1.84E+06	23%	6,486	1.04E-04	1.90E+02	2.82	0.40	0.00	0.06	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	105.3	1.84E+06	23%	6,486	1.04E-04	1.90E+02	2.82	0.40	0.00	0.06	0.005	0.005
241-B-106	44.1	6.35E+05	89%	5,284	4.25E-04	2.70E+02	2.81	0.40	0.00	0.06	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	44.1	6.35E+05	89%	5,284	4.25E-04	2.70E+02	2.81	0.40	0.00	0.06	0.005	0.005
241-B-107	58.6	9.94E+05	63%	5,569	9.29E-04	9.23E+02	5.34	0.14	0.00	0.00	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	58.6	9.94E+05	63%	5,569	9.29E-04	9.23E+02	5.34	0.14	0.00	0.00	0.005	0.005
241-B-108	33.5	5.84E+05	39%	5,075	8.79E-05	5.14E+01	6.08	1.17	0.00	0.07	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	33.5	5.84E+05	39%	5,075	8.79E-05	5.14E+01	6.08	1.17	0.00	0.07	0.005	0.005
241-B-109	45.4	8.37E+05	72%	5,309	3.16E-03	2.64E+03	2.82	0.39	0.00	0.06	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	45.4	8.37E+05	72%	5,309	3.16E-03	2.64E+03	2.82	0.39	0.00	0.06	0.005	0.005
241-B-110	88.7	1.26E+06	58%	6,160	6.15E-04	7.74E+02	0.16	0.02	0.00	0.00	0.023	0.023
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	88.7	1.26E+06	58%	6,160	6.15E-04	7.74E+02	0.16	0.02	0.00	0.00	0.023	0.023

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-B-111	87.3	1.08E+06	54%	6,132	2.01E-03	2.18E+03	0.16	0.02	0.00	0.00	0.023	0.023
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	87.3	1.08E+06	54%	6,132	2.01E-03	2.18E+03	0.16	0.02	0.00	0.00	0.023	0.023
241-B-112	12.7	1.88E+05	61%	4,666	4.97E-04	9.37E+01	2.80	2.16	0.93	4.28	0.005	0.015
Supernatant	1.1	1.11E+04	100%	21	0.00E+00	0.00E+00	0.16	0.02	0.00	0.00	0.024	0.024
Solid Layer	11.6	1.77E+05	59%	4,646	5.28E-04	9.37E+01	2.80	2.16	0.64	0.00	0.005	0.012
241-B-201	155.0	1.45E+05	59%	1,126	1.30E-05	1.89E+00	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	155.0	1.45E+05	59%	1,126	1.30E-05	1.89E+00	1.28	0.78	0.26	0.42	0.005	0.008
241-B-202	149.6	1.35E+05	81%	1,098	2.20E-05	2.98E+00	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	149.6	1.35E+05	81%	1,098	2.20E-05	2.98E+00	1.28	0.78	0.26	0.42	0.005	0.008
241-B-203	260.1	2.30E+05	85%	1,676	1.02E-05	2.34E+00	0.91	0.03	0.01	0.00	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	260.1	2.30E+05	85%	1,676	1.02E-05	2.34E+00	0.91	0.03	0.01	0.00	0.005	0.005
241-B-204	254.7	2.25E+05	50%	1,648	9.47E-06	2.13E+00	0.56	0.03	0.00	0.00	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	254.7	2.25E+05	50%	1,648	9.47E-06	2.13E+00	0.56	0.03	0.00	0.00	0.005	0.005
241-BX-101	17.3	2.98E+05	25%	4,757	6.52E-03	1.94E+03	1.95	1.40	0.39	na	0.005	0.011
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	17.3	2.98E+05	25%	4,757	6.52E-03	1.94E+03	1.95	1.40	0.39	na	0.005	0.011
241-BX-102	40.7	5.43E+05	59%	5,216	4.33E-03	2.35E+03	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	40.7	5.43E+05	59%	5,216	4.33E-03	2.35E+03	1.28	0.78	0.26	0.42	0.005	0.008

Author [illegible] Date 6/13/03 Check by [illegible] Date 6/13/02

Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-BX-103	26.6	4.33E+05	66%	4,940	3.79E-03	1.64E+03	0.86	0.36	0.39	1.93	0.005	0.010
Supernatant	4.0	4.66E+04	100%	79	2.82E-05	1.31E+00	0.86	0.36	0.39	1.93	0.005	0.010
Solid Layer	22.5	3.86E+05	62%	4,860	4.23E-03	1.64E+03	0.86	0.36	0.39	1.93	0.005	0.010
241-BX-104	36.4	6.32E+05	60%	5,132	1.68E-03	1.06E+03	2.16	1.39	0.25	0.22	0.005	0.011
Supernatant	1.1	1.41E+04	100%	21	5.00E-04	7.04E+00	2.16	1.39	0.25	0.22	0.005	0.011
Solid Layer	35.3	6.18E+05	59%	5,111	1.71E-03	1.06E+03	2.16	1.39	0.25	0.22	0.005	0.011
241-BX-105	26.0	4.38E+05	22%	4,928	1.03E-03	4.49E+02	1.89	1.70	0.73	0.46	0.005	0.014
Supernatant	1.7	2.32E+04	100%	34	5.11E-04	1.19E+01	1.89	1.70	0.73	0.46	0.005	0.014
Solid Layer	24.3	4.14E+05	17%	4,894	1.05E-03	4.37E+02	1.89	1.70	0.73	0.46	0.005	0.014
241-BX-106	13.6	2.40E+05	52%	4,685	1.19E-03	2.85E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	13.6	2.40E+05	52%	4,685	1.19E-03	2.85E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-107	125.9	1.89E+06	68%	6,891	1.22E-04	2.31E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	125.9	1.89E+06	68%	6,891	1.22E-04	2.31E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-108	11.4	1.76E+05	38%	4,642	1.22E-03	2.15E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	11.4	1.76E+05	38%	4,642	1.22E-03	2.15E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-109	70.1	1.11E+06	71%	5,795	8.25E-04	9.17E+02	1.28	0.78	0.26	0.42	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	70.1	1.11E+06	71%	5,795	8.25E-04	9.17E+02	1.28	0.78	0.26	0.42	0.005	0.009
241-BX-110	74.4	1.34E+06	74%	5,879	3.39E-04	4.56E+02	6.65	1.13	0.64	0.31	0.005	0.013
Supernatant	0.5	7.20E+03	100%	9	4.64E-04	3.34E+00	6.65	1.13	0.64	0.31	0.005	0.013
Solid Layer	74.0	1.34E+06	74%	5,870	3.39E-04	4.52E+02	6.66	1.13	0.64	0.31	0.005	0.013

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-BX-111	68.5	1.03E+06	8%	5,763	4.55E-04	4.69E+02	2.99	2.31	0.12	3.36	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	68.5	1.03E+06	8%	5,763	4.55E-04	4.69E+02	2.99	2.31	0.12	3.36	0.005	0.006
241-BX-112	59.7	8.14E+05	83%	5,589	2.48E-04	2.02E+02	1.59	0.77	0.00	0.00	0.005	0.005
Supernatant	0.5	5.90E+03	100%	9	3.11E-04	1.84E+00	1.59	0.77	0.00	0.00	0.005	0.005
Solid Layer	59.2	8.08E+05	83%	5,580	2.47E-04	2.00E+02	1.59	0.77	0.00	0.00	0.005	0.005
241-BY-101	134.3	2.53E+06	32%	7,055	1.25E-03	3.15E+03	2.82	2.16	0.64	2.96	0.005	0.017
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	134.3	2.53E+06	32%	7,055	1.25E-03	3.15E+03	2.82	2.16	0.64	2.96	0.005	0.017
241-BY-102	100.5	1.65E+06	31%	6,392	4.55E-04	7.49E+02	2.82	1.73	0.13	3.53	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	100.5	1.65E+06	31%	6,392	4.55E-04	7.49E+02	2.82	1.73	0.13	3.53	0.005	0.007
241-BY-103	151.1	2.58E+06	39%	7,384	6.48E-04	1.67E+03	2.73	1.17	0.15	3.21	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	151.1	2.58E+06	39%	7,384	6.48E-04	1.67E+03	2.73	1.17	0.15	3.21	0.005	0.008
241-BY-104	130.1	2.31E+06	29%	6,972	1.47E-03	3.39E+03	3.03	2.33	0.16	4.95	0.005	0.016
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	130.1	2.31E+06	29%	6,972	1.47E-03	3.39E+03	3.03	2.33	0.16	4.95	0.005	0.016
241-BY-105	182.5	3.36E+06	33%	8,002	5.86E-04	1.97E+03	3.22	1.49	0.17	2.71	0.005	0.013
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	182.5	3.36E+06	33%	8,002	5.86E-04	1.97E+03	3.22	1.49	0.17	2.71	0.005	0.013
241-BY-106	203.7	3.39E+06	43%	8,418	8.61E-04	2.92E+03	1.78	1.70	0.20	3.04	0.005	0.018
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	203.7	3.39E+06	43%	8,418	8.61E-04	2.92E+03	1.78	1.70	0.20	3.04	0.005	0.018

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-BY-107	98.6	1.73E+06	53%	6,354	8.93E-04	1.55E+03	2.12	2.55	0.16	na	0.005	0.011
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	98.6	1.73E+06	53%	6,354	8.93E-04	1.55E+03	2.12	2.55	0.16	na	0.005	0.011
241-BY-108	80.7	1.25E+06	54%	6,002	9.58E-04	1.20E+03	4.74	1.71	0.18	2.73	0.005	0.014
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	80.7	1.25E+06	54%	6,002	9.58E-04	1.20E+03	4.74	1.71	0.18	2.73	0.005	0.014
241-BY-109	100.4	1.79E+06	33%	6,390	1.17E-03	2.08E+03	3.07	1.80	0.13	2.58	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	100.4	1.79E+06	33%	6,390	1.17E-03	2.08E+03	3.07	1.80	0.13	2.58	0.005	0.006
241-BY-110	132.8	2.17E+06	26%	7,025	9.68E-04	2.10E+03	2.00	2.69	0.82	4.56	0.005	0.048
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	132.8	2.17E+06	26%	7,025	9.68E-04	2.10E+03	2.00	2.69	0.82	4.56	0.005	0.048
241-BY-111	109.7	1.93E+06	12%	6,573	4.16E-04	8.01E+02	1.96	0.72	0.09	1.81	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	109.7	1.93E+06	12%	6,573	4.16E-04	8.01E+02	1.96	0.72	0.09	1.81	0.005	0.007
241-BY-112	103.9	1.89E+06	12%	6,458	4.49E-04	8.47E+02	3.07	3.05	0.12	3.77	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	103.9	1.89E+06	12%	6,458	4.49E-04	8.47E+02	3.07	3.05	0.12	3.77	0.005	0.008
241-C-101	31.9	4.99E+05	38%	5,045	4.18E-03	2.08E+03	1.28	0.78	0.26	0.42	0.005	0.011
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	31.9	4.99E+05	38%	5,045	4.18E-03	2.08E+03	1.28	0.78	0.26	0.42	0.005	0.011
241-C-102	114.7	1.99E+06	38%	6,670	2.07E-03	4.11E+03	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	114.7	1.99E+06	38%	6,670	2.07E-03	4.11E+03	1.28	0.78	0.26	0.42	0.005	0.010

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-C-103	71.9	1.01E+06	76%	5,830	2.05E-02	2.08E+04	0.03	0.43	0.60	0.00	0.005	0.038
Supernatant	26.5	3.06E+05	100%	520	7.39E-04	2.26E+02	0.03	0.43	0.60	0.00	0.005	0.038
Solid Layer	45.5	7.06E+05	66%	5,311	2.91E-02	2.05E+04	0.03	0.43	0.60	0.00	0.005	0.038
241-C-104	94.0	1.66E+06	65%	6,264	2.23E-03	3.69E+03	1.28	0.78	0.48	0.42	0.005	0.020
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	94.0	1.66E+06	65%	6,264	2.23E-03	3.69E+03	1.28	0.78	0.48	0.42	0.005	0.020
241-C-105	48.0	7.75E+05	37%	5,360	4.60E-03	3.57E+03	0.55	0.80	0.23	0.00	0.005	0.017
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	48.0	7.75E+05	37%	5,360	4.60E-03	3.57E+03	0.55	0.80	0.23	0.00	0.005	0.017
241-C-106	13.2	1.65E+05	87%	4,678	1.19E-02	1.97E+03	0.01	0.27	0.28	0.18	0.054	0.060
Supernatant	11.0	1.30E+05	100%	217	2.42E-04	3.14E+01	0.01	0.27	0.28	0.18	0.054	0.060
Solid Layer	2.2	3.50E+04	38%	4,461	5.55E-02	1.94E+03	0.01	0.27	0.28	0.18	0.054	0.060
241-C-107	90.2	1.32E+06	46%	6,188	9.97E-03	1.32E+04	1.28	0.78	0.26	0.42	0.005	0.021
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	90.2	1.32E+06	46%	6,188	9.97E-03	1.32E+04	1.28	0.78	0.26	0.42	0.005	0.021
241-C-108	24.0	3.63E+05	58%	4,889	1.22E-03	4.42E+02	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	24.0	3.63E+05	58%	4,889	1.22E-03	4.42E+02	1.28	0.78	0.26	0.42	0.005	0.010
241-C-109	23.0	3.46E+05	59%	4,870	7.19E-03	2.49E+03	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	23.0	3.46E+05	59%	4,870	7.19E-03	2.49E+03	1.28	0.78	0.26	0.42	0.005	0.010
241-C-110	64.3	8.98E+05	59%	5,680	1.04E-04	9.30E+01	0.97	0.10	0.05	0.02	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	64.3	8.98E+05	59%	5,680	1.04E-04	9.30E+01	0.97	0.10	0.05	0.02	0.005	0.006

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-C-111	20.8	3.12E+05	32%	4,827	1.94E-02	6.05E+03	1.28	0.78	0.26	0.42	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	20.8	3.12E+05	32%	4,827	1.94E-02	6.05E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-C-112	37.7	6.29E+05	59%	5,158	9.05E-03	5.69E+03	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	37.7	6.29E+05	59%	5,158	9.05E-03	5.69E+03	1.28	0.78	0.26	0.42	0.005	0.010
241-C-201	5.4	6.00E+03	59%	342	5.23E-04	3.14E+00	1.28	0.78	0.26	0.42	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	5.4	6.00E+03	59%	342	5.23E-04	3.14E+00	1.28	0.78	0.26	0.42	0.005	0.007
241-C-202	5.4	6.00E+03	8%	342	5.45E-04	3.27E+00	1.28	0.78	0.26	0.42	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	5.4	6.00E+03	8%	342	5.45E-04	3.27E+00	1.28	0.78	0.26	0.42	0.005	0.007
241-C-203	13.5	1.50E+04	52%	385	4.17E-04	6.25E+00	1.28	0.78	0.26	0.42	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	13.5	1.50E+04	52%	385	4.17E-04	6.25E+00	1.28	0.78	0.26	0.42	0.005	0.007
241-C-204	13.5	1.50E+04	59%	385	2.69E-04	4.04E+00	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	13.5	1.50E+04	59%	385	2.69E-04	4.04E+00	1.28	0.78	0.26	0.42	0.005	0.008
241-S-101	154.1	2.61E+06	63%	7,443	2.18E-03	5.69E+03	3.45	2.45	0.12	2.03	0.005	0.012
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	154.1	2.61E+06	63%	7,443	2.18E-03	5.69E+03	3.45	2.45	0.12	2.03	0.005	0.012
241-S-102	119.8	1.98E+06	54%	6,770	9.23E-04	1.83E+03	2.43	2.42	0.31	3.01	0.005	0.016
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	119.8	1.98E+06	54%	6,770	9.23E-04	1.83E+03	2.43	2.42	0.31	3.01	0.005	0.016

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-S-103	86.0	1.42E+06	64%	6,107	9.16E-04	1.30E+03	3.48	3.20	0.32	2.21	0.005	0.012
Supernatant	0.4	5.80E+03	100%	8	1.14E-03	6.59E+00	3.48	3.20	0.32	2.21	0.005	0.012
Solid Layer	85.7	1.42E+06	64%	6,100	9.15E-04	1.30E+03	3.49	3.19	0.32	2.21	0.005	0.012
241-S-104	104.6	1.80E+06	68%	6,471	1.80E-03	3.25E+03	4.33	0.83	0.03	0.88	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	104.6	1.80E+06	68%	6,471	1.80E-03	3.25E+03	4.33	0.83	0.03	0.88	0.005	0.006
241-S-105	147.3	2.53E+06	20%	7,311	6.71E-04	1.70E+03	2.02	2.12	0.83	2.57	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	147.3	2.53E+06	20%	7,311	6.71E-04	1.70E+03	2.02	2.12	0.83	2.57	0.005	0.019
241-S-106	165.3	2.97E+06	59%	7,663	5.51E-04	1.64E+03	3.81	2.26	0.14	2.66	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	165.3	2.97E+06	59%	7,663	5.51E-04	1.64E+03	3.81	2.26	0.14	2.66	0.005	0.007
241-S-107	136.5	2.51E+06	51%	7,098	1.27E-03	3.18E+03	1.84	1.55	0.09	0.82	0.005	0.009
Supernatant	5.1	6.94E+04	100%	100	4.48E-04	3.11E+01	1.84	1.55	0.09	0.82	0.005	0.009
Solid Layer	131.4	2.44E+06	50%	6,998	1.29E-03	3.15E+03	1.85	1.55	0.09	0.82	0.005	0.009
241-S-108	199.7	3.44E+06	3%	8,339	6.63E-04	2.28E+03	2.02	2.11	0.83	2.57	0.005	0.021
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	199.7	3.44E+06	3%	8,339	6.63E-04	2.28E+03	2.02	2.11	0.83	2.57	0.005	0.021
241-S-109	193.5	3.34E+06	18%	8,217	1.89E-04	6.30E+02	2.12	1.85	0.07	3.08	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	193.5	3.34E+06	18%	8,217	1.89E-04	6.30E+02	2.12	1.85	0.07	3.08	0.005	0.007
241-S-110	141.3	2.44E+06	32%	7,192	1.02E-03	2.50E+03	3.51	1.87	0.16	2.16	0.005	0.013
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	141.3	2.44E+06	32%	7,192	1.02E-03	2.50E+03	3.51	1.87	0.16	2.16	0.005	0.013

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-S-111	169.4	2.71E+06	60%	7,744	1.82E-03	4.93E+03	3.10	1.81	0.10	2.51	0.005	0.008
Supernatant	17.3	2.61E+05	100%	339	1.05E-03	2.74E+02	3.10	1.81	0.10	2.51	0.005	0.008
Solid Layer	152.1	2.45E+06	56%	7,405	1.90E-03	4.66E+03	3.10	1.81	0.10	2.51	0.005	0.008
241-S-112	187.1	3.21E+06	63%	8,091	7.04E-04	2.26E+03	2.02	2.11	0.83	2.57	0.005	0.032
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	187.1	3.21E+06	63%	8,091	7.04E-04	2.26E+03	2.02	2.11	0.83	2.57	0.005	0.032
241-SX-101	154.6	2.67E+06	64%	7,454	2.22E-03	5.91E+03	1.74	1.63	0.02	5.41	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	154.6	2.67E+06	64%	7,454	2.22E-03	5.91E+03	1.74	1.63	0.02	5.41	0.005	0.007
241-SX-102	183.7	3.18E+06	81%	8,025	1.30E-03	4.13E+03	2.54	3.28	0.10	3.12	0.005	0.016
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	183.7	3.18E+06	81%	8,025	1.30E-03	4.13E+03	2.54	3.28	0.10	3.12	0.005	0.016
241-SX-103	184.8	3.31E+06	66%	8,047	1.43E-03	4.74E+03	2.53	3.42	0.23	3.00	0.005	0.045
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	184.8	3.31E+06	66%	8,047	1.43E-03	4.74E+03	2.53	3.42	0.23	3.00	0.005	0.045
241-SX-104	161.9	2.83E+06	70%	7,597	1.75E-03	4.96E+03	4.68	2.55	0.14	2.42	0.005	0.021
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	161.9	2.83E+06	70%	7,597	1.75E-03	4.96E+03	4.68	2.55	0.14	2.42	0.005	0.021
241-SX-105	120.7	2.04E+06	82%	6,787	1.13E-03	2.31E+03	2.65	3.11	0.22	2.99	0.005	0.054
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	120.7	2.04E+06	82%	6,787	1.13E-03	2.31E+03	2.65	3.11	0.22	2.99	0.005	0.054
241-SX-106	144.0	2.37E+06	88%	7,245	7.18E-04	1.70E+03	3.95	3.24	0.24	1.75	0.005	0.013
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	144.0	2.37E+06	88%	7,245	7.18E-04	1.70E+03	3.95	3.24	0.24	1.75	0.005	0.013

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-SX-107	34.2	6.19E+05	59%	5,090	3.52E-03	2.18E+03	2.81	2.39	0.01	2.98	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	34.2	6.19E+05	59%	5,090	3.52E-03	2.18E+03	2.81	2.39	0.01	2.98	0.005	0.007
241-SX-108	26.5	4.83E+05	2%	4,938	1.94E-02	9.37E+03	1.28	0.78	0.26	0.42	0.005	0.090
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	26.5	4.83E+05	2%	4,938	1.94E-02	9.37E+03	1.28	0.78	0.26	0.42	0.005	0.090
241-SX-109	87.6	1.58E+06	38%	6,137	2.08E-03	3.29E+03	2.83	2.33	0.66	1.98	0.005	0.070
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	87.6	1.58E+06	38%	6,137	2.08E-03	3.29E+03	2.83	2.33	0.66	1.98	0.005	0.070
241-SX-110	20.3	3.68E+05	59%	4,817	2.75E-03	1.01E+03	1.28	0.78	0.26	0.42	0.005	0.058
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	20.3	3.68E+05	59%	4,817	2.75E-03	1.01E+03	1.28	0.78	0.26	0.42	0.005	0.058
241-SX-111	41.8	7.49E+05	59%	5,239	3.11E-03	2.32E+03	2.81	2.39	0.01	2.98	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	41.8	7.49E+05	59%	5,239	3.11E-03	2.32E+03	2.81	2.39	0.01	2.98	0.005	0.008
241-SX-112	27.1	4.88E+05	59%	4,951	3.31E-03	1.62E+03	2.80	2.39	0.01	2.98	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	27.1	4.88E+05	59%	4,951	3.31E-03	1.62E+03	2.80	2.39	0.01	2.98	0.005	0.006
241-SX-113	6.8	7.53E+04	64%	4,552	8.09E-04	6.09E+01	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	6.8	7.53E+04	64%	4,552	8.09E-04	6.09E+01	1.28	0.78	0.26	0.42	0.005	0.010
241-SX-114	57.0	9.97E+05	59%	5,537	2.11E-03	2.10E+03	2.81	2.39	0.01	2.98	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	57.0	9.97E+05	59%	5,537	2.11E-03	2.10E+03	2.81	2.39	0.01	2.98	0.005	0.007

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-SX-115	1.3	2.45E+04	59%	4,444	9.96E-02	2.44E+03	1.28	0.78	0.26	0.42	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	1.3	2.45E+04	59%	4,444	9.96E-02	2.44E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-T-101	36.1	6.09E+05	64%	5,126	4.74E-04	2.89E+02	2.68	2.09	0.73	2.55	0.005	0.015
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	36.1	6.09E+05	64%	5,126	4.74E-04	2.89E+02	2.68	2.09	0.73	2.55	0.005	0.015
241-T-102	11.6	1.85E+05	71%	4,646	1.01E-03	1.86E+02	1.76	0.50	0.04	0.73	0.005	0.005
Supernatant	4.7	5.59E+04	100%	92	2.36E-04	1.32E+01	1.76	0.50	0.04	0.73	0.005	0.005
Solid Layer	6.9	1.29E+05	59%	4,553	1.34E-03	1.73E+02	1.76	0.50	0.04	0.73	0.005	0.005
241-T-103	9.8	1.65E+05	66%	4,610	5.53E-03	9.13E+02	0.78	0.52	0.10	15.45	0.005	0.006
Supernatant	1.4	1.77E+04	100%	28	3.85E-04	6.83E+00	1.27	0.81	0.00	0.92	0.005	0.005
Solid Layer	8.3	1.47E+05	61%	4,582	6.15E-03	9.06E+02	1.27	0.81	0.00	0.92	0.005	0.005
241-T-104	115.0	1.55E+06	77%	6,676	1.54E-05	2.38E+01	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	115.0	1.55E+06	77%	6,676	1.54E-05	2.38E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-105	35.6	5.42E+05	68%	5,117	7.96E-04	4.31E+02	0.60	1.18	0.25	0.03	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	35.6	5.42E+05	68%	5,117	7.96E-04	4.31E+02	0.60	1.18	0.25	0.03	0.005	0.008
241-T-106	7.9	1.25E+05	23%	4,572	2.52E-04	3.14E+01	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	7.9	1.25E+05	23%	4,572	2.52E-04	3.14E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-107	62.8	9.56E+05	50%	5,652	8.54E-04	8.17E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	62.8	9.56E+05	50%	5,652	8.54E-04	8.17E+02	1.28	0.78	0.26	0.42	0.005	0.008

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-T-108	5.8	8.65E+04	68%	4,531	6.94E-05	6.01E+00	2.81	0.40	0.00	0.04	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	5.8	8.65E+04	68%	4,531	6.94E-05	6.01E+00	2.81	0.40	0.00	0.04	0.005	0.005
241-T-109	22.5	3.42E+05	82%	4,860	3.91E-05	1.34E+01	2.82	0.40	0.00	0.04	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	22.5	3.42E+05	82%	4,860	3.91E-05	1.34E+01	2.82	0.40	0.00	0.04	0.005	0.005
241-T-110	134.0	1.77E+06	87%	7,049	2.49E-04	4.42E+02	0.30	0.00	0.00	0.00	0.030	0.030
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	134.0	1.77E+06	87%	7,049	2.49E-04	4.42E+02	0.30	0.00	0.00	0.00	0.030	0.030
241-T-111	162.3	2.10E+06	81%	7,605	2.99E-05	6.28E+01	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	162.3	2.10E+06	81%	7,605	2.99E-05	6.28E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-112	21.7	2.89E+05	90%	4,844	1.60E-04	4.63E+01	0.38	0.84	0.04	0.00	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	21.7	2.89E+05	90%	4,844	1.60E-04	4.63E+01	0.38	0.84	0.04	0.00	0.005	0.005
241-T-201	148.3	1.44E+05	76%	1,090	5.94E-07	8.58E-02	0.74	0.01	0.00	0.00	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	148.3	1.44E+05	76%	1,090	5.94E-07	8.58E-02	0.74	0.01	0.00	0.00	0.005	0.005
241-T-202	109.2	1.00E+05	101%	886	1.38E-07	1.39E-02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	109.2	1.00E+05	101%	886	1.38E-07	1.39E-02	1.28	0.78	0.26	0.42	0.005	0.008
241-T-203	188.7	1.70E+05	89%	1,302	9.54E-08	1.62E-02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	188.7	1.70E+05	89%	1,302	9.54E-08	1.62E-02	1.28	0.78	0.26	0.42	0.005	0.008

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-T-204	188.7	1.69E+05	101%	1,302	6.21E-08	1.05E-02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	188.7	1.69E+05	101%	1,302	6.21E-08	1.05E-02	1.28	0.78	0.26	0.42	0.005	0.008
241-TX-101	33.0	5.94E+05	59%	5,066	3.17E-03	1.88E+03	2.68	2.09	0.74	2.54	0.005	0.018
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	33.0	5.94E+05	59%	5,066	3.17E-03	1.88E+03	2.68	2.09	0.74	2.54	0.005	0.018
241-TX-102	78.8	1.35E+06	22%	5,964	5.73E-04	7.72E+02	2.68	2.08	0.74	2.55	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	78.8	1.35E+06	22%	5,964	5.73E-04	7.72E+02	2.68	2.08	0.74	2.55	0.005	0.019
241-TX-103	52.6	8.99E+05	32%	5,450	5.55E-04	4.99E+02	2.69	2.02	0.71	2.46	0.005	0.015
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	52.6	8.99E+05	32%	5,450	5.55E-04	4.99E+02	2.69	2.02	0.71	2.46	0.005	0.015
241-TX-104	24.3	4.39E+05	88%	4,894	1.84E-03	8.08E+02	5.72	2.05	0.09	0.22	0.005	0.006
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	24.3	4.39E+05	88%	4,894	1.84E-03	8.08E+02	5.72	2.05	0.09	0.22	0.005	0.006
241-TX-105	209.2	3.62E+06	7%	8,526	5.32E-04	1.93E+03	2.68	2.09	0.73	2.54	0.005	0.028
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	209.2	3.62E+06	7%	8,526	5.32E-04	1.93E+03	2.68	2.09	0.73	2.54	0.005	0.028
241-TX-106	126.4	2.17E+06	28%	6,900	6.04E-04	1.31E+03	2.68	2.09	0.73	2.55	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	126.4	2.17E+06	28%	6,900	6.04E-04	1.31E+03	2.68	2.09	0.73	2.55	0.005	0.019
241-TX-107	10.7	1.82E+05	44%	4,629	9.11E-04	1.66E+02	2.71	2.17	0.53	2.67	0.005	0.013
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	10.7	1.82E+05	44%	4,629	9.11E-04	1.66E+02	2.71	2.17	0.53	2.67	0.005	0.013

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-TX-108	46.9	8.07E+05	16%	5,339	5.63E-04	4.55E+02	2.68	2.09	0.73	2.55	0.005	0.014
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	46.9	8.07E+05	16%	5,339	5.63E-04	4.55E+02	2.68	2.09	0.73	2.55	0.005	0.014
241-TX-109	131.9	1.94E+06	53%	7,008	1.30E-04	2.52E+02	1.28	0.78	0.26	0.42	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	131.9	1.94E+06	53%	7,008	1.30E-04	2.52E+02	1.28	0.78	0.26	0.42	0.005	0.009
241-TX-110	169.5	2.91E+06	9%	7,746	4.96E-04	1.44E+03	2.68	2.09	0.73	2.54	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	169.5	2.91E+06	9%	7,746	4.96E-04	1.44E+03	2.68	2.09	0.73	2.54	0.005	0.019
241-TX-111	132.7	2.26E+06	11%	7,023	4.80E-04	1.09E+03	2.68	2.09	0.73	2.54	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	132.7	2.26E+06	11%	7,023	4.80E-04	1.09E+03	2.68	2.09	0.73	2.54	0.005	0.019
241-TX-112	230.0	3.97E+06	15%	8,934	5.14E-04	2.04E+03	2.69	1.86	0.65	2.26	0.005	0.014
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	230.0	3.97E+06	15%	8,934	5.14E-04	2.04E+03	2.69	1.86	0.65	2.26	0.005	0.014
241-TX-113	231.8	3.94E+06	11%	8,968	5.14E-05	2.03E+02	2.68	2.09	0.74	2.54	0.005	0.016
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	231.8	3.94E+06	11%	8,968	5.14E-05	2.03E+02	2.68	2.09	0.74	2.54	0.005	0.016
241-TX-114	193.3	3.31E+06	9%	8,213	4.72E-04	1.56E+03	2.76	1.04	0.32	1.12	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	193.3	3.31E+06	9%	8,213	4.72E-04	1.56E+03	2.76	1.04	0.32	1.12	0.005	0.009
241-TX-115	201.1	3.47E+06	9%	8,366	5.43E-04	1.89E+03	2.68	2.09	0.73	2.54	0.005	0.015
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	201.1	3.47E+06	9%	8,366	5.43E-04	1.89E+03	2.68	2.09	0.73	2.54	0.005	0.015

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-TX-116	216.4	3.54E+06	13%	8,667	1.57E-04	5.58E+02	4.98	0.71	0.00	0.07	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	216.4	3.54E+06	13%	8,667	1.57E-04	5.58E+02	4.98	0.71	0.00	0.07	0.005	0.005
241-TX-117	174.5	2.87E+06	8%	7,844	3.21E-04	9.22E+02	2.81	0.40	0.00	0.04	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	174.5	2.87E+06	8%	7,844	3.21E-04	9.22E+02	2.81	0.40	0.00	0.04	0.005	0.005
241-TX-118	92.9	1.63E+06	32%	6,241	9.39E-04	1.53E+03	2.68	2.10	0.73	2.54	0.005	0.016
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	92.9	1.63E+06	32%	6,241	9.39E-04	1.53E+03	2.68	2.10	0.73	2.54	0.005	0.016
241-TY-101	42.9	7.32E+05	14%	5,260	5.91E-05	4.33E+01	2.81	0.40	0.00	0.04	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	42.9	7.32E+05	14%	5,260	5.91E-05	4.33E+01	2.81	0.40	0.00	0.04	0.005	0.005
241-TY-102	25.0	4.54E+05	63%	4,909	1.58E-04	7.16E+01	2.73	1.35	0.45	1.57	0.005	0.009
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	25.0	4.54E+05	63%	4,909	1.58E-04	7.16E+01	2.73	1.35	0.45	1.57	0.005	0.009
241-TY-103	56.3	9.89E+05	51%	5,523	6.16E-04	6.09E+02	2.68	2.09	0.73	2.54	0.005	0.022
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	56.3	9.89E+05	51%	5,523	6.16E-04	6.09E+02	2.68	2.09	0.73	2.54	0.005	0.022
241-TY-104	16.0	2.80E+05	70%	4,732	7.53E-04	2.11E+02	1.60	0.25	0.18	0.05	0.005	0.007
Supernatant	0.4	4.72E+03	100%	8	4.96E-05	2.34E-01	1.60	0.25	0.18	0.05	0.005	0.007
Solid Layer	15.6	2.75E+05	69%	4,725	7.65E-04	2.11E+02	1.60	0.25	0.18	0.05	0.005	0.007
241-TY-105	83.8	1.34E+06	44%	6,064	1.10E-03	1.47E+03	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	83.8	1.34E+06	44%	6,064	1.10E-03	1.47E+03	1.28	0.78	0.26	0.42	0.005	0.010

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-TY-106	5.9	8.49E+04	46%	4,535	7.04E-04	5.98E+01	1.28	0.78	0.26	0.42	0.005	0.007
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	5.9	8.49E+04	46%	4,535	7.04E-04	5.98E+01	1.28	0.78	0.26	0.42	0.005	0.007
241-U-101	8.5	1.56E+05	39%	4,586	3.65E-03	5.68E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	8.5	1.56E+05	39%	4,586	3.65E-03	5.68E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-U-102	106.4	1.86E+06	75%	6,507	1.42E-03	2.65E+03	3.20	3.18	0.76	2.24	0.005	0.023
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	106.4	1.86E+06	75%	6,507	1.42E-03	2.65E+03	3.20	3.18	0.76	2.24	0.005	0.023
241-U-103	135.1	2.40E+06	79%	7,070	7.53E-04	1.80E+03	2.45	2.98	0.86	2.84	0.005	0.026
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	135.1	2.40E+06	79%	7,070	7.53E-04	1.80E+03	2.45	2.98	0.86	2.84	0.005	0.026
241-U-104	44.3	6.35E+05	64%	5,288	1.62E-03	1.03E+03	3.34	2.29	0.68	2.29	0.005	0.019
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	44.3	6.35E+05	64%	5,288	1.62E-03	1.03E+03	3.34	2.29	0.68	2.29	0.005	0.019
241-U-105	128.2	2.23E+06	46%	6,934	7.52E-04	1.68E+03	2.92	2.35	1.12	2.04	0.005	0.033
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	128.2	2.23E+06	46%	6,934	7.52E-04	1.68E+03	2.92	2.35	1.12	2.04	0.005	0.033
241-U-106	61.8	9.97E+05	83%	5,631	1.17E-03	1.16E+03	4.01	2.15	3.20	0.90	0.005	0.068
Supernatant	0.6	8.04E+03	100%	11	1.36E-03	1.09E+01	4.01	2.15	3.20	0.90	0.005	0.068
Solid Layer	61.2	9.89E+05	83%	5,620	1.17E-03	1.15E+03	4.01	2.15	3.19	0.90	0.005	0.068
241-U-107	136.2	2.38E+06	55%	7,092	4.56E-04	1.08E+03	3.40	2.53	0.29	2.00	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	136.2	2.38E+06	55%	7,092	4.56E-04	1.08E+03	3.40	2.53	0.29	2.00	0.005	0.010

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-U-108	161.2	2.77E+06	71%	7,584	7.41E-04	2.05E+03	2.97	2.91	0.51	2.18	0.005	0.017
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	161.2	2.77E+06	71%	7,584	7.41E-04	2.05E+03	2.97	2.91	0.51	2.18	0.005	0.017
241-U-109	103.5	1.79E+06	52%	6,450	6.16E-04	1.10E+03	2.99	2.79	0.44	1.99	0.005	0.015
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	103.5	1.79E+06	52%	6,450	6.16E-04	1.10E+03	2.99	2.79	0.44	1.99	0.005	0.015
241-U-110	63.8	1.10E+06	45%	5,670	1.29E-03	1.42E+03	1.28	0.78	0.26	0.42	0.005	0.010
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	63.8	1.10E+06	45%	5,670	1.29E-03	1.42E+03	1.28	0.78	0.26	0.42	0.005	0.010
241-U-111	123.5	2.01E+06	63%	6,844	9.17E-04	1.84E+03	2.68	2.61	0.39	2.62	0.005	0.012
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	123.5	2.01E+06	63%	6,844	9.17E-04	1.84E+03	2.68	2.61	0.39	2.62	0.005	0.012
241-U-112	16.5	2.99E+05	34%	4,742	1.71E-03	5.10E+02	1.28	0.78	0.26	0.42	0.005	0.008
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	16.5	2.99E+05	34%	4,742	1.71E-03	5.10E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-U-201	20.2	2.43E+04	38%	420	2.18E-04	5.31E+00	1.15	1.87	0.00	3.38	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	20.2	2.43E+04	38%	420	2.18E-04	5.31E+00	1.15	1.87	0.00	3.38	0.005	0.005
241-U-202	17.5	2.11E+04	40%	406	2.16E-04	4.55E+00	1.04	1.71	0.00	3.07	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	17.5	2.11E+04	40%	406	2.16E-04	4.55E+00	1.04	1.71	0.00	3.07	0.005	0.005
241-U-203	17.5	2.11E+04	57%	406	1.79E-04	3.77E+00	1.16	1.90	0.00	3.42	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	17.5	2.11E+04	57%	406	1.79E-04	3.77E+00	1.16	1.90	0.00	3.42	0.005	0.005

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Table B-2. Derived Data for Hydrogen Generation Rate Model Calculations for 177 Tanks. (23 Sheets)

Tank	Waste level D_w (inch)	Total mass M (kg)	Liquid in waste (wt%)	Wetted area A_{wet} (ft^2)	Heat load per kg H_L (watt/kg)	Tank heat load H_L (watt)	NO_3 in liquid $[NO_3]_M$ (mole/L)	NO_2 in liquid $[NO_2]_M$ (mole/L)	TOC in liquid $[TOC]_{\%}$ (wt%)	Al in liquid $[Al]_{\%}$ (wt%)	G values for water G_{H2O} (H_2/100eV)	Total G values G_{TOT} (H_2/100eV)
241-U-204	14.8	1.78E+04	30%	392	2.21E-04	3.94E+00	0.51	0.84	0.01	0.05	0.005	0.005
Supernatant	na	na	na	na	na	na	na	na	na	na	na	na
Solid Layer	14.8	1.78E+04	30%	392	2.21E-04	3.94E+00	0.51	0.84	0.01	0.05	0.005	0.005

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AN-101	2.86E-08	3.99E-08	5.57E-07	6.25E-07	3.87E-10	5.41E-10	7.54E-09	8.47E-09
Supernatant	2.86E-08	3.99E-08	5.57E-07	6.25E-07	3.87E-10	5.41E-10	7.54E-09	8.47E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AN-102	1.18E-06	2.03E-06	2.08E-07	3.42E-06	1.97E-08	3.38E-08	3.47E-09	5.70E-08
Supernatant	1.15E-06	2.06E-06	1.32E-07	3.34E-06	1.90E-08	3.40E-08	2.18E-09	5.52E-08
Solid Layer	1.55E-06	1.73E-06	9.63E-07	4.25E-06	2.81E-08	3.12E-08	1.74E-08	7.67E-08
241-AN-103	2.30E-07	4.85E-07	2.00E-07	9.15E-07	4.22E-09	8.91E-09	3.68E-09	1.68E-08
Supernatant	3.25E-07	5.80E-07	1.27E-07	1.03E-06	5.57E-09	9.94E-09	2.18E-09	1.77E-08
Solid Layer	1.29E-07	3.85E-07	2.78E-07	7.91E-07	2.57E-09	7.66E-09	5.53E-09	1.57E-08
241-AN-104	3.23E-07	8.56E-07	2.05E-07	1.38E-06	5.56E-09	1.47E-08	3.53E-09	2.38E-08
Supernatant	3.45E-07	8.99E-07	1.35E-07	1.38E-06	5.58E-09	1.46E-08	2.18E-09	2.23E-08
Solid Layer	3.00E-07	8.09E-07	2.79E-07	1.39E-06	5.53E-09	1.49E-08	5.13E-09	2.56E-08
241-AN-105	1.96E-07	7.17E-07	1.96E-07	1.11E-06	3.42E-09	1.25E-08	3.41E-09	1.93E-08
Supernatant	1.96E-07	7.58E-07	1.33E-07	1.09E-06	3.22E-09	1.25E-08	2.18E-09	1.79E-08
Solid Layer	1.96E-07	6.68E-07	2.71E-07	1.14E-06	3.68E-09	1.25E-08	5.07E-09	2.13E-08
241-AN-106	5.73E-08	5.45E-08	2.42E-06	2.53E-06	9.01E-10	8.57E-10	3.80E-08	3.98E-08
Supernatant	3.74E-08	6.80E-08	1.60E-07	2.65E-07	5.11E-10	9.29E-10	2.18E-09	3.62E-09
Solid Layer	7.57E-08	4.20E-08	4.50E-06	4.61E-06	1.38E-09	7.68E-10	8.22E-08	8.44E-08
241-AN-107	2.08E-06	5.68E-07	2.13E-07	2.86E-06	3.40E-08	9.30E-09	3.48E-09	4.68E-08
Supernatant	2.07E-06	5.99E-07	1.38E-07	2.81E-06	3.29E-08	9.49E-09	2.18E-09	4.46E-08
Solid Layer	2.09E-06	4.81E-07	4.24E-07	2.99E-06	3.77E-08	8.68E-09	7.66E-09	5.40E-08
241-AP-101	4.11E-08	3.91E-08	2.24E-07	3.04E-07	6.23E-10	5.93E-10	3.40E-09	4.61E-09
Supernatant	4.11E-08	3.91E-08	2.24E-07	3.04E-07	6.23E-10	5.93E-10	3.40E-09	4.61E-09
Solid Layer	na	na	na	na	na	na	na	na

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AP-102	8.87E-08	1.08E-07	2.47E-07	4.44E-07	1.23E-09	1.50E-09	3.43E-09	6.16E-09
Supernatant	8.87E-08	1.08E-07	2.47E-07	4.44E-07	1.23E-09	1.50E-09	3.43E-09	6.16E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AP-103	1.04E-07	8.94E-08	4.61E-07	6.54E-07	1.57E-09	1.36E-09	6.98E-09	9.91E-09
Supernatant	1.04E-07	8.94E-08	4.61E-07	6.54E-07	1.57E-09	1.36E-09	6.98E-09	9.91E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AP-104	1.14E-07	1.99E-07	2.35E-07	5.48E-07	1.64E-09	2.87E-09	3.40E-09	7.92E-09
Supernatant	1.14E-07	1.99E-07	2.35E-07	5.48E-07	1.64E-09	2.87E-09	3.40E-09	7.92E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AP-105	7.13E-08	9.82E-08	2.13E-07	3.83E-07	1.13E-09	1.55E-09	3.38E-09	6.06E-09
Supernatant	7.21E-08	1.01E-07	1.40E-07	3.13E-07	1.13E-09	1.57E-09	2.18E-09	4.88E-09
Solid Layer	6.10E-08	7.32E-08	9.51E-07	1.08E-06	1.12E-09	1.34E-09	1.74E-08	1.98E-08
241-AP-106	9.04E-08	1.41E-07	2.99E-07	5.30E-07	1.32E-09	2.05E-09	4.36E-09	7.73E-09
Supernatant	9.04E-08	1.41E-07	2.99E-07	5.30E-07	1.32E-09	2.05E-09	4.36E-09	7.73E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AP-107	9.73E-08	2.32E-07	2.46E-07	5.76E-07	1.41E-09	3.36E-09	3.57E-09	8.33E-09
Supernatant	9.73E-08	2.32E-07	2.46E-07	5.76E-07	1.41E-09	3.36E-09	3.57E-09	8.33E-09
Solid Layer	na	na	na	na	na	na	na	na
241-AP-108	2.13E-08	2.30E-08	3.08E-06	3.12E-06	3.09E-10	3.32E-10	4.45E-08	4.52E-08
Supernatant	2.13E-08	2.30E-08	3.08E-06	3.12E-06	3.09E-10	3.32E-10	4.45E-08	4.52E-08
Solid Layer	na	na	na	na	na	na	na	na
241-AW-101	3.08E-07	8.16E-07	1.95E-07	1.32E-06	5.39E-09	1.43E-08	3.41E-09	2.31E-08
Supernatant	3.26E-07	8.50E-07	1.28E-07	1.30E-06	5.55E-09	1.45E-08	2.18E-09	2.22E-08
Solid Layer	2.74E-07	7.53E-07	3.21E-07	1.35E-06	5.05E-09	1.39E-08	5.91E-09	2.48E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AW-102	6.74E-07	1.13E-09	1.32E-06	2.00E-06	9.20E-09	1.54E-11	1.81E-08	2.73E-08
Supernatant	7.48E-09	1.49E-09	1.87E-07	1.96E-07	8.75E-11	1.74E-11	2.18E-09	2.29E-09
Solid Layer	1.50E-06	6.80E-10	2.73E-06	4.23E-06	2.58E-08	1.17E-11	4.71E-08	7.30E-08
241-AW-103	3.12E-08	5.48E-08	2.24E-07	3.11E-07	4.75E-10	8.33E-10	3.41E-09	4.72E-09
Supernatant	4.22E-08	6.32E-08	1.52E-07	2.58E-07	6.06E-10	9.07E-10	2.18E-09	3.70E-09
Solid Layer	8.24E-09	3.73E-08	3.75E-07	4.21E-07	1.43E-10	6.47E-10	6.51E-09	7.30E-09
241-AW-104	2.77E-08	4.38E-09	4.09E-07	4.41E-07	4.39E-10	6.93E-11	6.47E-09	6.98E-09
Supernatant	1.21E-09	6.00E-09	1.76E-07	1.84E-07	1.50E-11	7.42E-11	2.18E-09	2.27E-09
Solid Layer	3.57E-08	3.90E-09	4.79E-07	5.18E-07	6.16E-10	6.72E-11	8.26E-09	8.94E-09
241-AW-105	1.60E-08	3.36E-09	3.82E-07	4.01E-07	2.24E-10	4.71E-11	5.35E-09	5.62E-09
Supernatant	2.79E-09	4.14E-09	1.76E-07	1.83E-07	3.46E-11	5.13E-11	2.18E-09	2.27E-09
Solid Layer	2.32E-08	2.93E-09	4.96E-07	5.22E-07	3.51E-10	4.44E-11	7.49E-09	7.89E-09
241-AW-106	1.45E-07	5.51E-07	3.80E-07	1.08E-06	2.57E-09	9.74E-09	6.71E-09	1.90E-08
Supernatant	9.69E-08	5.80E-07	1.43E-07	8.20E-07	1.48E-09	8.86E-09	2.18E-09	1.25E-08
Solid Layer	1.55E-07	5.44E-07	4.29E-07	1.13E-06	2.84E-09	9.96E-09	7.84E-09	2.06E-08
241-AY-101	6.80E-07	1.45E-07	6.45E-07	1.47E-06	1.08E-08	2.30E-09	1.02E-08	2.33E-08
Supernatant	2.03E-08	1.89E-07	1.55E-07	3.64E-07	2.86E-10	2.66E-09	2.18E-09	5.13E-09
Solid Layer	1.24E-06	1.09E-07	1.06E-06	2.41E-06	2.19E-08	1.91E-09	1.87E-08	4.25E-08
241-AY-102	1.61E-05	6.65E-07	3.06E-07	1.71E-05	2.27E-07	9.37E-09	4.32E-09	2.40E-07
Supernatant	1.76E-07	2.57E-07	1.64E-07	5.97E-07	2.34E-09	3.42E-09	2.18E-09	7.94E-09
Solid Layer	5.18E-05	1.58E-06	6.25E-07	5.40E-05	8.37E-07	2.55E-08	1.01E-08	8.73E-07
241-AZ-101	1.35E-06	6.33E-07	2.48E-07	2.24E-06	1.98E-08	9.24E-09	3.62E-09	3.26E-08
Supernatant	6.36E-07	5.90E-07	1.52E-07	1.38E-06	9.13E-09	8.47E-09	2.18E-09	1.98E-08
Solid Layer	1.08E-05	1.20E-06	1.50E-06	1.35E-05	2.02E-07	2.26E-08	2.82E-08	2.53E-07

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-AZ-102	1.97E-06	1.55E-06	2.63E-07	3.78E-06	2.66E-08	2.09E-08	3.54E-09	5.10E-08
Supernatant	1.35E-06	1.62E-06	1.66E-07	3.14E-06	1.78E-08	2.14E-08	2.18E-09	4.14E-08
Solid Layer	6.31E-06	1.08E-06	9.45E-07	8.33E-06	1.01E-07	1.72E-08	1.51E-08	1.33E-07
241-SY-101	2.48E-07	7.02E-07	2.22E-07	1.17E-06	4.03E-09	1.14E-08	3.60E-09	1.90E-08
Supernatant	2.56E-07	7.30E-07	1.39E-07	1.12E-06	4.03E-09	1.15E-08	2.18E-09	1.77E-08
Solid Layer	2.30E-07	6.35E-07	4.23E-07	1.29E-06	4.03E-09	1.11E-08	7.39E-09	2.25E-08
241-SY-102	1.60E-07	3.09E-07	2.39E-07	7.09E-07	2.34E-09	4.52E-09	3.49E-09	1.04E-08
Supernatant	1.68E-07	3.20E-07	1.51E-07	6.39E-07	2.44E-09	4.63E-09	2.18E-09	9.25E-09
Solid Layer	6.54E-08	1.88E-07	1.27E-06	1.53E-06	1.09E-09	3.14E-09	2.12E-08	2.55E-08
241-SY-103	3.10E-07	7.48E-07	2.28E-07	1.29E-06	5.49E-09	1.33E-08	4.04E-09	2.28E-08
Supernatant	3.72E-07	8.62E-07	1.28E-07	1.36E-06	6.33E-09	1.47E-08	2.18E-09	2.32E-08
Solid Layer	2.38E-07	6.15E-07	3.44E-07	1.20E-06	4.44E-09	1.15E-08	6.41E-09	2.23E-08
241-A-101	3.29E-07	4.37E-06	4.55E-07	5.15E-06	6.14E-09	8.09E-08	8.43E-09	9.55E-08
Supernatant	3.82E-07	5.43E-06	8.35E-07	6.64E-06	6.58E-09	9.36E-08	1.44E-08	1.15E-07
Solid Layer	3.01E-07	3.73E-06	2.25E-07	4.25E-06	5.84E-09	7.23E-08	4.37E-09	8.26E-08
241-A-102	4.90E-07	4.80E-07	3.88E-06	4.85E-06	9.32E-09	9.25E-09	7.46E-08	9.32E-08
Supernatant	3.87E-07	7.50E-07	2.41E-07	1.38E-06	7.03E-09	1.36E-08	4.37E-09	2.50E-08
Solid Layer	4.89E-07	4.68E-07	4.05E-06	5.01E-06	9.43E-09	9.03E-09	7.82E-08	9.66E-08
241-A-103	2.64E-07	2.24E-06	7.33E-07	3.24E-06	4.19E-09	3.57E-08	1.17E-08	5.15E-08
Supernatant	3.41E-07	3.78E-06	2.61E-07	4.38E-06	5.72E-09	6.35E-08	4.37E-09	7.36E-08
Solid Layer	2.62E-07	2.22E-06	7.39E-07	3.22E-06	4.18E-09	3.53E-08	1.18E-08	5.13E-08
241-A-104	3.26E-05	4.94E-06	5.33E-06	4.29E-05	6.20E-07	9.37E-08	1.01E-07	8.14E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.26E-05	4.94E-06	5.33E-06	4.29E-05	6.20E-07	9.37E-08	1.01E-07	8.14E-07

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA
Supernatant	NA	NA	NA	NA	NA	NA	NA	NA
Solid Layer	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	3.70E-06	2.42E-06	2.16E-06	8.28E-06	6.64E-08	4.34E-08	3.87E-08	1.49E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.70E-06	2.42E-06	2.16E-06	8.28E-06	6.64E-08	4.34E-08	3.87E-08	1.49E-07
241-AX-101	2.52E-07	2.04E-06	4.52E-07	2.74E-06	4.69E-09	3.80E-08	8.42E-09	5.11E-08
Supernatant	2.65E-07	2.39E-06	2.47E-07	2.90E-06	4.69E-09	4.22E-08	4.37E-09	5.13E-08
Solid Layer	2.42E-07	1.77E-06	6.14E-07	2.62E-06	4.69E-09	3.43E-08	1.19E-08	5.09E-08
241-AX-102	1.86E-06	3.04E-07	5.35E-06	7.51E-06	3.29E-08	5.36E-09	9.43E-08	1.33E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.86E-06	3.04E-07	5.35E-06	7.51E-06	3.29E-08	5.36E-09	9.43E-08	1.33E-07
241-AX-103	3.16E-06	3.19E-06	1.57E-06	7.92E-06	5.94E-08	5.98E-08	2.94E-08	1.49E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.16E-06	3.19E-06	1.57E-06	7.92E-06	5.94E-08	5.98E-08	2.94E-08	1.49E-07
241-AX-104	2.88E-06	9.06E-09	1.78E-05	2.07E-05	6.01E-08	1.89E-10	3.71E-07	4.31E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.88E-06	9.06E-09	1.78E-05	2.07E-05	6.01E-08	1.89E-10	3.71E-07	4.31E-07
241-B-101	2.79E-07	1.70E-14	1.70E-06	1.98E-06	4.81E-09	2.92E-16	2.93E-08	3.41E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.79E-07	1.70E-14	1.70E-06	1.98E-06	4.81E-09	2.92E-16	2.93E-08	3.41E-08
241-B-102	2.03E-09	5.42E-16	4.94E-06	4.94E-06	3.66E-11	9.79E-18	8.91E-08	8.92E-08
Supernatant	6.68E-09	1.30E-15	3.17E-07	3.24E-07	9.20E-11	1.79E-17	4.37E-09	4.46E-09
Solid Layer	1.54E-09	4.63E-16	5.42E-06	5.42E-06	2.88E-11	8.65E-18	1.01E-07	1.01E-07

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-B-103	4.03E-09	1.04E-15	2.84E-06	2.84E-06	7.53E-11	1.94E-17	5.30E-08	5.31E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.03E-09	1.04E-15	2.84E-06	2.84E-06	7.53E-11	1.94E-17	5.30E-08	5.31E-08
241-B-104	1.39E-08	1.48E-15	7.40E-07	7.54E-07	2.17E-10	2.32E-17	1.16E-08	1.18E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.39E-08	1.48E-15	7.40E-07	7.54E-07	2.17E-10	2.32E-17	1.16E-08	1.18E-08
241-B-105	1.09E-09	3.05E-16	7.09E-07	7.10E-07	2.11E-11	5.91E-18	1.37E-08	1.37E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.09E-09	3.05E-16	7.09E-07	7.10E-07	2.11E-11	5.91E-18	1.37E-08	1.37E-08
241-B-106	1.69E-08	1.09E-15	1.67E-06	1.69E-06	2.71E-10	1.74E-17	2.67E-08	2.69E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.69E-08	1.09E-15	1.67E-06	1.69E-06	2.71E-10	1.74E-17	2.67E-08	2.69E-08
241-B-107	2.60E-08	1.97E-16	1.12E-06	1.15E-06	4.90E-10	3.70E-18	2.12E-08	2.16E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.60E-08	1.97E-16	1.12E-06	1.15E-06	4.90E-10	3.70E-18	2.12E-08	2.16E-08
241-B-108	1.54E-09	3.56E-16	1.74E-06	1.74E-06	2.98E-11	6.90E-18	3.38E-08	3.38E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.54E-09	3.56E-16	1.74E-06	1.74E-06	2.98E-11	6.90E-18	3.38E-08	3.38E-08
241-B-109	1.02E-07	8.71E-16	1.27E-06	1.37E-06	2.08E-09	1.78E-17	2.61E-08	2.81E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.02E-07	8.71E-16	1.27E-06	1.37E-06	2.08E-09	1.78E-17	2.61E-08	2.81E-08
241-B-110	7.55E-08	0.00E+00	9.82E-07	1.06E-06	1.19E-09	0.00E+00	1.55E-08	1.66E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.55E-08	0.00E+00	9.82E-07	1.06E-06	1.19E-09	0.00E+00	1.55E-08	1.66E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-B-111	2.27E-07	0.00E+00	1.14E-06	1.36E-06	3.12E-09	0.00E+00	1.56E-08	1.88E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.27E-07	0.00E+00	1.14E-06	1.36E-06	3.12E-09	0.00E+00	1.56E-08	1.88E-08
241-B-112	3.03E-08	0.00E+00	4.97E-06	5.00E-06	5.00E-10	0.00E+00	8.21E-08	8.26E-08
Supernatant	0.00E+00	0.00E+00	3.74E-07	3.74E-07	0.00E+00	0.00E+00	4.37E-09	4.37E-09
Solid Layer	3.21E-08	0.00E+00	5.26E-06	5.29E-06	5.45E-10	0.00E+00	8.91E-08	8.97E-08
241-B-201	5.16E-10	8.84E-09	1.56E-06	1.57E-06	7.53E-12	1.29E-10	2.27E-08	2.29E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.16E-10	8.84E-09	1.56E-06	1.57E-06	7.53E-12	1.29E-10	2.27E-08	2.29E-08
241-B-202	1.35E-09	2.24E-08	1.63E-06	1.65E-06	1.91E-11	3.17E-10	2.30E-08	2.33E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.35E-09	2.24E-08	1.63E-06	1.65E-06	1.91E-11	3.17E-10	2.30E-08	2.33E-08
241-B-203	3.95E-10	0.00E+00	1.46E-06	1.46E-06	5.44E-12	0.00E+00	2.02E-08	2.02E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.95E-10	0.00E+00	1.46E-06	1.46E-06	5.44E-12	0.00E+00	2.02E-08	2.02E-08
241-B-204	2.10E-10	0.00E+00	1.47E-06	1.47E-06	2.89E-12	0.00E+00	2.02E-08	2.02E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.10E-10	0.00E+00	1.47E-06	1.47E-06	2.89E-12	0.00E+00	2.02E-08	2.02E-08
241-BX-101	1.56E-07	1.40E-08	3.20E-06	3.37E-06	2.99E-09	2.70E-10	6.14E-08	6.46E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.56E-07	1.40E-08	3.20E-06	3.37E-06	2.99E-09	2.70E-10	6.14E-08	6.46E-08
241-BX-102	1.87E-07	1.40E-08	1.93E-06	2.13E-06	2.77E-09	2.08E-10	2.86E-08	3.15E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.87E-07	1.40E-08	1.93E-06	2.13E-06	2.77E-09	2.08E-10	2.86E-08	3.15E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-BX-103	2.17E-07	5.13E-08	2.29E-06	2.56E-06	3.92E-09	9.28E-10	4.14E-08	4.62E-08
Supernatant	2.59E-09	7.72E-08	3.40E-07	4.20E-07	3.33E-11	9.92E-10	4.37E-09	5.40E-09
Solid Layer	2.43E-07	4.82E-08	2.52E-06	2.81E-06	4.62E-09	9.16E-10	4.80E-08	5.35E-08
241-BX-104	9.33E-08	3.37E-08	1.63E-06	1.75E-06	1.80E-09	6.51E-10	3.14E-08	3.39E-08
Supernatant	4.71E-08	5.65E-08	2.95E-07	3.99E-07	6.98E-10	8.38E-10	4.37E-09	5.91E-09
Solid Layer	9.44E-08	3.32E-08	1.66E-06	1.79E-06	1.83E-09	6.45E-10	3.22E-08	3.47E-08
241-BX-105	2.56E-08	1.58E-08	2.26E-06	2.30E-06	4.79E-10	2.96E-10	4.22E-08	4.30E-08
Supernatant	6.55E-08	7.30E-08	2.93E-07	4.31E-07	9.78E-10	1.09E-09	4.37E-09	6.44E-09
Solid Layer	2.34E-08	1.26E-08	2.37E-06	2.41E-06	4.44E-10	2.39E-10	4.49E-08	4.56E-08
241-BX-106	4.53E-08	1.28E-08	3.92E-06	3.97E-06	8.87E-10	2.51E-10	7.66E-08	7.77E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.53E-08	1.28E-08	3.92E-06	3.97E-06	8.87E-10	2.51E-10	7.66E-08	7.77E-08
241-BX-107	6.23E-09	1.75E-08	7.31E-07	7.55E-07	1.04E-10	2.91E-10	1.22E-08	1.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.23E-09	1.75E-08	7.31E-07	7.55E-07	1.04E-10	2.91E-10	1.22E-08	1.26E-08
241-BX-108	3.38E-08	8.84E-09	5.29E-06	5.34E-06	5.78E-10	1.51E-10	9.06E-08	9.13E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.38E-08	8.84E-09	5.29E-06	5.34E-06	5.78E-10	1.51E-10	9.06E-08	9.13E-08
241-BX-109	4.52E-08	2.20E-08	1.05E-06	1.11E-06	7.95E-10	3.86E-10	1.84E-08	1.96E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.52E-08	2.20E-08	1.05E-06	1.11E-06	7.95E-10	3.86E-10	1.84E-08	1.96E-08
241-BX-110	2.92E-08	3.81E-08	8.78E-07	9.45E-07	5.84E-10	7.63E-10	1.76E-08	1.89E-08
Supernatant	5.37E-08	5.13E-08	2.62E-07	3.67E-07	8.95E-10	8.55E-10	4.37E-09	6.12E-09
Solid Layer	2.90E-08	3.80E-08	8.81E-07	9.48E-07	5.82E-10	7.63E-10	1.77E-08	1.90E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-BX-111	2.08E-09	1.85E-09	1.12E-06	1.13E-06	3.47E-11	3.09E-11	1.87E-08	1.88E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.08E-09	1.85E-09	1.12E-06	1.13E-06	3.47E-11	3.09E-11	1.87E-08	1.88E-08
241-BX-112	9.23E-09	0.00E+00	1.38E-06	1.39E-06	1.40E-10	0.00E+00	2.09E-08	2.10E-08
Supernatant	1.39E-08	0.00E+00	3.20E-07	3.34E-07	1.90E-10	0.00E+00	4.37E-09	4.56E-09
Solid Layer	9.20E-09	0.00E+00	1.38E-06	1.39E-06	1.39E-10	0.00E+00	2.10E-08	2.11E-08
241-BY-101	5.97E-08	9.09E-08	5.60E-07	7.11E-07	1.25E-09	1.90E-09	1.17E-08	1.48E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.97E-08	9.09E-08	5.60E-07	7.11E-07	1.25E-09	1.90E-09	1.17E-08	1.48E-08
241-BY-102	8.51E-09	1.06E-08	7.79E-07	7.98E-07	1.55E-10	1.92E-10	1.42E-08	1.45E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.51E-09	1.06E-08	7.79E-07	7.98E-07	1.55E-10	1.92E-10	1.42E-08	1.45E-08
241-BY-103	1.74E-08	2.55E-08	5.75E-07	6.18E-07	3.29E-10	4.82E-10	1.09E-08	1.17E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.74E-08	2.55E-08	5.75E-07	6.18E-07	3.29E-10	4.82E-10	1.09E-08	1.17E-08
241-BY-104	6.16E-08	3.51E-07	6.06E-07	1.02E-06	1.21E-09	6.91E-09	1.19E-08	2.01E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.16E-08	3.51E-07	6.06E-07	1.02E-06	1.21E-09	6.91E-09	1.19E-08	2.01E-08
241-BY-105	2.24E-08	1.59E-07	4.78E-07	6.60E-07	4.58E-10	3.26E-09	9.76E-09	1.35E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.24E-08	1.59E-07	4.78E-07	6.60E-07	4.58E-10	3.26E-09	9.76E-09	1.35E-08
241-BY-106	6.18E-08	5.16E-07	4.98E-07	1.08E-06	1.14E-09	9.54E-09	9.20E-09	1.99E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.18E-08	5.16E-07	4.98E-07	1.08E-06	1.14E-09	9.54E-09	9.20E-09	1.99E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-BY-107	4.59E-08	4.66E-07	7.36E-07	1.25E-06	8.95E-10	9.09E-09	1.43E-08	2.43E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.59E-08	4.66E-07	7.36E-07	1.25E-06	8.95E-10	9.09E-09	1.43E-08	2.43E-08
241-BY-108	6.58E-08	3.27E-07	9.64E-07	1.36E-06	1.13E-09	5.62E-09	1.66E-08	2.33E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.58E-08	3.27E-07	9.64E-07	1.36E-06	1.13E-09	5.62E-09	1.66E-08	2.33E-08
241-BY-109	2.23E-08	6.60E-09	7.18E-07	7.47E-07	4.40E-10	1.30E-10	1.42E-08	1.47E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.23E-08	6.60E-09	7.18E-07	7.47E-07	4.40E-10	1.30E-10	1.42E-08	1.47E-08
241-BY-110	1.07E-07	9.17E-07	6.49E-07	1.67E-06	1.94E-09	1.66E-08	1.18E-08	3.04E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.07E-07	9.17E-07	6.49E-07	1.67E-06	1.94E-09	1.66E-08	1.18E-08	3.04E-08
241-BY-111	3.17E-09	5.85E-09	6.85E-07	6.94E-07	6.18E-11	1.14E-10	1.33E-08	1.35E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.17E-09	5.85E-09	6.85E-07	6.94E-07	6.18E-11	1.14E-10	1.33E-08	1.35E-08
241-BY-112	3.86E-09	1.31E-08	6.87E-07	7.04E-07	7.78E-11	2.64E-10	1.38E-08	1.42E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.86E-09	1.31E-08	6.87E-07	7.04E-07	7.78E-11	2.64E-10	1.38E-08	1.42E-08
241-C-101	1.63E-07	3.63E-08	2.03E-06	2.23E-06	2.82E-09	6.29E-10	3.52E-08	3.86E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.63E-07	3.63E-08	2.03E-06	2.23E-06	2.82E-09	6.29E-10	3.52E-08	3.86E-08
241-C-102	7.32E-08	2.54E-08	6.73E-07	7.72E-07	1.41E-09	4.90E-10	1.29E-08	1.48E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.32E-08	2.54E-08	6.73E-07	7.72E-07	1.41E-09	4.90E-10	1.29E-08	1.48E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-C-103	4.60E-06	7.27E-08	1.15E-06	5.82E-06	7.18E-08	1.14E-09	1.80E-08	9.10E-08
Supernatant	2.50E-07	9.53E-08	3.40E-07	6.85E-07	3.21E-09	1.22E-09	4.37E-09	8.80E-09
Solid Layer	6.48E-06	6.29E-08	1.51E-06	8.05E-06	1.12E-07	1.08E-09	2.60E-08	1.39E-07
241-C-104	2.61E-07	1.88E-07	7.59E-07	1.21E-06	5.11E-09	3.68E-09	1.48E-08	2.36E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.61E-07	1.88E-07	7.59E-07	1.21E-06	5.11E-09	3.68E-09	1.48E-08	2.36E-08
241-C-105	2.57E-07	1.05E-08	1.39E-06	1.65E-06	4.61E-09	1.88E-10	2.49E-08	2.97E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.57E-07	1.05E-08	1.39E-06	1.65E-06	4.61E-09	1.88E-10	2.49E-08	2.97E-08
241-C-106	5.56E-06	5.01E-08	5.69E-06	1.13E-05	3.47E-08	6.93E-10	7.87E-08	1.14E-07
Supernatant	1.29E-07	5.77E-08	3.34E-07	5.21E-07	1.69E-09	7.54E-10	4.37E-09	6.82E-09
Solid Layer	1.13E-05	2.20E-08	2.56E-05	3.70E-05	1.99E-07	3.87E-10	4.50E-07	6.50E-07
241-C-107	8.49E-07	2.69E-07	9.37E-07	2.06E-06	1.39E-08	4.39E-09	1.53E-08	3.35E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.49E-07	2.69E-07	9.37E-07	2.06E-06	1.39E-08	4.39E-09	1.53E-08	3.35E-08
241-C-108	6.07E-08	2.88E-08	2.71E-06	2.79E-06	1.02E-09	4.84E-10	4.54E-08	4.69E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.07E-08	2.88E-08	2.71E-06	2.79E-06	1.02E-09	4.84E-10	4.54E-08	4.69E-08
241-C-109	3.67E-07	3.04E-08	2.82E-06	3.22E-06	6.13E-09	5.08E-10	4.71E-08	5.37E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.67E-07	3.04E-08	2.82E-06	3.22E-06	6.13E-09	5.08E-10	4.71E-08	5.37E-08
241-C-110	3.11E-09	9.21E-10	1.27E-06	1.27E-06	4.83E-11	1.43E-11	1.97E-08	1.97E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.11E-09	9.21E-10	1.27E-06	1.27E-06	4.83E-11	1.43E-11	1.97E-08	1.97E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-C-111	5.25E-07	1.43E-08	3.10E-06	3.64E-06	8.75E-09	2.39E-10	5.16E-08	6.06E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.25E-07	1.43E-08	3.10E-06	3.64E-06	8.75E-09	2.39E-10	5.16E-08	6.06E-08
241-C-112	4.85E-07	3.72E-08	1.65E-06	2.17E-06	8.98E-09	6.89E-10	3.05E-08	4.01E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.85E-07	3.72E-08	1.65E-06	2.17E-06	8.98E-09	6.89E-10	3.05E-08	4.01E-08
241-C-201	2.06E-08	8.48E-09	1.14E-05	1.15E-05	3.57E-10	1.47E-10	1.99E-07	1.99E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.06E-08	8.48E-09	1.14E-05	1.15E-05	3.57E-10	1.47E-10	1.99E-07	1.99E-07
241-C-202	2.87E-09	1.08E-09	1.14E-05	1.15E-05	4.98E-11	1.87E-11	1.99E-07	1.99E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.87E-09	1.08E-09	1.14E-05	1.15E-05	4.98E-11	1.87E-11	1.99E-07	1.99E-07
241-C-203	1.43E-08	6.70E-09	5.14E-06	5.17E-06	2.48E-10	1.16E-10	8.93E-08	8.97E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.43E-08	6.70E-09	5.14E-06	5.17E-06	2.48E-10	1.16E-10	8.93E-08	8.97E-08
241-C-204	1.09E-08	1.01E-08	5.14E-06	5.17E-06	1.90E-10	1.75E-10	8.93E-08	8.97E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.09E-08	1.01E-08	5.14E-06	5.17E-06	1.90E-10	1.75E-10	8.93E-08	8.97E-08
241-S-101	1.43E-07	2.59E-07	5.72E-07	9.73E-07	2.68E-09	4.86E-09	1.08E-08	1.83E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.43E-07	2.59E-07	5.72E-07	9.73E-07	2.68E-09	4.86E-09	1.08E-08	1.83E-08
241-S-102	7.11E-08	2.72E-07	6.86E-07	1.03E-06	1.30E-09	5.00E-09	1.26E-08	1.89E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.11E-08	2.72E-07	6.86E-07	1.03E-06	1.30E-09	5.00E-09	1.26E-08	1.89E-08

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-S-103	6.12E-08	1.00E-07	8.61E-07	1.02E-06	1.12E-09	1.84E-09	1.58E-08	1.88E-08
Supernatant	1.18E-07	1.55E-07	2.61E-07	5.34E-07	1.98E-09	2.61E-09	4.37E-09	8.96E-09
Solid Layer	6.10E-08	9.99E-08	8.64E-07	1.02E-06	1.12E-09	1.83E-09	1.59E-08	1.88E-08
241-S-104	6.78E-08	2.55E-08	7.19E-07	8.12E-07	1.30E-09	4.89E-10	1.38E-08	1.56E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.78E-08	2.55E-08	7.19E-07	8.12E-07	1.30E-09	4.89E-10	1.38E-08	1.56E-08
241-S-105	2.30E-08	6.07E-08	5.79E-07	6.63E-07	4.39E-10	1.16E-09	1.11E-08	1.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.30E-08	6.07E-08	5.79E-07	6.63E-07	4.39E-10	1.16E-09	1.11E-08	1.26E-08
241-S-106	2.12E-08	2.75E-08	5.18E-07	5.67E-07	4.22E-10	5.47E-10	1.03E-08	1.13E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.12E-08	2.75E-08	5.18E-07	5.67E-07	4.22E-10	5.47E-10	1.03E-08	1.13E-08
241-S-107	5.02E-08	5.94E-08	5.68E-07	6.78E-07	1.01E-09	1.21E-09	1.16E-08	1.38E-08
Supernatant	3.47E-08	1.16E-07	2.88E-07	4.39E-07	5.26E-10	1.76E-09	4.37E-09	6.66E-09
Solid Layer	4.98E-08	5.78E-08	5.76E-07	6.84E-07	1.02E-09	1.19E-09	1.19E-08	1.41E-08
241-S-108	3.67E-09	1.15E-08	4.87E-07	5.02E-07	7.02E-11	2.19E-10	9.30E-09	9.59E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.67E-09	1.15E-08	4.87E-07	5.02E-07	7.02E-11	2.19E-10	9.30E-09	9.59E-09
241-S-109	2.05E-09	8.57E-09	4.93E-07	5.04E-07	3.92E-11	1.64E-10	9.46E-09	9.66E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.05E-09	8.57E-09	4.93E-07	5.04E-07	3.92E-11	1.64E-10	9.46E-09	9.66E-09
241-S-110	3.76E-08	1.46E-07	5.91E-07	7.75E-07	7.22E-10	2.81E-09	1.13E-08	1.49E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.76E-08	1.46E-07	5.91E-07	7.75E-07	7.22E-10	2.81E-09	1.13E-08	1.49E-08

Author [illegible] Date 6/13/02 Check by [illegible] Date 6/13/02

Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-S-111	7.27E-08	4.88E-08	5.73E-07	6.94E-07	1.29E-09	8.67E-10	1.02E-08	1.23E-08
Supernatant	7.15E-08	8.06E-08	2.61E-07	4.13E-07	1.20E-09	1.35E-09	4.37E-09	6.93E-09
Solid Layer	7.28E-08	4.54E-08	6.06E-07	7.24E-07	1.30E-09	8.11E-10	1.08E-08	1.30E-08
241-S-112	1.27E-07	6.87E-07	5.05E-07	1.32E-06	2.42E-09	1.31E-08	9.63E-09	2.52E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.27E-07	6.87E-07	5.05E-07	1.32E-06	2.42E-09	1.31E-08	9.63E-09	2.52E-08
241-SX-101	9.05E-08	2.20E-07	5.60E-07	8.71E-07	1.73E-09	4.22E-09	1.07E-08	1.67E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.05E-08	2.20E-07	5.60E-07	8.71E-07	1.73E-09	4.22E-09	1.07E-08	1.67E-08
241-SX-102	1.55E-07	1.41E-06	5.06E-07	2.07E-06	2.98E-09	2.71E-08	9.73E-09	3.98E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.55E-07	1.41E-06	5.06E-07	2.07E-06	2.98E-09	2.71E-08	9.73E-09	3.98E-08
241-SX-103	3.81E-07	6.32E-06	4.88E-07	7.19E-06	7.56E-09	1.25E-07	9.70E-09	1.43E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.81E-07	6.32E-06	4.88E-07	7.19E-06	7.56E-09	1.25E-07	9.70E-09	1.43E-07
241-SX-104	2.26E-07	1.45E-06	5.39E-07	2.22E-06	4.38E-09	2.82E-08	1.04E-08	4.30E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.26E-07	1.45E-06	5.39E-07	2.22E-06	4.38E-09	2.82E-08	1.04E-08	4.30E-08
241-SX-105	4.46E-07	1.19E-05	6.66E-07	1.30E-05	8.39E-09	2.24E-07	1.25E-08	2.45E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.46E-07	1.19E-05	6.66E-07	1.30E-05	8.39E-09	2.24E-07	1.25E-08	2.45E-07
241-SX-106	7.56E-08	2.67E-07	6.13E-07	9.56E-07	1.38E-09	4.87E-09	1.12E-08	1.75E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.56E-08	2.67E-07	6.13E-07	9.56E-07	1.38E-09	4.87E-09	1.12E-08	1.75E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-SX-107	1.25E-07	3.08E-07	1.65E-06	2.08E-06	2.51E-09	6.18E-09	3.31E-08	4.18E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.25E-07	3.08E-07	1.65E-06	2.08E-06	2.51E-09	6.18E-09	3.31E-08	4.18E-08
241-SX-108	3.82E-07	4.32E-07	2.05E-06	2.87E-06	7.74E-09	8.75E-09	4.15E-08	5.80E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.82E-07	4.32E-07	2.05E-06	2.87E-06	7.74E-09	8.75E-09	4.15E-08	5.80E-08
241-SX-109	4.92E-07	2.71E-06	7.81E-07	3.99E-06	9.84E-09	5.42E-08	1.56E-08	7.97E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.92E-07	2.71E-06	7.81E-07	3.99E-06	9.84E-09	5.42E-08	1.56E-08	7.97E-08
241-SX-110	8.43E-07	4.06E-06	2.63E-06	7.53E-06	1.69E-08	8.16E-08	5.28E-08	1.51E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.43E-07	4.06E-06	2.63E-06	7.53E-06	1.69E-08	8.16E-08	5.28E-08	1.51E-07
241-SX-111	1.26E-07	7.54E-07	1.40E-06	2.28E-06	2.51E-09	1.50E-08	2.79E-08	4.54E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.26E-07	7.54E-07	1.40E-06	2.28E-06	2.51E-09	1.50E-08	2.79E-08	4.54E-08
241-SX-112	1.07E-07	1.34E-07	2.03E-06	2.28E-06	2.14E-09	2.68E-09	4.06E-08	4.54E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.07E-07	1.34E-07	2.03E-06	2.28E-06	2.14E-09	2.68E-09	4.06E-08	4.54E-08
241-SX-113	4.68E-08	3.84E-08	1.21E-05	1.22E-05	5.74E-10	4.71E-10	1.49E-07	1.50E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.68E-08	3.84E-08	1.21E-05	1.22E-05	5.74E-10	4.71E-10	1.49E-07	1.50E-07
241-SX-114	7.93E-08	4.71E-07	1.11E-06	1.66E-06	1.54E-09	9.14E-09	2.16E-08	3.23E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.93E-08	4.71E-07	1.11E-06	1.66E-06	1.54E-09	9.14E-09	2.16E-08	3.23E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-SX-115	4.93E-06	2.68E-08	3.64E-05	4.13E-05	9.99E-08	5.44E-10	7.37E-07	8.37E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.93E-06	2.68E-08	3.64E-05	4.13E-05	9.99E-08	5.44E-10	7.37E-07	8.37E-07
241-T-101	4.11E-08	1.10E-07	1.69E-06	1.84E-06	7.70E-10	2.06E-09	3.17E-08	3.45E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.11E-08	1.10E-07	1.69E-06	1.84E-06	7.70E-10	2.06E-09	3.17E-08	3.45E-08
241-T-102	3.02E-08	2.45E-09	5.05E-06	5.08E-06	5.33E-10	4.33E-11	8.91E-08	8.97E-08
Supernatant	1.15E-08	3.45E-09	3.31E-07	3.46E-07	1.51E-10	4.55E-11	4.37E-09	4.57E-09
Solid Layer	3.83E-08	2.02E-09	7.09E-06	7.13E-06	7.93E-10	4.19E-11	1.47E-07	1.48E-07
241-T-103	1.53E-07	3.21E-12	5.60E-06	5.76E-06	2.86E-09	6.00E-14	1.05E-07	1.08E-07
Supernatant	1.73E-08	4.89E-12	3.20E-07	3.37E-07	2.36E-10	6.68E-14	4.37E-09	4.61E-09
Solid Layer	1.69E-07	3.00E-12	6.24E-06	6.41E-06	3.32E-09	5.89E-14	1.22E-07	1.26E-07
241-T-104	8.58E-10	1.74E-08	8.66E-07	8.84E-07	1.28E-11	2.60E-10	1.29E-08	1.32E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.58E-10	1.74E-08	8.66E-07	8.84E-07	1.28E-11	2.60E-10	1.29E-08	1.32E-08
241-T-105	3.65E-08	3.63E-09	1.90E-06	1.94E-06	6.16E-10	6.14E-11	3.20E-08	3.27E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.65E-08	3.63E-09	1.90E-06	1.94E-06	6.16E-10	6.14E-11	3.20E-08	3.27E-08
241-T-106	4.13E-09	5.08E-09	7.35E-06	7.35E-06	7.28E-11	8.95E-11	1.29E-07	1.30E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.13E-09	5.08E-09	7.35E-06	7.35E-06	7.28E-11	8.95E-11	1.29E-07	1.30E-07
241-T-107	3.17E-08	1.27E-08	1.19E-06	1.23E-06	5.36E-10	2.15E-10	2.00E-08	2.08E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.17E-08	1.27E-08	1.19E-06	1.23E-06	5.36E-10	2.15E-10	2.00E-08	2.08E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-T-108	2.11E-09	5.67E-16	1.05E-05	1.05E-05	3.52E-11	9.46E-18	1.75E-07	1.75E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.11E-09	5.67E-16	1.05E-05	1.05E-05	3.52E-11	9.46E-18	1.75E-07	1.75E-07
241-T-109	1.44E-09	9.84E-16	2.85E-06	2.85E-06	2.43E-11	1.66E-17	4.80E-08	4.80E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.44E-09	9.84E-16	2.85E-06	2.85E-06	2.43E-11	1.66E-17	4.80E-08	4.80E-08
241-T-110	5.92E-08	0.00E+00	7.98E-07	8.57E-07	8.69E-10	0.00E+00	1.17E-08	1.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.92E-08	0.00E+00	7.98E-07	8.57E-07	8.69E-10	0.00E+00	1.17E-08	1.26E-08
241-T-111	1.80E-09	2.05E-08	7.27E-07	7.49E-07	2.58E-11	2.94E-10	1.04E-08	1.08E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.80E-09	2.05E-08	7.27E-07	7.49E-07	2.58E-11	2.94E-10	1.04E-08	1.08E-08
241-T-112	7.07E-09	0.00E+00	3.36E-06	3.37E-06	1.05E-10	0.00E+00	4.98E-08	4.99E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.07E-09	0.00E+00	3.36E-06	3.37E-06	1.05E-10	0.00E+00	4.98E-08	4.99E-08
241-T-201	2.01E-11	0.00E+00	1.51E-06	1.51E-06	3.06E-13	0.00E+00	2.30E-08	2.30E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.01E-11	0.00E+00	1.51E-06	1.51E-06	3.06E-13	0.00E+00	2.30E-08	2.30E-08
241-T-202	9.75E-12	1.81E-08	1.77E-06	1.79E-06	1.40E-13	2.60E-10	2.54E-08	2.56E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.75E-12	1.81E-08	1.77E-06	1.79E-06	1.40E-13	2.60E-10	2.54E-08	2.56E-08
241-T-203	6.03E-12	1.77E-08	1.54E-06	1.55E-06	8.49E-14	2.48E-10	2.16E-08	2.18E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.03E-12	1.77E-08	1.54E-06	1.55E-06	8.49E-14	2.48E-10	2.16E-08	2.18E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-T-204	4.47E-12	2.05E-08	1.54E-06	1.56E-06	6.26E-14	2.87E-10	2.16E-08	2.19E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.47E-12	2.05E-08	1.54E-06	1.56E-06	6.26E-14	2.87E-10	2.16E-08	2.19E-08
241-TX-101	2.94E-07	1.56E-07	1.71E-06	2.16E-06	5.88E-09	3.12E-09	3.42E-08	4.32E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.94E-07	1.56E-07	1.71E-06	2.16E-06	5.88E-09	3.12E-09	3.42E-08	4.32E-08
241-TX-102	2.15E-08	7.45E-08	8.88E-07	9.84E-07	4.08E-10	1.42E-09	1.69E-08	1.87E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.15E-08	7.45E-08	8.88E-07	9.84E-07	4.08E-10	1.42E-09	1.69E-08	1.87E-08
241-TX-103	2.39E-08	5.61E-08	1.22E-06	1.30E-06	4.55E-10	1.07E-09	2.31E-08	2.46E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.39E-08	5.61E-08	1.22E-06	1.30E-06	4.55E-10	1.07E-09	2.31E-08	2.46E-08
241-TX-104	9.00E-08	6.39E-09	2.23E-06	2.33E-06	1.81E-09	1.28E-10	4.49E-08	4.68E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.00E-08	6.39E-09	2.23E-06	2.33E-06	1.81E-09	1.28E-10	4.49E-08	4.68E-08
241-TX-105	9.65E-09	6.57E-08	4.72E-07	5.47E-07	1.86E-10	1.26E-09	9.08E-09	1.05E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.65E-09	6.57E-08	4.72E-07	5.47E-07	1.86E-10	1.26E-09	9.08E-09	1.05E-08
241-TX-106	2.84E-08	8.79E-08	6.37E-07	7.53E-07	5.42E-10	1.68E-09	1.22E-08	1.44E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.84E-08	8.79E-08	6.37E-07	7.53E-07	5.42E-10	1.68E-09	1.22E-08	1.44E-08
241-TX-107	4.49E-08	5.95E-08	5.09E-06	5.19E-06	8.46E-10	1.12E-09	9.59E-08	9.79E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.49E-08	5.95E-08	5.09E-06	5.19E-06	8.46E-10	1.12E-09	9.59E-08	9.79E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-TX-108	1.14E-08	2.13E-08	1.33E-06	1.36E-06	2.18E-10	4.07E-10	2.53E-08	2.60E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.14E-08	2.13E-08	1.33E-06	1.36E-06	2.18E-10	4.07E-10	2.53E-08	2.60E-08
241-TX-109	5.49E-09	1.93E-08	7.25E-07	7.50E-07	8.96E-11	3.15E-10	1.18E-08	1.22E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.49E-09	1.93E-08	7.25E-07	7.50E-07	8.96E-11	3.15E-10	1.18E-08	1.22E-08
241-TX-110	8.17E-09	3.30E-08	5.34E-07	5.75E-07	1.56E-10	6.28E-10	1.02E-08	1.10E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.17E-09	3.30E-08	5.34E-07	5.75E-07	1.56E-10	6.28E-10	1.02E-08	1.10E-08
241-TX-111	8.49E-09	3.25E-08	6.22E-07	6.63E-07	1.61E-10	6.17E-10	1.18E-08	1.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.49E-09	3.25E-08	6.22E-07	6.63E-07	1.61E-10	6.17E-10	1.18E-08	1.26E-08
241-TX-112	1.00E-08	2.43E-08	4.51E-07	4.86E-07	1.92E-10	4.67E-10	8.65E-09	9.31E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.00E-08	2.43E-08	4.51E-07	4.86E-07	1.92E-10	4.67E-10	8.65E-09	9.31E-09
241-TX-113	7.91E-10	2.12E-08	4.57E-07	4.79E-07	1.49E-11	4.00E-10	8.62E-09	9.03E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.91E-10	2.12E-08	4.57E-07	4.79E-07	1.49E-11	4.00E-10	8.62E-09	9.03E-09
241-TX-114	3.68E-09	4.61E-09	4.97E-07	5.06E-07	7.01E-11	8.77E-11	9.46E-09	9.62E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.68E-09	4.61E-09	4.97E-07	5.06E-07	7.01E-11	8.77E-11	9.46E-09	9.62E-09
241-TX-115	6.49E-09	1.54E-08	4.83E-07	5.05E-07	1.25E-10	2.95E-10	9.27E-09	9.69E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.49E-09	1.54E-08	4.83E-07	5.05E-07	1.25E-10	2.95E-10	9.27E-09	9.69E-09

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-TX-116	9.11E-10	4.45E-16	4.91E-07	4.92E-07	1.66E-11	8.10E-18	8.92E-09	8.94E-09
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.11E-10	4.45E-16	4.91E-07	4.92E-07	1.66E-11	8.10E-18	8.92E-09	8.94E-09
241-TX-117	1.16E-09	1.26E-16	5.47E-07	5.49E-07	2.13E-11	2.31E-18	1.00E-08	1.00E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.16E-09	1.26E-16	5.47E-07	5.49E-07	2.13E-11	2.31E-18	1.00E-08	1.00E-08
241-TX-118	4.44E-08	6.99E-08	7.67E-07	8.81E-07	8.65E-10	1.36E-09	1.50E-08	1.72E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.44E-08	6.99E-08	7.67E-07	8.81E-07	8.65E-10	1.36E-09	1.50E-08	1.72E-08
241-TY-101	3.75E-10	1.87E-16	1.44E-06	1.44E-06	7.11E-12	3.55E-18	2.73E-08	2.73E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.75E-10	1.87E-16	1.44E-06	1.44E-06	7.11E-12	3.55E-18	2.73E-08	2.73E-08
241-TY-102	8.29E-09	2.65E-08	2.17E-06	2.20E-06	1.67E-10	5.33E-10	4.37E-08	4.44E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.29E-09	2.65E-08	2.17E-06	2.20E-06	1.67E-10	5.33E-10	4.37E-08	4.44E-08
241-TY-103	6.03E-08	2.34E-07	1.12E-06	1.41E-06	1.18E-09	4.56E-09	2.18E-08	2.76E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.03E-08	2.34E-07	1.12E-06	1.41E-06	1.18E-09	4.56E-09	2.18E-08	2.76E-08
241-TY-104	3.35E-08	4.62E-09	3.39E-06	3.43E-06	6.51E-10	8.97E-11	6.58E-08	6.65E-08
Supernatant	3.19E-09	6.63E-09	3.20E-07	3.30E-07	4.35E-11	9.05E-11	4.37E-09	4.51E-09
Solid Layer	3.40E-08	4.58E-09	3.44E-06	3.48E-06	6.66E-10	8.97E-11	6.73E-08	6.81E-08
241-TY-105	4.15E-08	2.21E-08	9.10E-07	9.73E-07	7.35E-10	3.92E-10	1.61E-08	1.72E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.15E-08	2.21E-08	9.10E-07	9.73E-07	7.35E-10	3.92E-10	1.61E-08	1.72E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-TY-106	2.19E-08	6.63E-09	1.07E-05	1.07E-05	3.47E-10	1.05E-10	1.70E-07	1.70E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.19E-08	6.63E-09	1.07E-05	1.07E-05	3.47E-10	1.05E-10	1.70E-07	1.70E-07
241-U-101	1.03E-07	8.37E-09	5.91E-06	6.02E-06	2.08E-09	1.69E-10	1.20E-07	1.22E-07
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.03E-07	8.37E-09	5.91E-06	6.02E-06	2.08E-09	1.69E-10	1.20E-07	1.22E-07
241-U-102	2.18E-07	3.68E-07	7.00E-07	1.29E-06	4.24E-09	7.15E-09	1.36E-08	2.50E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.18E-07	3.68E-07	7.00E-07	1.29E-06	4.24E-09	7.15E-09	1.36E-08	2.50E-08
241-U-103	1.37E-07	5.06E-07	5.92E-07	1.24E-06	2.70E-09	9.97E-09	1.17E-08	2.43E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.37E-07	5.06E-07	5.92E-07	1.24E-06	2.70E-09	9.97E-09	1.17E-08	2.43E-08
241-U-104	1.74E-07	2.10E-07	1.67E-06	2.05E-06	2.77E-09	3.34E-09	2.66E-08	3.27E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.74E-07	2.10E-07	1.67E-06	2.05E-06	2.77E-09	3.34E-09	2.66E-08	3.27E-08
241-U-105	1.04E-07	3.73E-07	6.23E-07	1.10E-06	2.01E-09	7.21E-09	1.20E-08	2.13E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.04E-07	3.73E-07	6.23E-07	1.10E-06	2.01E-09	7.21E-09	1.20E-08	2.13E-08
241-U-106	5.91E-07	8.39E-07	1.13E-06	2.56E-06	1.06E-08	1.50E-08	2.03E-08	4.59E-08
Supernatant	8.32E-07	1.01E-06	2.82E-07	2.13E-06	1.29E-08	1.57E-08	4.37E-09	3.30E-08
Solid Layer	5.89E-07	8.37E-07	1.14E-06	2.57E-06	1.06E-08	1.50E-08	2.04E-08	4.60E-08
241-U-107	2.28E-08	5.61E-08	5.99E-07	6.78E-07	4.41E-10	1.09E-09	1.16E-08	1.31E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.28E-08	5.61E-08	5.99E-07	6.78E-07	4.41E-10	1.09E-09	1.16E-08	1.31E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-U-108	7.93E-08	2.24E-07	5.49E-07	8.53E-07	1.51E-09	4.28E-09	1.05E-08	1.63E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.93E-08	2.24E-07	5.49E-07	8.53E-07	1.51E-09	4.28E-09	1.05E-08	1.63E-08
241-U-109	4.24E-08	1.27E-07	7.25E-07	8.94E-07	8.13E-10	2.43E-09	1.39E-08	1.71E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.24E-08	1.27E-07	7.25E-07	8.94E-07	8.13E-10	2.43E-09	1.39E-08	1.71E-08
241-U-110	5.00E-08	2.22E-08	1.03E-06	1.10E-06	9.60E-10	4.27E-10	1.98E-08	2.12E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.00E-08	2.22E-08	1.03E-06	1.10E-06	9.60E-10	4.27E-10	1.98E-08	2.12E-08
241-U-111	6.38E-08	1.10E-07	6.83E-07	8.57E-07	1.15E-09	1.98E-09	1.23E-08	1.55E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.38E-08	1.10E-07	6.83E-07	8.57E-07	1.15E-09	1.98E-09	1.23E-08	1.55E-08
241-U-112	4.39E-08	8.99E-09	3.18E-06	3.24E-06	8.82E-10	1.81E-10	6.40E-08	6.51E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.39E-08	8.99E-09	3.18E-06	3.24E-06	8.82E-10	1.81E-10	6.40E-08	6.51E-08
241-U-201	3.76E-09	0.00E+00	3.47E-06	3.47E-06	7.05E-11	0.00E+00	6.50E-08	6.51E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.76E-09	0.00E+00	3.47E-06	3.47E-06	7.05E-11	0.00E+00	6.50E-08	6.51E-08
241-U-202	3.91E-09	0.00E+00	3.87E-06	3.87E-06	7.32E-11	0.00E+00	7.25E-08	7.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.91E-09	0.00E+00	3.87E-06	3.87E-06	7.32E-11	0.00E+00	7.25E-08	7.26E-08
241-U-203	4.61E-09	0.00E+00	3.87E-06	3.87E-06	8.64E-11	0.00E+00	7.25E-08	7.26E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.61E-09	0.00E+00	3.87E-06	3.87E-06	8.64E-11	0.00E+00	7.25E-08	7.26E-08

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Table B-3. Calculated Hydrogen Generation Rate as Mole Per Unit Waste Weight and Volume for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis RC_{rad} (mole/kg-d)	HGR from thermolysis RC_{therm} (mole/kg-d)	HGR from corrosion RC_{corr} (mole/kg-d)	Total HGR from model RC_{tot} (mole/kg-d)	HGR from radiolysis RC_{rad} (mole/m^3-s)	HGR from thermolysis RC_{therm} (mole/m^3-s)	HGR from corrosion RC_{corr} (mole/m^3-s)	Total HGR from model RC_{tot} (mole/m^3-s)
241-U-204	3.03E-09	6.14E-11	4.41E-06	4.41E-06	5.69E-11	1.15E-12	8.27E-08	8.27E-08
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.03E-09	6.14E-11	4.41E-06	4.41E-06	5.69E-11	1.15E-12	8.27E-08	8.27E-08

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from *radiolysis* G_{rad} (cfm)	HGR from *thermolysis* G_{therm} (cfm)	HGR from *corrosion* G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AN-101	1.92E-05	2.68E-05	3.74E-04	5%	6%	89%	4.20E-04	17
Supernatant	1.92E-05	2.68E-05	3.74E-04	5%	6%	89%	4.20E-04	17
Solid Layer	na	na	na	na	na	na	na	na
241-AN-102	4.17E-03	7.14E-03	7.32E-04	35%	59%	6%	1.20E-02	493
Supernatant	3.67E-03	6.58E-03	4.22E-04	34%	62%	4%	1.07E-02	437
Solid Layer	5.01E-04	5.57E-04	3.10E-04	37%	41%	23%	1.37E-03	56
241-AN-103	7.63E-04	1.61E-03	6.66E-04	25%	53%	22%	3.04E-03	125
Supernatant	5.55E-04	9.90E-04	2.18E-04	32%	56%	12%	1.76E-03	72
Solid Layer	2.08E-04	6.21E-04	4.48E-04	16%	49%	35%	1.28E-03	52
241-AN-104	1.13E-03	2.99E-03	7.15E-04	23%	62%	15%	4.83E-03	198
Supernatant	6.18E-04	1.61E-03	2.42E-04	25%	65%	10%	2.47E-03	101
Solid Layer	5.10E-04	1.37E-03	4.73E-04	22%	58%	20%	2.36E-03	97
241-AN-105	7.57E-04	2.76E-03	7.54E-04	18%	65%	18%	4.27E-03	175
Supernatant	4.11E-04	1.59E-03	2.78E-04	18%	70%	12%	2.28E-03	93
Solid Layer	3.46E-04	1.18E-03	4.76E-04	17%	59%	24%	2.00E-03	82
241-AN-106	6.63E-06	6.30E-06	2.80E-04	2%	2%	96%	2.93E-04	12
Supernatant	2.08E-06	3.78E-06	8.88E-06	14%	26%	60%	1.47E-05	1
Solid Layer	4.56E-06	2.53E-06	2.71E-04	2%	1%	97%	2.78E-04	11
241-AN-107	7.03E-03	1.92E-03	7.20E-04	73%	20%	7%	9.67E-03	396
Supernatant	5.18E-03	1.50E-03	3.44E-04	74%	21%	5%	7.02E-03	288
Solid Layer	1.85E-03	4.26E-04	3.76E-04	70%	16%	14%	2.65E-03	109
241-AP-101	1.35E-04	1.29E-04	7.38E-04	13%	13%	74%	1.00E-03	41
Supernatant	1.35E-04	1.29E-04	7.38E-04	13%	13%	74%	1.00E-03	41
Solid Layer	na	na	na	na	na	na	na	na

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AP-102	2.62E-04	3.20E-04	7.30E-04	20%	24%	56%	1.31E-03	54
Supernatant	2.62E-04	3.20E-04	7.30E-04	20%	24%	56%	1.31E-03	54
Solid Layer	na	na	na	na	na	na	na	na
241-AP-103	8.67E-05	7.46E-05	3.84E-04	16%	14%	70%	5.46E-04	22
Supernatant	8.67E-05	7.46E-05	3.84E-04	16%	14%	70%	5.46E-04	22
Solid Layer	na	na	na	na	na	na	na	na
241-AP-104	3.57E-04	6.24E-04	7.39E-04	21%	36%	43%	1.72E-03	70
Supernatant	3.57E-04	6.24E-04	7.39E-04	21%	36%	43%	1.72E-03	70
Solid Layer	na	na	na	na	na	na	na	na
241-AP-105	2.46E-04	3.39E-04	7.37E-04	19%	26%	56%	1.32E-03	54
Supernatant	2.26E-04	3.16E-04	4.39E-04	23%	32%	45%	9.82E-04	40
Solid Layer	1.91E-05	2.29E-05	2.98E-04	6%	7%	88%	3.40E-04	14
241-AP-106	1.61E-04	2.50E-04	5.31E-04	17%	27%	56%	9.42E-04	39
Supernatant	1.61E-04	2.50E-04	5.31E-04	17%	27%	56%	9.42E-04	39
Solid Layer	na	na	na	na	na	na	na	na
241-AP-107	2.71E-04	6.48E-04	6.88E-04	17%	40%	43%	1.61E-03	66
Supernatant	2.71E-04	6.48E-04	6.88E-04	17%	40%	43%	1.61E-03	66
Solid Layer	na	na	na	na	na	na	na	na
241-AP-108	1.92E-06	2.07E-06	2.78E-04	1%	1%	99%	2.82E-04	12
Supernatant	1.92E-06	2.07E-06	2.78E-04	1%	1%	99%	2.82E-04	12
Solid Layer	na	na	na	na	na	na	na	na
241-AW-101	1.18E-03	3.13E-03	7.49E-04	23%	62%	15%	5.06E-03	208
Supernatant	8.18E-04	2.13E-03	3.22E-04	25%	65%	10%	3.27E-03	134
Solid Layer	3.65E-04	1.00E-03	4.28E-04	20%	56%	24%	1.79E-03	74

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AW-102	1.53E-04	2.55E-07	3.00E-04	34%	0%	66%	4.53E-04	19
Supernatant	9.36E-07	1.87E-07	2.34E-05	4%	1%	95%	2.45E-05	1
Solid Layer	1.52E-04	6.88E-08	2.76E-04	35%	0%	65%	4.28E-04	18
241-AW-103	1.03E-04	1.81E-04	7.40E-04	10%	18%	72%	1.02E-03	42
Supernatant	9.41E-05	1.41E-04	3.39E-04	16%	25%	59%	5.74E-04	24
Solid Layer	8.80E-06	3.98E-05	4.01E-04	2%	9%	89%	4.49E-04	18
241-AW-104	2.69E-05	4.25E-06	3.96E-04	6%	1%	93%	4.28E-04	18
Supernatant	2.71E-07	1.34E-06	3.94E-05	1%	3%	96%	4.10E-05	2
Solid Layer	2.66E-05	2.91E-06	3.57E-04	7%	1%	92%	3.87E-04	16
241-AW-105	1.84E-05	3.89E-06	4.42E-04	4%	1%	95%	4.64E-04	19
Supernatant	1.15E-06	1.70E-06	7.26E-05	2%	2%	96%	7.54E-05	3
Solid Layer	1.73E-05	2.19E-06	3.69E-04	4%	1%	95%	3.89E-04	16
241-AW-106	1.55E-04	5.87E-04	4.04E-04	13%	51%	35%	1.15E-03	47
Supernatant	1.78E-05	1.07E-04	2.63E-05	12%	71%	17%	1.51E-04	6
Solid Layer	1.37E-04	4.80E-04	3.78E-04	14%	48%	38%	9.95E-04	41
241-AY-101	3.75E-04	8.03E-05	3.56E-04	46%	10%	44%	8.12E-04	33
Supernatant	5.15E-06	4.79E-05	3.93E-05	6%	52%	43%	9.23E-05	4
Solid Layer	3.70E-04	3.24E-05	3.17E-04	51%	5%	44%	7.20E-04	29
241-AY-102	3.00E-02	1.24E-03	5.71E-04	94%	4%	2%	3.18E-02	1303
Supernatant	2.26E-04	3.31E-04	2.11E-04	29%	43%	27%	7.68E-04	31
Solid Layer	2.98E-02	9.08E-04	3.60E-04	96%	3%	1%	3.10E-02	1272
241-AZ-101	4.14E-03	1.94E-03	7.58E-04	61%	28%	11%	6.83E-03	280
Supernatant	1.81E-03	1.68E-03	4.32E-04	46%	43%	11%	3.92E-03	160
Solid Layer	2.33E-03	2.60E-04	3.25E-04	80%	9%	11%	2.92E-03	120

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-AZ-102	5.56E-03	4.38E-03	7.41E-04	52%	41%	7%	1.07E-02	438
Supernatant	3.34E-03	4.00E-03	4.09E-04	43%	52%	5%	7.75E-03	318
Solid Layer	2.22E-03	3.78E-04	3.32E-04	76%	13%	11%	2.93E-03	120
241-SY-101	7.67E-04	2.17E-03	6.86E-04	21%	60%	19%	3.62E-03	148
Supernatant	5.58E-04	1.59E-03	3.03E-04	23%	65%	12%	2.45E-03	101
Solid Layer	2.09E-04	5.76E-04	3.84E-04	18%	49%	33%	1.17E-03	48
241-SY-102	5.00E-04	9.65E-04	7.45E-04	23%	44%	34%	2.21E-03	91
Supernatant	4.84E-04	9.19E-04	4.34E-04	26%	50%	24%	1.84E-03	75
Solid Layer	1.60E-05	4.60E-05	3.11E-04	4%	12%	83%	3.73E-04	15
241-SY-103	7.99E-04	1.93E-03	5.88E-04	24%	58%	18%	3.31E-03	136
Supernatant	5.15E-04	1.19E-03	1.78E-04	27%	63%	9%	1.89E-03	77
Solid Layer	2.84E-04	7.33E-04	4.10E-04	20%	51%	29%	1.43E-03	58
241-A-101	8.44E-04	1.11E-02	1.16E-03	6%	85%	9%	1.31E-02	538
Supernatant	3.66E-04	5.21E-03	8.02E-04	6%	82%	13%	6.37E-03	261
Solid Layer	4.78E-04	5.92E-03	3.58E-04	7%	88%	5%	6.75E-03	277
241-A-102	7.21E-05	7.16E-05	5.78E-04	10%	10%	80%	7.22E-04	30
Supernatant	2.61E-06	5.06E-06	1.62E-06	28%	54%	17%	9.30E-06	0
Solid Layer	6.95E-05	6.66E-05	5.76E-04	10%	9%	81%	7.12E-04	29
241-A-103	3.15E-04	2.68E-03	8.78E-04	8%	69%	23%	3.87E-03	159
Supernatant	5.20E-06	5.78E-05	3.98E-06	8%	86%	6%	6.69E-05	3
Solid Layer	3.10E-04	2.62E-03	8.74E-04	8%	69%	23%	3.81E-03	156
241-A-104	3.51E-03	5.30E-04	5.72E-04	76%	12%	12%	4.61E-03	189
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.51E-03	5.30E-04	5.72E-04	76%	12%	12%	4.61E-03	189

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA
Supernatant	NA	NA	NA	NA	NA	NA	NA	NA
Solid Layer	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	1.10E-03	7.18E-04	6.39E-04	45%	29%	26%	2.46E-03	101
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.10E-03	7.18E-04	6.39E-04	45%	29%	26%	2.46E-03	101
241-AX-101	6.41E-04	5.19E-03	8.73E-04	10%	77%	13%	6.70E-03	275
Supernatant	2.97E-04	2.68E-03	3.41E-07	10%	90%	0%	2.97E-03	122
Solid Layer	3.44E-04	2.51E-03	8.73E-04	9%	67%	23%	3.73E-03	153
241-AX-102	1.95E-04	3.17E-05	5.59E-04	25%	4%	71%	7.85E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.95E-04	3.17E-05	5.59E-04	25%	4%	71%	7.85E-04	32
241-AX-103	1.30E-03	1.31E-03	6.42E-04	40%	40%	20%	3.25E-03	133
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.30E-03	1.31E-03	6.42E-04	40%	40%	20%	3.25E-03	133
241-AX-104	8.93E-05	2.81E-07	5.51E-04	14%	0%	86%	6.40E-04	26
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.93E-05	2.81E-07	5.51E-04	14%	0%	86%	6.40E-04	26
241-B-101	1.04E-04	6.34E-12	6.36E-04	14%	0%	86%	7.40E-04	30
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.04E-04	6.34E-12	6.36E-04	14%	0%	86%	7.40E-04	30
241-B-102	2.26E-07	6.05E-14	5.47E-04	0%	0%	100%	5.47E-04	22
Supernatant	7.05E-08	1.37E-14	5.30E-09	93%	0%	7%	7.58E-08	0
Solid Layer	1.56E-07	4.68E-14	5.47E-04	0%	0%	100%	5.47E-04	22

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-B-103	8.09E-07	2.08E-13	5.69E-04	0%	0%	100%	5.70E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.09E-07	2.08E-13	5.69E-04	0%	0%	100%	5.70E-04	23
241-B-104	1.56E-05	1.67E-12	8.35E-04	2%	0%	98%	8.51E-04	35
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.56E-05	1.67E-12	8.35E-04	2%	0%	98%	8.51E-04	35
241-B-105	1.17E-06	3.29E-13	7.64E-04	0%	0%	100%	7.65E-04	31
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.17E-06	3.29E-13	7.64E-04	0%	0%	100%	7.65E-04	31
241-B-106	6.32E-06	4.06E-13	6.22E-04	1%	0%	99%	6.29E-04	26
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.32E-06	4.06E-13	6.22E-04	1%	0%	99%	6.29E-04	26
241-B-107	1.50E-05	1.13E-13	6.48E-04	2%	0%	98%	6.63E-04	27
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.50E-05	1.13E-13	6.48E-04	2%	0%	98%	6.63E-04	27
241-B-108	5.28E-07	1.22E-13	5.97E-04	0%	0%	100%	5.98E-04	24
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.28E-07	1.22E-13	5.97E-04	0%	0%	100%	5.98E-04	24
241-B-109	4.99E-05	4.28E-13	6.25E-04	7%	0%	93%	6.75E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.99E-05	4.28E-13	6.25E-04	7%	0%	93%	6.75E-04	28
241-B-110	5.62E-05	0.00E+00	7.31E-04	7%	0%	93%	7.87E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.62E-05	0.00E+00	7.31E-04	7%	0%	93%	7.87E-04	32

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-B-111	1.47E-04	0.00E+00	7.34E-04	17%	0%	83%	8.81E-04	36
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.47E-04	0.00E+00	7.34E-04	17%	0%	83%	8.81E-04	36
241-B-112	3.35E-06	0.00E+00	5.48E-04	1%	0%	99%	5.51E-04	23
Supernatant	0.00E+00	0.00E+00	4.56E-09	0%	0%	100%	4.56E-09	0
Solid Layer	3.35E-06	0.00E+00	5.48E-04	1%	0%	99%	5.51E-04	23
241-B-201	4.38E-08	7.50E-07	1.32E-04	0%	1%	99%	1.33E-04	5
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.38E-08	7.50E-07	1.32E-04	0%	1%	99%	1.33E-04	5
241-B-202	1.08E-07	1.80E-06	1.30E-04	0%	1%	99%	1.32E-04	5
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.08E-07	1.80E-06	1.30E-04	0%	1%	99%	1.32E-04	5
241-B-203	5.21E-08	0.00E+00	1.93E-04	0%	0%	100%	1.93E-04	8
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.21E-08	0.00E+00	1.93E-04	0%	0%	100%	1.93E-04	8
241-B-204	2.77E-08	0.00E+00	1.94E-04	0%	0%	100%	1.94E-04	8
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.77E-08	0.00E+00	1.94E-04	0%	0%	100%	1.94E-04	8
241-BX-101	2.77E-05	2.49E-06	5.68E-04	5%	0%	95%	5.98E-04	25
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.77E-05	2.49E-06	5.68E-04	5%	0%	95%	5.98E-04	25
241-BX-102	6.00E-05	4.51E-06	6.20E-04	9%	1%	91%	6.84E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.00E-05	4.51E-06	6.20E-04	9%	1%	91%	6.84E-04	28

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-BX-103	5.57E-05	1.32E-05	5.79E-04	9%	2%	89%	6.47E-04	27
Supernatant	7.16E-08	2.14E-06	1.60E-08	3%	96%	1%	2.22E-06	0
Solid Layer	5.56E-05	1.10E-05	5.79E-04	9%	2%	90%	6.45E-04	26
241-BX-104	3.53E-05	1.28E-05	6.14E-04	5%	2%	93%	6.62E-04	27
Supernatant	3.97E-07	4.77E-07	3.66E-09	45%	54%	0%	8.77E-07	0
Solid Layer	3.49E-05	1.23E-05	6.14E-04	5%	2%	93%	6.61E-04	27
241-BX-105	6.63E-06	4.09E-06	5.80E-04	1%	1%	98%	5.91E-04	24
Supernatant	8.99E-07	1.00E-06	5.87E-09	47%	53%	0%	1.91E-06	0
Solid Layer	5.73E-06	3.09E-06	5.80E-04	1%	1%	99%	5.89E-04	24
241-BX-106	6.43E-06	1.82E-06	5.56E-04	1%	0%	99%	5.64E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.43E-06	1.82E-06	5.56E-04	1%	0%	99%	5.64E-04	23
241-BX-107	6.98E-06	1.96E-05	8.19E-04	1%	2%	97%	8.45E-04	35
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.98E-06	1.96E-05	8.19E-04	1%	2%	97%	8.45E-04	35
241-BX-108	3.51E-06	9.18E-07	5.50E-04	1%	0%	99%	5.54E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.51E-06	9.18E-07	5.50E-04	1%	0%	99%	5.54E-04	23
241-BX-109	2.98E-05	1.45E-05	6.90E-04	4%	2%	94%	7.35E-04	30
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.98E-05	1.45E-05	6.90E-04	4%	2%	94%	7.35E-04	30
241-BX-110	2.32E-05	3.03E-05	6.97E-04	3%	4%	93%	7.50E-04	31
Supernatant	2.29E-07	2.19E-07	1.46E-09	51%	49%	0%	4.49E-07	0
Solid Layer	2.29E-05	3.01E-05	6.97E-04	3%	4%	93%	7.50E-04	31

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-BX-111	1.26E-06	1.12E-06	6.81E-04	0%	0%	100%	6.83E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.26E-06	1.12E-06	6.81E-04	0%	0%	100%	6.83E-04	28
241-BX-112	4.43E-06	0.00E+00	6.59E-04	1%	0%	99%	6.64E-04	27
Supernatant	4.84E-08	0.00E+00	1.78E-09	96%	0%	4%	5.02E-08	0
Solid Layer	4.38E-06	0.00E+00	6.59E-04	1%	0%	99%	6.64E-04	27
241-BY-101	9.04E-05	1.38E-04	8.48E-04	8%	13%	79%	1.08E-03	44
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.04E-05	1.38E-04	8.48E-04	8%	13%	79%	1.08E-03	44
241-BY-102	8.33E-06	1.03E-05	7.62E-04	1%	1%	98%	7.81E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.33E-06	1.03E-05	7.62E-04	1%	1%	98%	7.81E-04	32
241-BY-103	2.69E-05	3.95E-05	8.91E-04	3%	4%	93%	9.57E-04	39
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.69E-05	3.95E-05	8.91E-04	3%	4%	93%	9.57E-04	39
241-BY-104	8.59E-05	4.90E-04	8.46E-04	6%	34%	60%	1.42E-03	58
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.59E-05	4.90E-04	8.46E-04	6%	34%	60%	1.42E-03	58
241-BY-105	4.73E-05	3.37E-04	1.01E-03	3%	24%	72%	1.39E-03	57
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.73E-05	3.37E-04	1.01E-03	3%	24%	72%	1.39E-03	57
241-BY-106	1.26E-04	1.05E-03	1.01E-03	6%	48%	46%	2.19E-03	90
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.26E-04	1.05E-03	1.01E-03	6%	48%	46%	2.19E-03	90

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-BY-107	4.81E-05	4.89E-04	7.72E-04	4%	37%	59%	1.31E-03	54
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.81E-05	4.89E-04	7.72E-04	4%	37%	59%	1.31E-03	54
241-BY-108	4.98E-05	2.48E-04	7.31E-04	5%	24%	71%	1.03E-03	42
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.98E-05	2.48E-04	7.31E-04	5%	24%	71%	1.03E-03	42
241-BY-109	2.32E-05	6.88E-06	7.49E-04	3%	1%	96%	7.79E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.32E-05	6.88E-06	7.49E-04	3%	1%	96%	7.79E-04	32
241-BY-110	1.40E-04	1.20E-03	8.49E-04	6%	55%	39%	2.19E-03	90
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.40E-04	1.20E-03	8.49E-04	6%	55%	39%	2.19E-03	90
241-BY-111	3.65E-06	6.75E-06	7.89E-04	0%	1%	99%	7.99E-04	33
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.65E-06	6.75E-06	7.89E-04	0%	1%	99%	7.99E-04	33
241-BY-112	4.36E-06	1.48E-05	7.76E-04	1%	2%	98%	7.95E-04	33
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.36E-06	1.48E-05	7.76E-04	1%	2%	98%	7.95E-04	33
241-C-101	4.99E-05	1.11E-05	6.23E-04	7%	2%	91%	6.84E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.99E-05	1.11E-05	6.23E-04	7%	2%	91%	6.84E-04	28
241-C-102	8.78E-05	3.05E-05	8.07E-04	9%	3%	87%	9.25E-04	38
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.78E-05	3.05E-05	8.07E-04	9%	3%	87%	9.25E-04	38

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-C-103	2.93E-03	4.63E-05	6.70E-04	80%	1%	18%	3.64E-03	149
Supernatant	4.81E-05	1.83E-05	1.11E-07	72%	28%	0%	6.65E-05	3
Solid Layer	2.88E-03	2.79E-05	6.69E-04	80%	1%	19%	3.57E-03	146
241-C-104	2.67E-04	1.92E-04	7.75E-04	22%	16%	63%	1.23E-03	51
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.67E-04	1.92E-04	7.75E-04	22%	16%	63%	1.23E-03	51
241-C-105	1.25E-04	5.12E-06	6.77E-04	16%	1%	84%	8.08E-04	33
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.25E-04	5.12E-06	6.77E-04	16%	1%	84%	8.08E-04	33
241-C-106	2.51E-04	5.02E-06	5.44E-04	31%	1%	68%	8.00E-04	33
Supernatant	1.02E-05	4.56E-06	4.40E-08	69%	31%	0%	1.48E-05	1
Solid Layer	2.41E-04	4.68E-07	5.44E-04	31%	0%	69%	7.86E-04	32
241-C-107	7.16E-04	2.27E-04	7.90E-04	41%	13%	46%	1.73E-03	71
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.16E-04	2.27E-04	7.90E-04	41%	13%	46%	1.73E-03	71
241-C-108	1.33E-05	6.29E-06	5.90E-04	2%	1%	97%	6.10E-04	25
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.33E-05	6.29E-06	5.90E-04	2%	1%	97%	6.10E-04	25
241-C-109	7.65E-05	6.34E-06	5.89E-04	11%	1%	88%	6.71E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.65E-05	6.34E-06	5.89E-04	11%	1%	88%	6.71E-04	28
241-C-110	1.66E-06	4.92E-07	6.78E-04	0%	0%	100%	6.80E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.66E-06	4.92E-07	6.78E-04	0%	0%	100%	6.80E-04	28

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-C-111	9.86E-05	2.69E-06	5.82E-04	14%	0%	85%	6.83E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.86E-05	2.69E-06	5.82E-04	14%	0%	85%	6.83E-04	28
241-C-112	1.85E-04	1.42E-05	6.27E-04	22%	2%	76%	8.26E-04	34
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.85E-04	1.42E-05	6.27E-04	22%	2%	76%	8.26E-04	34
241-C-201	7.25E-08	2.98E-08	4.03E-05	0%	0%	100%	4.04E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.25E-08	2.98E-08	4.03E-05	0%	0%	100%	4.04E-05	2
241-C-202	1.01E-08	3.79E-09	4.02E-05	0%	0%	100%	4.03E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.01E-08	3.79E-09	4.02E-05	0%	0%	100%	4.03E-05	2
241-C-203	1.26E-07	5.89E-08	4.52E-05	0%	0%	100%	4.54E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.26E-07	5.89E-08	4.52E-05	0%	0%	100%	4.54E-05	2
241-C-204	9.51E-08	8.77E-08	4.48E-05	0%	0%	100%	4.50E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.51E-08	8.77E-08	4.48E-05	0%	0%	100%	4.50E-05	2
241-S-101	2.30E-04	4.16E-04	9.20E-04	15%	27%	59%	1.57E-03	64
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.30E-04	4.16E-04	9.20E-04	15%	27%	59%	1.57E-03	64
241-S-102	8.56E-05	3.28E-04	8.26E-04	7%	26%	67%	1.24E-03	51
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	8.56E-05	3.28E-04	8.26E-04	7%	26%	67%	1.24E-03	51

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-S-103	5.24E-05	8.57E-05	7.36E-04	6%	10%	84%	8.75E-04	36
Supernatant	4.11E-07	5.42E-07	1.18E-09	43%	57%	0%	9.55E-07	0
Solid Layer	5.20E-05	8.52E-05	7.36E-04	6%	10%	84%	8.74E-04	36
241-S-104	7.50E-05	2.82E-05	7.97E-04	8%	3%	89%	9.00E-04	37
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.50E-05	2.82E-05	7.97E-04	8%	3%	89%	9.00E-04	37
241-S-105	3.49E-05	9.20E-05	8.78E-04	3%	9%	87%	1.01E-03	41
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.49E-05	9.20E-05	8.78E-04	3%	9%	87%	1.01E-03	41
241-S-106	3.74E-05	4.86E-05	9.16E-04	4%	5%	91%	1.00E-03	41
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.74E-05	4.86E-05	9.16E-04	4%	5%	91%	1.00E-03	41
241-S-107	7.52E-05	9.05E-05	8.54E-04	7%	9%	84%	1.02E-03	42
Supernatant	1.46E-06	4.90E-06	1.75E-08	23%	77%	0%	6.38E-06	0
Solid Layer	7.38E-05	8.56E-05	8.54E-04	7%	8%	84%	1.01E-03	42
241-S-108	7.59E-06	2.37E-05	1.01E-03	1%	2%	97%	1.04E-03	42
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.59E-06	2.37E-05	1.01E-03	1%	2%	97%	1.04E-03	42
241-S-109	4.10E-06	1.72E-05	9.89E-04	0%	2%	98%	1.01E-03	41
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.10E-06	1.72E-05	9.89E-04	0%	2%	98%	1.01E-03	41
241-S-110	5.59E-05	2.17E-04	8.77E-04	5%	19%	76%	1.15E-03	47
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.59E-05	2.17E-04	8.77E-04	5%	19%	76%	1.15E-03	47

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-S-111	1.19E-04	7.96E-05	8.94E-04	11%	7%	82%	1.09E-03	45
Supernatant	1.12E-05	1.27E-05	5.32E-08	47%	53%	0%	2.40E-05	1
Solid Layer	1.07E-04	6.69E-05	8.94E-04	10%	6%	84%	1.07E-03	44
241-S-112	2.45E-04	1.32E-03	9.73E-04	10%	52%	38%	2.54E-03	104
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.45E-04	1.32E-03	9.73E-04	10%	52%	38%	2.54E-03	104
241-SX-101	1.51E-04	3.67E-04	9.34E-04	10%	25%	64%	1.45E-03	59
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.51E-04	3.67E-04	9.34E-04	10%	25%	64%	1.45E-03	59
241-SX-102	3.06E-04	2.78E-03	9.98E-04	8%	68%	24%	4.08E-03	167
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.06E-04	2.78E-03	9.98E-04	8%	68%	24%	4.08E-03	167
241-SX-103	7.79E-04	1.29E-02	9.99E-04	5%	88%	7%	1.47E-02	602
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.79E-04	1.29E-02	9.99E-04	5%	88%	7%	1.47E-02	602
241-SX-104	3.94E-04	2.53E-03	9.40E-04	10%	66%	24%	3.87E-03	158
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.94E-04	2.53E-03	9.40E-04	10%	66%	24%	3.87E-03	158
241-SX-105	5.68E-04	1.52E-02	8.48E-04	3%	91%	5%	1.66E-02	680
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.68E-04	1.52E-02	8.48E-04	3%	91%	5%	1.66E-02	680
241-SX-106	1.10E-04	3.88E-04	8.92E-04	8%	28%	64%	1.39E-03	57
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.10E-04	3.88E-04	8.92E-04	8%	28%	64%	1.39E-03	57

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-SX-107	5.03E-05	1.24E-04	6.64E-04	6%	15%	79%	8.38E-04	34
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.03E-05	1.24E-04	6.64E-04	6%	15%	79%	8.38E-04	34
241-SX-108	1.23E-04	1.39E-04	6.59E-04	13%	15%	72%	9.21E-04	38
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.23E-04	1.39E-04	6.59E-04	13%	15%	72%	9.21E-04	38
241-SX-109	5.02E-04	2.77E-03	7.96E-04	12%	68%	20%	4.06E-03	167
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.02E-04	2.77E-03	7.96E-04	12%	68%	20%	4.06E-03	167
241-SX-110	2.11E-04	1.01E-03	6.56E-04	11%	54%	35%	1.88E-03	77
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.11E-04	1.01E-03	6.56E-04	11%	54%	35%	1.88E-03	77
241-SX-111	6.25E-05	3.74E-04	6.95E-04	6%	33%	61%	1.13E-03	46
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.25E-05	3.74E-04	6.95E-04	6%	33%	61%	1.13E-03	46
241-SX-112	3.40E-05	4.26E-05	6.46E-04	5%	6%	89%	7.23E-04	30
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.40E-05	4.26E-05	6.46E-04	5%	6%	89%	7.23E-04	30
241-SX-113	2.13E-06	1.75E-06	5.52E-04	0%	0%	99%	5.56E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.13E-06	1.75E-06	5.52E-04	0%	0%	99%	5.56E-04	23
241-SX-114	5.17E-05	3.07E-04	7.27E-04	5%	28%	67%	1.09E-03	44
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.17E-05	3.07E-04	7.27E-04	5%	28%	67%	1.09E-03	44

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-SX-115	7.25E-05	3.95E-07	5.35E-04	12%	0%	88%	6.08E-04	25
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.25E-05	3.95E-07	5.35E-04	12%	0%	88%	6.08E-04	25
241-T-101	1.48E-05	3.97E-05	6.09E-04	2%	6%	92%	6.64E-04	27
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.48E-05	3.97E-05	6.09E-04	2%	6%	92%	6.64E-04	27
241-T-102	3.27E-06	2.65E-07	5.35E-04	1%	0%	99%	5.39E-04	22
Supernatant	3.75E-07	1.13E-07	1.79E-08	74%	22%	4%	5.06E-07	0
Solid Layer	2.89E-06	1.53E-07	5.35E-04	1%	0%	99%	5.38E-04	22
241-T-103	1.49E-05	3.12E-10	5.42E-04	3%	0%	97%	5.57E-04	23
Supernatant	1.81E-07	5.11E-11	5.33E-09	97%	0%	3%	1.86E-07	0
Solid Layer	1.47E-05	2.61E-10	5.42E-04	3%	0%	97%	5.57E-04	23
241-T-104	7.85E-07	1.59E-05	7.91E-04	0%	2%	98%	8.08E-04	33
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.85E-07	1.59E-05	7.91E-04	0%	2%	98%	8.08E-04	33
241-T-105	1.15E-05	1.14E-06	5.97E-04	2%	0%	98%	6.09E-04	25
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.15E-05	1.14E-06	5.97E-04	2%	0%	98%	6.09E-04	25
241-T-106	3.05E-07	3.75E-07	5.42E-04	0%	0%	100%	5.43E-04	22
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.05E-07	3.75E-07	5.42E-04	0%	0%	100%	5.43E-04	22
241-T-107	1.80E-05	7.21E-06	6.73E-04	3%	1%	96%	6.98E-04	29
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.80E-05	7.21E-06	6.73E-04	3%	1%	96%	6.98E-04	29

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-T-108	1.08E-07	2.91E-14	5.39E-04	0%	0%	100%	5.39E-04	22
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.08E-07	2.91E-14	5.39E-04	0%	0%	100%	5.39E-04	22
241-T-109	2.91E-07	1.99E-13	5.74E-04	0%	0%	100%	5.75E-04	24
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.91E-07	1.99E-13	5.74E-04	0%	0%	100%	5.75E-04	24
241-T-110	6.20E-05	0.00E+00	8.36E-04	7%	0%	93%	8.98E-04	37
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.20E-05	0.00E+00	8.36E-04	7%	0%	93%	8.98E-04	37
241-T-111	2.24E-06	2.56E-05	9.08E-04	0%	3%	97%	9.36E-04	38
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.24E-06	2.56E-05	9.08E-04	0%	3%	97%	9.36E-04	38
241-T-112	1.21E-06	0.00E+00	5.74E-04	0%	0%	100%	5.75E-04	24
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.21E-06	0.00E+00	5.74E-04	0%	0%	100%	5.75E-04	24
241-T-201	1.71E-09	0.00E+00	1.29E-04	0%	0%	100%	1.29E-04	5
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.71E-09	0.00E+00	1.29E-04	0%	0%	100%	1.29E-04	5
241-T-202	5.78E-10	1.07E-06	1.05E-04	0%	1%	99%	1.06E-04	4
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.78E-10	1.07E-06	1.05E-04	0%	1%	99%	1.06E-04	4
241-T-203	6.05E-10	1.77E-06	1.54E-04	0%	1%	99%	1.56E-04	6
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.05E-10	1.77E-06	1.54E-04	0%	1%	99%	1.56E-04	6

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-T-204	4.47E-10	2.05E-06	1.54E-04	0%	1%	99%	1.56E-04	6
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.47E-10	2.05E-06	1.54E-04	0%	1%	99%	1.56E-04	6
241-TX-101	1.04E-04	5.54E-05	6.06E-04	14%	7%	79%	7.66E-04	31
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.04E-04	5.54E-05	6.06E-04	14%	7%	79%	7.66E-04	31
241-TX-102	1.74E-05	6.06E-05	7.21E-04	2%	8%	90%	7.99E-04	33
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.74E-05	6.06E-05	7.21E-04	2%	8%	90%	7.99E-04	33
241-TX-103	1.28E-05	2.99E-05	6.49E-04	2%	4%	94%	6.91E-04	28
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.28E-05	2.99E-05	6.49E-04	2%	4%	94%	6.91E-04	28
241-TX-104	2.34E-05	1.66E-06	5.81E-04	4%	0%	96%	6.06E-04	25
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.34E-05	1.66E-06	5.81E-04	4%	0%	96%	6.06E-04	25
241-TX-105	2.09E-05	1.42E-04	1.02E-03	2%	12%	86%	1.18E-03	48
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.09E-05	1.42E-04	1.02E-03	2%	12%	86%	1.18E-03	48
241-TX-106	3.70E-05	1.15E-04	8.31E-04	4%	12%	85%	9.83E-04	40
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.70E-05	1.15E-04	8.31E-04	4%	12%	85%	9.83E-04	40
241-TX-107	4.86E-06	6.45E-06	5.52E-04	1%	1%	98%	5.63E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.86E-06	6.45E-06	5.52E-04	1%	1%	98%	5.63E-04	23

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-TX-108	5.41E-06	1.01E-05	6.31E-04	1%	2%	98%	6.47E-04	26
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.41E-06	1.01E-05	6.31E-04	1%	2%	98%	6.47E-04	26
241-TX-109	6.32E-06	2.22E-05	8.34E-04	1%	3%	97%	8.63E-04	35
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.32E-06	2.22E-05	8.34E-04	1%	3%	97%	8.63E-04	35
241-TX-110	1.41E-05	5.69E-05	9.22E-04	1%	6%	93%	9.93E-04	41
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.41E-05	5.69E-05	9.22E-04	1%	6%	93%	9.93E-04	41
241-TX-111	1.15E-05	4.39E-05	8.39E-04	1%	5%	94%	8.94E-04	37
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.15E-05	4.39E-05	8.39E-04	1%	5%	94%	8.94E-04	37
241-TX-112	2.35E-05	5.71E-05	1.06E-03	2%	5%	93%	1.14E-03	47
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.35E-05	5.71E-05	1.06E-03	2%	5%	93%	1.14E-03	47
241-TX-113	1.85E-06	4.95E-05	1.07E-03	0%	4%	95%	1.12E-03	46
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.85E-06	4.95E-05	1.07E-03	0%	4%	95%	1.12E-03	46
241-TX-114	7.14E-06	8.94E-06	9.64E-04	1%	1%	98%	9.80E-04	40
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.14E-06	8.94E-06	9.64E-04	1%	1%	98%	9.80E-04	40
241-TX-115	1.33E-05	3.17E-05	9.93E-04	1%	3%	96%	1.04E-03	43
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.33E-05	3.17E-05	9.93E-04	1%	3%	96%	1.04E-03	43

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-TX-116	1.90E-06	9.29E-13	1.02E-03	0%	0%	100%	1.03E-03	42
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.90E-06	9.29E-13	1.02E-03	0%	0%	100%	1.03E-03	42
241-TX-117	1.97E-06	2.13E-13	9.26E-04	0%	0%	100%	9.28E-04	38
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.97E-06	2.13E-13	9.26E-04	0%	0%	100%	9.28E-04	38
241-TX-118	4.31E-05	6.79E-05	7.45E-04	5%	8%	87%	8.56E-04	35
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.31E-05	6.79E-05	7.45E-04	5%	8%	87%	8.56E-04	35
241-TY-101	1.62E-07	8.09E-14	6.23E-04	0%	0%	100%	6.23E-04	26
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.62E-07	8.09E-14	6.23E-04	0%	0%	100%	6.23E-04	26
241-TY-102	2.21E-06	7.06E-06	5.79E-04	0%	1%	98%	5.88E-04	24
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.21E-06	7.06E-06	5.79E-04	0%	1%	98%	5.88E-04	24
241-TY-103	3.54E-05	1.37E-04	6.56E-04	4%	17%	79%	8.29E-04	34
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.54E-05	1.37E-04	6.56E-04	4%	17%	79%	8.29E-04	34
241-TY-104	5.54E-06	7.63E-07	5.59E-04	1%	0%	99%	5.65E-04	23
Supernatant	8.87E-09	1.84E-08	1.42E-09	31%	64%	5%	2.87E-08	0
Solid Layer	5.53E-06	7.44E-07	5.59E-04	1%	0%	99%	5.65E-04	23
241-TY-105	3.31E-05	1.76E-05	7.25E-04	4%	2%	93%	7.76E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.31E-05	1.76E-05	7.25E-04	4%	2%	93%	7.76E-04	32

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-TY-106	1.09E-06	3.31E-07	5.35E-04	0%	0%	100%	5.36E-04	22
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.09E-06	3.31E-07	5.35E-04	0%	0%	100%	5.36E-04	22
241-U-101	9.47E-06	7.73E-07	5.45E-04	2%	0%	98%	5.56E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	9.47E-06	7.73E-07	5.45E-04	2%	0%	98%	5.56E-04	23
241-U-102	2.46E-04	4.16E-04	7.92E-04	17%	29%	54%	1.45E-03	60
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.46E-04	4.16E-04	7.92E-04	17%	29%	54%	1.45E-03	60
241-U-103	2.00E-04	7.37E-04	8.62E-04	11%	41%	48%	1.80E-03	74
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	2.00E-04	7.37E-04	8.62E-04	11%	41%	48%	1.80E-03	74
241-U-104	6.61E-05	7.97E-05	6.35E-04	8%	10%	81%	7.81E-04	32
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	6.61E-05	7.97E-05	6.35E-04	8%	10%	81%	7.81E-04	32
241-U-105	1.41E-04	5.06E-04	8.45E-04	9%	34%	57%	1.49E-03	61
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.41E-04	5.06E-04	8.45E-04	9%	34%	57%	1.49E-03	61
241-U-106	3.55E-04	5.05E-04	6.80E-04	23%	33%	44%	1.54E-03	63
Supernatant	4.04E-06	4.92E-06	1.92E-09	45%	55%	0%	8.95E-06	0
Solid Layer	3.51E-04	5.00E-04	6.80E-04	23%	33%	44%	1.53E-03	63
241-U-107	3.25E-05	8.00E-05	8.53E-04	3%	8%	88%	9.66E-04	40
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.25E-05	8.00E-05	8.53E-04	3%	8%	88%	9.66E-04	40

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-U-108	1.32E-04	3.74E-04	9.16E-04	9%	26%	64%	1.42E-03	58
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	1.32E-04	3.74E-04	9.16E-04	9%	26%	64%	1.42E-03	58
241-U-109	4.61E-05	1.38E-04	7.88E-04	5%	14%	81%	9.71E-04	40
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.61E-05	1.38E-04	7.88E-04	5%	14%	81%	9.71E-04	40
241-U-110	3.31E-05	1.47E-05	6.83E-04	5%	2%	93%	7.31E-04	30
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.31E-05	1.47E-05	6.83E-04	5%	2%	93%	7.31E-04	30
241-U-111	7.72E-05	1.33E-04	8.26E-04	7%	13%	80%	1.04E-03	42
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.72E-05	1.33E-04	8.26E-04	7%	13%	80%	1.04E-03	42
241-U-112	7.76E-06	1.59E-06	5.63E-04	1%	0%	98%	5.73E-04	23
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	7.76E-06	1.59E-06	5.63E-04	1%	0%	98%	5.73E-04	23
241-U-201	5.38E-08	0.00E+00	4.96E-05	0%	0%	100%	4.96E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.38E-08	0.00E+00	4.96E-05	0%	0%	100%	4.96E-05	2
241-U-202	4.84E-08	0.00E+00	4.79E-05	0%	0%	100%	4.79E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	4.84E-08	0.00E+00	4.79E-05	0%	0%	100%	4.79E-05	2
241-U-203	5.69E-08	0.00E+00	4.78E-05	0%	0%	100%	4.78E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	5.69E-08	0.00E+00	4.78E-05	0%	0%	100%	4.78E-05	2

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Table B-4. Calculated Total Hydrogen Generation Rate In Dome Space for 177 Tanks. (23 Sheets)

Tank	HGR from radiolysis G_{rad} (cfm)	HGR from thermolysis G_{therm} (cfm)	HGR from corrosion G_{corr} (cfm)	Percent of HGR from radiolysis $(G_{rad})_{\%}$	Percent of HGR from thermolysis $(G_{therm})_{\%}$	Percent of HGR from corrosion $(G_{corr})_{\%}$	Total HGR from model G_{mod} (cfm)	Total HGR from model G_{mod} (L/day)
241-U-204	3.17E-08	6.41E-10	4.61E-05	0%	0%	100%	4.61E-05	2
Supernatant	na	na	na	na	na	na	na	na
Solid Layer	3.17E-08	6.41E-10	4.61E-05	0%	0%	100%	4.61E-05	2

APPENDIX C

CALCULATIONS OF THE HENRY'S LAW CONSTANTS AND THE MASS TRANSPORT PRODUCTS OF h AND A

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Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table C-1. Input Ion Concentration for NH_3 Calculation. (3 Sheets)

Tanks	Na^{+} in liquid (µg/mL)	Al^{+3} in liquid (µg/mL)	Fe^{+3} in liquid (µg/mL)	Cr^{+3} in liquid (µg/mL)	Ni^{+2} in liquid (µg/mL)	K^{+1} in liquid (µg/mL)	OH^{-1} in liquid (µg/mL)	NO_3^{-1} in liquid (µg/mL)	NO_2^{-1} in liquid (µg/mL)	CO_3^{-2} in liquid (µg/mL)	PO_4^{-3} in liquid (µg/mL)	SO_4^{-2} in liquid (µg/mL)	F^{-1} in liquid (µg/mL)	Cl^{-1} in liquid (µg/mL)
241-AN-101	9.29E+04	1.09E+04	6.32E+00	1.21E+02	3.61E+00	2.68E+03	3.08E+04	7.18E+04	4.07E+04	9.65E+03	1.59E+03	1.36E+03	2.89E+02	2.33E+03
241-AN-102	2.27E+05	1.54E+04	4.90E+01	2.97E+02	4.17E+02	2.88E+03	3.23E+03	2.36E+05	9.04E+04	7.00E+04	5.52E+03	1.53E+04	1.91E+03	4.11E+03
241-AN-103	2.85E+05	3.02E+04	3.01E+01	5.66E+02	1.20E+01	1.68E+04	9.93E+04	1.68E+05	1.65E+05	5.80E+03	1.65E+03	1.45E+03	6.60E+02	9.76E+03
241-AN-104	2.56E+05	3.86E+04	3.01E+01	3.36E+02	1.20E+01	6.69E+03	7.09E+04	1.70E+05	1.25E+05	1.07E+04	2.71E+03	3.54E+03	8.19E+01	8.09E+03
241-AN-105	2.46E+05	4.11E+04	2.47E+01	2.22E+02	9.95E+00	6.50E+03	5.86E+04	1.62E+05	1.21E+05	1.18E+04	1.22E+03	2.85E+03	3.06E+02	9.90E+03
241-AN-106	7.56E+04	3.22E+03	1.77E+00	9.91E+01	2.79E+02	5.96E+03	9.93E+04	6.58E+04	1.76E+04	2.18E+04	2.02E+03	5.50E+03	5.11E+03	9.60E+02
241-AN-107	2.03E+05	2.93E+02	1.67E+03	1.72E+02	5.51E+02	1.81E+03	9.93E+04	2.38E+05	6.59E+04	7.55E+04	2.94E+03	8.98E+03	4.18E+03	2.02E+03
241-AP-101	1.29E+05	6.94E+03	2.50E+00	1.43E+02	7.90E+00	3.12E+04	4.94E+04	1.32E+05	4.19E+04	3.23E+04	1.02E+03	4.03E+03	2.90E+03	1.98E+03
241-AP-102	1.02E+05	1.15E+04	3.82E+00	6.19E+02	2.66E+01	1.29E+03	9.09E+03	7.60E+04	3.59E+04	2.66E+04	1.16E+04	4.52E+03	1.68E+02	2.73E+03
241-AP-103	1.81E+05	8.43E+03	3.01E+01	3.72E+02	1.22E+02	1.33E+04	9.51E+03	1.35E+05	1.06E+05	7.55E+04	3.46E+03	4.50E+03	2.09E+03	2.82E+03
241-AP-104	1.36E+05	1.97E+04	1.04E+02	1.37E+03	7.85E+01	2.11E+03	2.26E+03	1.13E+05	6.74E+04	1.93E+04	3.86E+03	3.84E+03	4.15E+02	5.49E+03
241-AP-105	1.90E+05	2.07E+04	3.01E+01	5.13E+02	2.54E+01	1.23E+04	3.35E+04	2.32E+05	1.01E+05	1.12E+05	3.16E+03	6.78E+03	4.74E+03	5.45E+03
241-AP-106	1.22E+05	1.83E+04	1.13E+02	1.57E+03	7.56E+01	3.12E+03	9.01E+03	9.03E+04	6.14E+04	1.88E+04	2.76E+03	3.20E+03	6.71E+02	4.92E+03
241-AP-107	7.97E+04	8.69E+03	1.01E+01	6.55E+02	2.36E+00	1.58E+03	7.28E+03	9.56E+04	2.80E+04	4.55E+03	4.84E+03	2.41E+03	7.22E+02	2.29E+03
241-AP-108	9.03E+04	1.09E+04	1.01E+01	8.21E+02	4.02E+00	2.85E+03	1.39E+04	9.10E+04	3.27E+04	1.27E+04	3.40E+03	2.72E+03	9.70E+02	2.86E+03
241-AW-101	2.53E+05	3.07E+04	1.80E+01	1.12E+02	6.10E+00	4.12E+04	8.63E+04	1.70E+05	1.20E+05	9.20E+03	9.96E+02	1.26E+03	9.62E+02	7.30E+03
241-AW-102	5.68E+04	6.39E+03	6.95E+00	4.81E+02	1.90E+00	1.32E+03	7.45E+03	6.50E+04	2.01E+04	2.31E+03	6.22E+02	1.72E+03	5.42E+02	1.68E+03
241-AW-103	2.46E+04	6.46E+01	5.57E+00	2.53E+01	5.08E+00	1.43E+04	9.62E+03	4.22E+03	1.78E+03	4.70E+03	5.92E+01	6.72E+02	1.68E+04	1.38E+02
241-AW-104	1.74E+04	7.11E+02	1.86E+00	2.20E+00	7.40E-01	1.67E+03	3.55E+03	1.66E+04	5.33E+03	7.25E+03	2.93E+02	6.54E+02	1.32E+02	2.39E+02
241-AW-105	1.49E+04	4.34E+01	4.61E+00	2.12E+00	9.91E-01	1.99E+03	6.12E+03	2.70E+04	1.28E+03	1.62E+03	1.85E+02	3.01E+02	4.81E+02	2.45E+02
241-AW-106	1.77E+05	1.99E+04	2.18E+01	1.47E+03	8.39E+00	5.65E+03	9.80E+03	1.92E+05	6.35E+04	2.84E+04	1.47E+03	5.14E+03	1.23E+03	5.17E+03

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Table C-1. Input Ion Concentration for NH_3 Calculation. (3 Sheets)

Tanks	Na^{+} in liquid (µg/mL)	Al^{+3} in liquid (µg/mL)	Fe^{+3} in liquid (µg/mL)	Cr^{+3} in liquid (µg/mL)	Ni^{+2} in liquid (µg/mL)	K^{+1} in liquid (µg/mL)	OH^{-1} in liquid (µg/mL)	NO_3^{-1} in liquid (µg/mL)	NO_2^{-1} in liquid (µg/mL)	CO_3^{-2} in liquid (µg/mL)	PO_4^{-3} in liquid (µg/mL)	SO_4^{-2} in liquid (µg/mL)	F^{-1} in liquid (µg/mL)	Cl^{-1} in liquid (µg/mL)
241-AY-101	5.19E+04	1.21E+01	1.20E+01	1.05E+02	5.90E+01	7.63E+02	2.29E+02	2.60E+04	3.53E+04	3.44E+04	1.15E+03	5.87E+03	1.74E+02	6.36E+02
241-AY-102	5.40E+04	1.97E+03	1.01E+01	2.91E+01	4.02E+00	3.88E+02	1.44E+03	4.86E+02	7.29E+03	4.87E+04	3.01E+03	2.32E+03	1.72E+02	1.60E+02
241-AZ-101	1.11E+05	8.56E+03	2.24E+01	7.23E+02	8.02E+00	4.76E+03	1.15E+04	7.12E+04	7.26E+04	3.42E+04	1.34E+03	1.50E+04	1.75E+03	1.51E+02
241-AZ-102	5.59E+04	6.68E+02	1.00E+00	7.37E+02	1.75E+00	3.20E+03	1.21E+03	1.85E+04	3.55E+04	3.50E+04	4.97E+02	1.86E+04	1.14E+03	7.66E+01
241-SY-101	1.63E+05	1.34E+04	3.97E+02	5.18E+03	2.02E+02	4.14E+03	2.63E+04	1.52E+05	9.56E+04	3.44E+04	4.94E+03	4.19E+03	5.50E+02	1.11E+04
241-SY-102	9.84E+04	1.44E+04	1.41E+01	2.41E+02	5.04E+01	1.53E+03	1.97E+04	9.20E+04	5.89E+04	1.31E+04	3.48E+03	2.91E+03	1.51E+02	4.64E+03
241-SY-103	2.12E+05	4.14E+04	2.10E+01	3.30E+01	4.90E+01	3.91E+03	2.89E+04	1.79E+05	1.43E+05	3.44E+04	3.12E+03	4.08E+03	3.51E+02	1.16E+04
241-A-101	2.78E+05	5.18E+04	4.29E+01	5.73E+01	1.85E+01	7.42E+03	4.48E+04	2.33E+05	1.65E+05	1.33E+04	5.89E+03	1.40E+03	2.17E+02	9.01E+03
241-A-103	2.20E+05	3.56E+04	1.81E+01	2.96E+02	9.46E+01	5.44E+03	4.48E+04	1.33E+05	1.65E+05	1.33E+04	3.67E+03	1.40E+03	2.17E+02	9.01E+03
241-AX-101	2.82E+05	5.03E+04	3.01E+01	1.75E+02	1.20E+01	7.42E+03	3.90E+04	2.72E+05	1.73E+05	1.10E+04	6.59E+03	1.54E+03	5.78E+01	8.82E+03
241-B-203	3.12E+04	1.00E+01	1.00E+01	1.62E+02	4.02E+00	5.44E+03	3.90E+04	5.67E+04	1.57E+03	1.09E+04	1.90E+03	5.62E+02	6.04E+03	6.77E+02
241-B-204	2.94E+04	8.35E+00	8.35E+00	1.52E+02	3.35E+00	6.42E+03	3.90E+04	4.82E+04	1.82E+03	1.09E+04	7.14E+02	8.24E+02	6.55E+03	6.22E+02
241-C-103	3.53E+04	1.16E+01	5.40E+00	7.86E+01	7.85E+01	3.10E+02	4.49E+04	4.30E+03	2.43E+04	2.94E+04	4.59E+03	3.22E+03	1.16E+03	4.05E+02
241-S-101	2.15E+05	2.45E+04	2.01E+01	8.13E+02	8.02E+00	2.36E+03	4.49E+04	1.81E+05	9.40E+04	5.30E+03	3.86E+03	5.65E+03	1.06E+02	7.45E+03
241-S-102	2.36E+05	4.19E+04	4.01E+01	1.08E+02	1.64E+01	3.25E+03	4.10E+04	1.59E+05	1.14E+05	2.01E+04	4.93E+03	4.63E+03	3.50E+02	1.04E+04
241-S-103	2.28E+05	3.20E+04	3.01E+01	2.69E+02	1.20E+01	3.90E+03	3.65E+04	2.16E+05	1.47E+05	2.21E+04	3.57E+03	5.10E+03	2.56E+02	1.33E+04
241-S-106	2.44E+05	3.85E+04	3.01E+01	9.41E+03	1.20E+01	1.84E+03	5.49E+04	2.40E+05	1.09E+05	1.58E+04	6.38E+03	5.73E+03	1.40E+02	1.11E+04
241-S-111	2.19E+05	2.91E+04	2.01E+01	4.06E+03	8.02E+00	1.64E+03	4.73E+04	1.90E+05	7.05E+04	1.28E+04	1.02E+04	4.32E+03	1.05E+02	6.39E+03
241-SX-101	2.42E+05	7.56E+04	3.56E+01	1.21E+04	3.44E+04	2.52E+03	4.87E+04	1.05E+05	7.80E+04	8.05E+03	5.18E+03	1.83E+03	7.14E+01	1.67E+04
241-SX-102	2.35E+05	4.56E+04	3.65E+01	2.77E+03	1.45E+01	3.55E+03	5.01E+04	1.58E+05	1.51E+05	8.80E+03	3.49E+03	3.33E+03	7.80E+01	1.02E+04
241-SX-103	2.37E+05	4.41E+04	3.01E+01	8.36E+01	2.05E+04	4.24E+03	4.15E+04	1.59E+05	1.58E+05	1.28E+04	3.33E+03	2.01E+03	1.01E+02	1.10E+04

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Table C-1. Input Ion Concentration for NH_3 Calculation. (3 Sheets)

Tanks	Na^{+} in liquid (µg/mL)	Al^{+3} in liquid (µg/mL)	Fe^{+3} in liquid (µg/mL)	Cr^{+3} in liquid (µg/mL)	Ni^{+2} in liquid (µg/mL)	K^{+1} in liquid (µg/mL)	OH^{-1} in liquid (µg/mL)	NO_3^{-1} in liquid (µg/mL)	NO_2^{-1} in liquid (µg/mL)	CO_3^{-2} in liquid (µg/mL)	PO_4^{-3} in liquid (µg/mL)	SO_4^{-2} in liquid (µg/mL)	F^{-1} in liquid (µg/mL)	Cl^{-1} in liquid (µg/mL)
241-SX-104	2.50E+05	3.56E+04	3.38E+01	9.39E+02	1.35E+01	2.88E+03	3.42E+04	2.91E+05	1.17E+05	2.48E+04	1.27E+04	3.90E+03	1.87E+02	8.23E+03
241-SX-105	2.36E+05	4.41E+04	3.01E+01	3.38E+02	1.20E+01	3.38E+03	4.09E+04	1.65E+05	1.43E+05	1.41E+04	3.27E+03	4.20E+03	1.04E+02	9.01E+03
241-SX-106	2.45E+05	2.59E+04	3.01E+01	1.30E+02	1.20E+01	3.89E+03	3.31E+04	2.10E+05	1.32E+05	2.56E+04	3.52E+03	7.20E+03	3.11E+02	1.17E+04
241-SX-108	2.27E+05	1.54E+04	4.90E+01	2.97E+02	4.17E+02	2.88E+03	4.14E+04	2.36E+05	9.04E+04	7.00E+04	5.66E+03	1.53E+04	1.91E+03	4.11E+03
241-T-110	3.70E+04	5.00E+00	5.00E+00	3.46E+01	2.00E+00	3.27E+02	5.11E+03	1.83E+04	5.90E+01	7.00E+04	1.49E+03	4.36E+03	4.22E+03	9.58E+02
241-T-203	4.12E+04	5.05E+00	5.05E+00	4.26E+01	2.02E+00	8.39E+03	5.11E+03	7.37E+04	3.53E+02	7.00E+04	1.90E+03	4.69E+02	7.02E+03	7.07E+02
241-U-102	2.43E+05	1.80E+04	2.01E+01	2.79E+02	1.26E+02	3.77E+03	2.93E+04	2.45E+05	1.05E+05	4.68E+04	3.80E+03	9.84E+03	1.33E+02	8.82E+03
241-U-103	2.31E+05	4.09E+04	3.01E+01	1.08E+02	1.69E+02	4.83E+03	3.08E+04	1.52E+05	1.37E+05	1.56E+04	7.64E+02	2.68E+03	1.09E+03	1.14E+04
241-U-105	2.27E+05	2.98E+04	3.10E+01	2.01E+02	2.48E+02	3.98E+03	2.09E+04	1.81E+05	1.08E+05	2.78E+04	3.92E+03	8.01E+03	1.31E+03	8.92E+03
241-U-106	2.23E+05	1.20E+04	3.93E+01	4.96E+02	5.22E+02	1.89E+03	5.11E+03	2.52E+05	9.90E+04	4.73E+04	3.84E+03	8.64E+03	3.32E+02	5.46E+03
241-U-107	2.21E+05	2.64E+04	3.77E+01	5.75E+02	1.72E+01	3.27E+03	3.61E+04	2.27E+05	1.11E+05	2.65E+04	3.44E+03	6.63E+03	1.67E+02	8.99E+03
241-U-108	2.43E+05	3.29E+04	3.33E+01	1.28E+03	3.13E+01	4.01E+03	4.92E+04	1.81E+05	1.30E+05	2.20E+04	3.13E+03	4.23E+03	7.90E+02	8.94E+03
241-U-109	2.28E+05	2.92E+04	1.00E+02	2.61E+03	4.55E+01	3.33E+03	4.42E+04	1.85E+05	1.28E+05	1.87E+04	3.37E+03	5.17E+03	3.96E+02	8.69E+03

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Table C-2. Calculations of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tanks	$(NH_3)_{ss}$ in dome (ppm)	Liquid NH_3 (µg/mL)	H_2O in liquid (wt%)	Spg in liquid (g/mL)	Waste volume (kL)	Headspace temp. T_h (°C)	Waste temp. T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H* in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-AN-101	11	4.00E+01	70	1.15	606	18	18	8.64	0.82	86.11	1.25	41.96
241-AN-102	300	2.10E+02	48	1.43	4013	29	31	18.10	1.69	46.94	2.03	14.36
241-AN-103	7	3.45E+02	49	1.49	3627	28	38	26.53	2.54	34.01	2.30	4.25
241-AN-104	21	2.46E+02	51	1.40	3986	29	36	22.85	2.24	37.50	2.30	6.17
241-AN-105	15	2.10E+02	50	1.42	4263	28	34	21.62	2.15	40.39	2.26	7.15
241-AN-106	1	2.10E+02	76	1.20	148	18	17	11.59	1.04	88.51	1.38	40.30
241-AN-107	400	2.10E+02	50	1.37	3952	26	29	21.70	1.89	50.67	2.26	16.24
241-AP-101	125	4.39E+02	58	1.31	4221	19	19	13.43	1.22	81.52	1.41	30.97
241-AP-102	75	4.39E+02	75	1.20	4134	20	20	8.15	0.82	77.21	1.23	35.13
241-AP-103	1	2.50E+02	80	1.31	1079	16	16	15.11	1.46	96.18	1.40	24.73
241-AP-104	3	1.33E+02	97	1.29	91	15	15	10.73	1.06	98.90	1.33	37.70
241-AP-105	7	3.24E+02	62	1.35	2896	26	19	19.62	1.84	79.34	1.95	19.84
241-AP-106	5	6.75E+01	94	1.25	352	19	18	9.95	0.99	86.11	1.31	34.54
241-AP-107	5	1.06E+03	87	1.21	3695	17	14	6.67	0.60	101.71	1.17	61.92
241-AP-108	27	8.00E+02	81	1.25	1397	19	16	7.83	0.74	93.55	1.21	49.38
241-AW-101	5	1.00E+01	49	1.47	4263	16	34	24.06	2.31	40.39	2.26	6.46
241-AW-102	3	7.43E+01	88	1.15	303	26	21	4.81	0.44	75.16	1.10	51.68
241-AW-103	138	5.12E+02	93	1.02	1931	27	17	3.09	0.30	88.51	1.10	68.43
241-AW-104	6	1.69E+02	82	1.06	4236	25	21	1.56	0.15	73.16	1.10	68.40
241-AW-105	43	1.01E+03	93	1.02	1624	33	16	1.59	0.12	93.55	1.10	92.16
241-AW-106	28	3.55E+02	59	1.38	1791	33	32	14.42	1.34	44.63	1.60	16.10

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Table C-2. Calculations of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tanks	$(NH_3)_{ss}$ in dome (ppm)	Liquid NH_3 (µg/mL)	H_2O in liquid (wt%)	Spg in liquid (g/mL)	Waste volume (kL)	Headspace temp. T_h (°C)	Waste temp. T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H° in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-AY-101	5	1.13E+02	84	1.09	583	30	38	4.15	0.42	34.01	1.00	20.48
241-AY-102	4	7.37E+01	92	1.12	2355	21	37	3.56	0.43	35.71	1.00	19.65
241-AZ-101	1	1.25E+02	72	1.22	3199	27	51	9.52	0.94	19.43	1.67	10.69
241-AZ-102	6	4.38E+02	84	1.14	3524	19	46	4.54	0.47	24.40	1.00	13.53
241-SY-101	400	1.04E+03	61	1.33	3685	30	32.0	14.89	1.37	43.96	1.63	15.79
241-SY-102	12	1.15E+03	75	1.23	2317	15	22	9.20	0.87	69.34	1.28	32.86
241-SY-103	59.43	1.29E+03	49	1.47	2817	16	31	19.55	1.93	45.77	2.25	10.57
241-A-101	394	5.31E+02	55	1.49	3608	36	60	24.74	2.42	13.69	3.28	2.61
241-A-103	261	5.31E+02	75	1.48	1404	36	58	19.95	1.98	14.96	3.28	4.70
241-AX-101	41	4.10E+03	48	1.49	2832	29	49	25.28	2.42	20.79	2.57	3.32
241-B-203	5	1.00E+02	89	1.17	193	12	12	5.28	0.44	115.89	1.00	76.38
241-B-204	5	1.00E+02	89	1.05	189	14	13	5.11	0.43	107.29	1.00	70.65
241-C-103	324	1.21E+03	86	1.08	750	38	43	5.43	0.53	27.01	1.17	16.99
241-S-101	765	1.21E+03	63	1.36	1616	31	43	18.34	1.73	26.82	2.27	8.66
241-S-102	588	1.70E+03	50	1.39	1946	27	39	20.10	2.03	32.41	2.31	6.54
241-S-103	149	1.41E+03	50	1.45	939	23	28	20.88	1.96	53.20	2.26	13.35
241-S-106	14	2.40E+02	51	1.46	1613	20	25	22.44	2.12	62.01	2.26	12.86
241-S-111	120	1.50E+03	52	1.40	2044	23	28	18.67	1.79	51.99	2.24	14.83
241-SX-101	4	1.32E+02	49	1.46	1696	38	52	21.14	2.37	19.00	2.57	2.14
241-SX-102	5	1.37E+03	48	1.45	1946	33	55	21.34	2.13	16.63	3.28	4.30
241-SX-103	31	1.80E+03	47	1.47	2400	31	62	21.45	2.17	12.84	3.28	3.10

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Table C-2. Calculations of Henry's Law Constant by Schumpe Model. (3 Sheets)

Tanks	$(NH_3)_{ss}$ in dome (ppm)	Liquid NH_3 (µg/mL)	H_2O in liquid (wt%)	Spg in liquid (g/mL)	Waste volume (kL)	Headspace temp. T_h (°C)	Waste temp. T_w (°C)	Sum C_i (mole/m^3)	Sum C_i*H_i (mole/m^3)	K_H° in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-SX-104	5	7.93E+02	51	1.39	1768	29	46	22.36	2.07	23.85	2.57	6.23
241-SX-105	27	1.21E+03	43	1.47	2411	34	63	20.74	2.07	12.06	3.28	3.31
241-SX-106	177	2.50E+03	46	1.42	1601	26	37	20.81	1.96	35.71	2.31	9.06
241-SX-108	5	1.30E+03	47.2	1.43	329	53	72	20.35	1.88	8.86	4.04	4.48
241-T-110	107	1.50E+03	87	1.17	1465	16	17	3.69	0.41	90.99	1.00	53.35
241-T-203	5	1.00E+02	85	1.17	132	15	17	5.08	0.47	89.83	1.00	53.34
241-U-102	651	7.45E+02	48	1.38	1420	24	28	20.47	1.88	53.34	2.26	15.39
241-U-103	722	1.40E+03	49	1.41	1772	25	28	19.59	1.97	51.99	2.26	11.13
241-U-105	1936	1.60E+03	69	1.46	1582	25	30	18.50	1.80	48.15	2.10	12.29
241-U-106	940	1.05E+03	49	1.36	856	24	26	17.81	1.60	57.66	2.01	21.04
241-U-107	448	4.03E+02	58	1.41	1545	23	24	19.69	1.82	62.37	2.00	16.58
241-U-108	684	1.05E+03	50	1.40	1772	24	28	21.29	2.06	51.99	2.26	10.70
241-U-109	5	1.10E+03	52	1.47	1760	23	26	20.17	1.93	57.66	2.26	14.45

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Table C-3. Calculation of Mass Transport Properties for Off-Normal Ventilation Based on Normal Condition. (3 Sheets)

Tanks	Normal vent Q (cfm)	Headspace volume V (ft^3)	Equiv $(NH_3)_{ss}$ in liquid (mole/L)	hA from field data at normal condition (cfm)	Normal steady-state release rate (cfm)	Barometric breathing rate (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	$(NH3)_{ss}$ at off-normal vent (atm)	$(NH3)_{ss}$ at off-normal vent (ppm)	Off-normal steady-state release rate (cfm)
241-AN-101	113	166,700	0.00047	2.85E-02	1.28E-03	0.52	1.74E-04	4.02E-10	5.50E-05	55	2.86E-05
241-AN-102	119	46,387	0.00431	1.80E-01	3.57E-02	0.14	1.38E-03	4.77E-08	8.57E-04	857	1.24E-04
241-AN-103	100	60,023	0.00003	1.33E-03	6.65E-04	0.19	5.46E-06	4.49E-10	2.03E-03	2034	3.82E-04
241-AN-104	100	47,323	0.00013	5.92E-03	2.10E-03	0.15	2.23E-05	1.81E-09	2.01E-03	2011	2.97E-04
241-AN-105	100	37,564	0.00011	5.02E-03	1.51E-03	0.12	2.67E-05	1.65E-09	1.52E-03	1523	1.79E-04
241-AN-106	117	182,875	0.00004	3.99E-04	1.17E-04	0.57	5.22E-06	2.69E-11	1.23E-04	123	7.02E-05
241-AN-107	129	48,526	0.00649	3.60E-01	5.16E-02	0.15	2.96E-03	9.15E-08	7.59E-04	759	1.15E-04
241-AP-101	108	39,035	0.00387	2.57E-02	1.35E-02	0.12	4.92E-04	1.70E-08	8.27E-04	827	1.01E-04
241-AP-102	135	42,109	0.00264	1.83E-02	1.02E-02	0.13	3.69E-04	1.12E-08	7.28E-04	728	9.57E-05
241-AP-103	200	149,990	0.00002	5.76E-04	2.00E-04	0.47	5.38E-06	5.64E-11	2.48E-04	248	1.16E-04
241-AP-104	71	184,881	0.00012	1.23E-03	2.23E-04	0.58	9.04E-06	5.19E-11	1.36E-04	136	7.83E-05
241-AP-105	176	85,823	0.00015	2.79E-03	1.29E-03	0.27	1.89E-05	6.18E-10	8.00E-04	800	2.15E-04
241-AP-106	111	175,657	0.00018	6.54E-03	5.92E-04	0.55	3.39E-05	1.48E-10	1.04E-04	104	5.72E-05
241-AP-107	342	57,616	0.00031	1.16E-03	1.71E-03	0.18	3.28E-05	1.25E-09	9.09E-04	909	1.64E-04
241-AP-108	129	138,761	0.00131	3.14E-03	3.43E-03	0.43	2.99E-05	1.06E-09	8.52E-04	852	3.69E-04
241-AW-101	100	37,564	0.00003	3.92E-02	5.15E-04	0.12	1.63E-04	6.13E-10	8.92E-05	89	1.05E-05
241-AW-102	292	177,394	0.00013	7.16E-03	7.44E-04	0.55	5.44E-05	1.76E-10	7.96E-05	80	4.41E-05
241-AW-103	134	119,912	0.00942	3.63E-02	1.85E-02	0.37	5.13E-04	9.10E-09	4.37E-04	437	1.64E-04
241-AW-104	141	38,500	0.00041	3.64E-03	8.46E-04	0.12	1.61E-04	9.37E-10	1.42E-04	142	1.71E-05
241-AW-105	194	130,740	0.00394	5.97E-03	8.30E-03	0.41	1.09E-04	2.71E-09	6.25E-04	625	2.55E-04
241-AW-106	158	124,858	0.00045	8.59E-03	4.40E-03	0.39	3.09E-05	1.43E-09	1.16E-03	1164	4.54E-04

Author [illegible] Date 6/13/02, Check by [illegible] Date 6/13/02

Table C-3. Calculation of Mass Transport Properties for Off-Normal Ventilation Based on Normal Condition. (3 Sheets)

Tanks	Normal vent Q (cfm)	Headspace volume V (ft^3)	Equiv $(NH_3)_{ss}$ in liquid (mole/L)	hA from field data at normal condition (cfm)	Normal steady-state release rate (cfm)	Barometric breathing rate (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	$(NH3)_{ss}$ at off-normal vent (atm)	$(NH3)_{ss}$ at off-normal vent (ppm)	Off-normal steady-state release rate (cfm)
241-AY-101	250	167,502	0.00010	7.69E-03	1.25E-03	0.52	2.65E-05	3.05E-10	2.86E-04	286	1.50E-04
241-AY-102	250	104,939	0.00008	1.05E-02	1.07E-03	0.33	5.04E-05	4.31E-10	2.07E-04	207	6.78E-05
241-AZ-101	150	75,129	0.00001	8.31E-04	1.50E-04	0.23	6.04E-06	8.12E-11	3.31E-04	331	7.77E-05
241-AZ-102	112	63,632	0.00007	1.01E-03	6.19E-04	0.20	8.26E-06	4.07E-10	1.18E-03	1181	2.35E-04
241-SY-101	486	57834	0.00632	1.42E-01	1.94E-01	0.18	9.68E-04	1.51E-07	3.87E-03	3870	6.99E-04
241-SY-102	363	106,276	0.00038	2.67E-03	4.24E-03	0.33	2.26E-05	1.70E-09	1.77E-03	1771	5.88E-04
241-SY-103	116	88,630	0.00063	3.88E-03	6.92E-03	0.28	1.41E-05	3.32E-09	5.58E-03	5581	1.55E-03
241-A-101	10	48,793	0.00103	5.17E-03	3.94E-03	0.15	1.01E-05	3.30E-09	8.25E-03	8253	1.26E-03
241-A-103	8	126,596	0.00122	2.61E-03	1.98E-03	0.40	5.58E-06	6.44E-10	2.92E-03	2922	1.16E-03
241-AX-101	10	80,208	0.00014	6.96E-05	4.15E-04	0.25	3.20E-06	2.09E-10	1.62E-03	1618	4.06E-04
241-B-203	0.28	1,069	0.00038	1.10E-05	1.41E-06	0.003	2.15E-05	6.03E-11	6.57E-05	66	2.20E-07
241-B-204	0.27	1,203	0.00035	1.05E-05	1.36E-06	0.004	1.76E-05	5.10E-11	6.83E-05	68	2.57E-07
241-C-103	10	87,026	0.00550	1.94E-03	3.24E-03	0.27	1.28E-05	1.58E-09	3.16E-03	3159	8.59E-04
241-S-101	6	83,283	0.00662	2.94E-03	4.72E-03	0.26	1.07E-05	2.51E-09	5.82E-03	5817	1.51E-03
241-S-102	2	71,653	0.00384	5.47E-04	1.29E-03	0.22	4.35E-06	7.62E-10	4.31E-03	4312	9.66E-04
241-S-103	15	107,212	0.00198	1.16E-03	2.28E-03	0.34	6.63E-06	8.95E-10	3.28E-03	3281	1.10E-03
241-S-106	9	83,417	0.00018	3.78E-04	1.27E-04	0.26	4.53E-06	6.38E-11	3.40E-04	340	8.85E-05
241-S-111	5	68,177	0.00178	3.09E-04	6.49E-04	0.21	4.76E-06	4.00E-10	2.04E-03	2041	4.35E-04
241-SX-101	40	113,228	0.00001	7.62E-04	1.51E-04	0.35	3.49E-06	5.22E-11	3.81E-04	381	1.35E-04
241-SX-102	40	104,405	0.00002	9.91E-05	2.00E-04	0.33	3.23E-06	7.63E-11	5.94E-04	594	1.94E-04
241-SX-103	53	88,363	0.00009	6.11E-04	1.61E-03	0.28	3.66E-06	7.30E-10	4.98E-03	4977	1.37E-03

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Table C-3. Calculation of Mass Transport Properties for Off-Normal Ventilation Based on Normal Condition. (3 Sheets)

Tanks	Normal vent Q (cfm)	Headspace volume V (ft^3)	Equiv $(NH_3)_{ss}$ in liquid (mole/L)	hA from field data at normal condition (cfm)	Normal steady-state release rate (cfm)	Barometric breathing rate (cfm)	Off-normal constant k_1 (min^{-1})	Off-normal constant k_2 (mole/L-min)	$(NH3)_{ss}$ at off-normal vent (atm)	$(NH3)_{ss}$ at off-normal vent (ppm)	Off-normal steady-state release rate (cfm)
241-SX-104	30	110,688	0.00003	1.30E-04	1.50E-04	0.35	3.31E-06	5.48E-11	4.10E-04	410	1.42E-04
241-SX-105	40	87,962	0.00009	6.11E-04	1.09E-03	0.27	3.71E-06	4.94E-10	3.36E-03	3358	9.23E-04
241-SX-106	39	116,570	0.00160	1.93E-03	6.86E-03	0.36	6.80E-06	2.43E-09	8.75E-03	8752	3.19E-03
241-SX-108	455	161,486	0.00002	1.11E-03	2.28E-03	0.50	3.95E-06	5.27E-10	3.57E-03	3565	1.80E-03
241-T-110	7	61,761	0.00570	3.83E-04	7.48E-04	0.19	1.10E-05	5.47E-10	1.18E-03	1181	2.28E-04
241-T-203	6	3,208	0.00027	2.28E-04	3.02E-05	0.01	9.27E-05	4.18E-10	1.06E-04	106	1.07E-06
241-U-102	2	63,365	0.01002	1.66E-03	1.37E-03	0.20	1.30E-05	1.15E-09	2.16E-03	2157	4.27E-04
241-U-103	2	50,932	0.00804	9.56E-04	1.73E-03	0.16	8.24E-06	1.54E-09	4.58E-03	4582	7.29E-04
241-U-105	5	57,616	0.02379	5.64E-03	9.68E-03	0.18	3.26E-05	9.19E-09	6.91E-03	6909	1.24E-03
241-U-106	1	83,283	0.01977	1.20E-03	1.22E-03	0.26	1.05E-05	8.88E-10	2.06E-03	2058	5.36E-04
241-U-107	12	58,953	0.00743	1.34E-02	5.27E-03	0.18	9.45E-05	5.37E-09	1.38E-03	1380	2.54E-04
241-U-108	4	50,932	0.00732	1.87E-03	2.47E-03	0.16	1.27E-05	2.26E-09	4.34E-03	4345	6.92E-04
241-U-109	4	51,333	0.00007	1.37E-05	2.14E-05	0.16	3.22E-06	1.72E-11	1.30E-04	130	2.08E-05