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Steady-State Flammable Gas Release Rate Calculation and Lower Flammability Level Evaluation for Hanford Tank Waste

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STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION AND LOWER FLAMMABILITY LEVEL EVALUATION FOR HANFORD TANK WASTE

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STEADY-STATE FLAMMABLE GAS RELEASE RATE CALCULATION AND LOWER FLAMMABILITY LEVEL EVALUATION FOR HANFORD TANK WASTE

ABSTRACT

Flammable gases such as hydrogen, ammonia, and methane are observed in the tank dome space. The flammability level has exceeded 25% of lower flammability limit during sudden gas release events. This work is to assess the steady-state flammability level at normal and off-normal ventilation conditions in the tank dome space for 177 double-shell and single-shell tanks at Hanford. The steady-state flammability level was estimated from the gas concentration of the mixture in the dome space using 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 gas release rate and ventilation rates in the dome space, has been developed. With this dynamic model, the time required to reach the specified flammability level at given ventilation condition.can be calculated. In the evaluation, hydrogen, the major flammable gas observed in the dome space will be estimated with the newly developed empirical rate equation model. Hydrogen generation rates can be calculated for a given tank waste composition and physical properties. The release rate of other gases can be derived from the observed steady-state gas concentration at normal ventilation conditions. The off-normal vent rate is assumed to be natural barometric breathing only. A large body of data is required to do both the hydrogen generation rate calculation and the flammability level evaluation. For those tanks, which do not have sample-based data, a statistical default value from probability distribution regression, based on data from tanks belonging to a similar waste group, was used. Overall, the flammability assessment indicates that the shortest times to reach 25% LFL for the off-normal ventilation conditions are 9 days for double-shell tanks, for tank 241-SY-101, and 22 days for single-shell tanks, for tank 241-A-101.

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1.0 INTRODUCTION

The purpose of this work is to develop a methodology to predict the steady-state gas release rate and to evaluate the steady-state flammability level of the tank dome space at both normal and off-normal ventilation operating conditions for 177 underground nuclear waste tanks. This report replaces two previous calculation notes, HNF-SD-WM-CN-116 (CN-116)(Stauffer 1997) and HNF-SD-WM-CN-117 (CN-117)(Hu 1997), and provides the technical basis for flammable gas control. The focus of the document is to discuss the loss of ventilation transient such that Technical Safety Requirement (TSR) surveillance frequencies and action times can be established. It provides 1) estimates of the flammable gas release rates in the tank headspace; 2) reasonable 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 SSTs; 3) the estimates of the minimum ventilation rate required to maintain less than 25% of the LFL; and 4) estimates of the maximum headspace concentrations attainable following an extended loss of normal ventilation.

In order to clarify the application of the subject document, a definition for "steady-state" has been developed. Steady-state is defined as: 1) condition of no active operational changes to the tank; and 2) non-GRE (Gas Release Event) condition with GRE defined as a 500 ppm rise in concentration followed by exponential decay. For this application the following assumptions are used; 1) long- term variations in ventilation brought about by seasonal effects, or vent rate changes within the exhaust system operating range are included; and 2) variability of hydrogen concentration about the baseline is less than that produced by a GRE. Where only one sample is available, it is assumed that it is taken at the steady-state condition, unless there is clear documentation to show existence of a GRE condition.

The gases generated from tank waste are a mixture of hydrogen, nitrogen, ammonia, nitrous oxide, a small amount of methane, and other hydrocarbons. Among the several flammable gases observed in the tank dome space, hydrogen is the most abundant and contributes more than 90% of the flammable components in the dome space for the majority of the gas generating storage tanks. All of the gases mentioned above, except ammonia, have little solubility and are either fully released to the dome space or partially trapped in the solid layer of tank waste. Ninety-nine percent of the ammonia generated is dissolved and stored in the liquid waste (Shekarriz et al. 1997) rather than released to the dome space because of its high solubility. For the majority of the tanks, there is little generation of methane, but it is the major species among the observed hydrocarbon vapors. Nitrous oxide is not flammable by itself, but it is an oxidizer. Studies (Pfahl and Shepherd 1997) show that concentrated nitrous oxide can lower the flammability limit of fuels in air mixture.

Understanding gas generation and predicting the gas generation and gas release rates are important in controlling the flammable gas hazard and planning daily operational activities in the tank farms. For example, the overall rate of generation is needed to verify that any given tank has

sufficient ventilation to ensure that the level of flammable gases is maintained under the operational flammability limit in the dome space. In the past decade, there have been many studies (Johnson et al., 1997) on the mechanism of gas generation, gas release, and gas retention of tank waste using simulated or actual waste. Also, systematic tank waste characterization programs and various tank safety programs have generated a tremendous amount of tank waste data. All of this information was the basis of the recently published Empirical Rate Equation Model of Hydrogen Generation (Hu 2000). The model is tank waste constituent and tank condition based and provides a tool to estimate the generation rate not only for the current tank waste content, but also for tanks whose contents have changed. The other observed gases do not have a general rate equation to calculate generation rates as a function of waste constituents.

In this work, the methodology of calculating gas release rates is presented. The hydrogen generation rate (HGR) equation model (Hu 2000) is used to estimate the hydrogen release rate by subtracting the field observed gas accumulation rate, if there is any, from the model-calculated generation rate. The gas release rates of ammonia, methane, and nitrous oxide, which are the minor gases of interest, observed in the dome space, are derived from vapor concentration data and ventilation rate in the dome space. A time-dependent equation for gas concentration at tank dome space was developed by solving the mass balance equations for the gas volume. Once the steady-state gas release rates are obtained, a time-dependent gas concentration can be derived from the equation for a given ventilation condition. Thus the flammability level of the gas mixture in the dome space can be calculated at both normal and off-normal operating conditions. Also, the time required to reach a specified flammability level in the dome space, and the minimum ventilation rate required to prevent reaching certain flammability limits can be estimated.

In this report, Section 2 describes the hydrogen generation rate model calculation. The empirical equation of hydrogen generation rates is summarized and discussed. Section 3 describes the methodology to evaluate the flammability level of the gas mixture in the dome space. Details of the validity of the lower flammability limits in air, time-dependent gas concentration model, and the flammability level calculations and evaluations will be discussed. Section 4 reports the data gathering and results of the model calculations and the flammability evaluations. Section 5 gives an overall summary and conclusions.

2.0 HYDROGEN GENERATION RATE MODEL CALCULATION

Several models (Hopkins 1994, 1995; Graves 1994; Bryan and Pederson; 1996, Hu 1997) have been previously proposed to estimate the hydrogen generation rate, but were limited by very little waste data. Recently a more comprehensive hydrogen generation rate model (Hu 1998, 2000) was developed and validated based on a large body of tank waste data. The model constructed a set of semi-empirical rate equations to simulate the gas generation mechanism 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 able to estimate the hydrogen generation rate of current waste content as well as the newly mixed waste of known waste properties. The model has been applied to calculate the rate of thirty more single and double-shell tanks and shows good agreement with field observed rates.

2.1 SEMI-EMPIRICAL RATE EQUATIONS

As summarized below, the total HGR (Hu 2000) in units of hydrogen yield per kilogram of total waste per day consists of the thermal rate (HGR_{thm}), the radiolysis rate (HGR_{rad}), and the corrosion rate (HGR_{cor}). It takes into account the dependence of the rate on tank waste compositions, temperature, radiation dose rate, liquid fraction, and etc.,

$$HGR = HGR_{thm} + HGR_{rad} + HGR_{corr} \qquad (2\text{-}1)$$

Where $HGR_{thm} = a_{thm} \cdot r_f \cdot [TOC] \cdot [Al]^{0.4} \cdot L_f \cdot e^{-(Ethm/RT)}$

$HGR_{rad} = (G_{H2O} + G_{ORG} \cdot L_f) \cdot H_{load} \cdot CF_1$

$HGR_{corr} = R_{corr} \cdot A_{wetted} / M_{tank} \cdot CF_2$

With $G_{ORG} = a_{rad} \cdot e^{(-Erad/RT)} \cdot (r_f \cdot [TOC])$

$G_{H2O} = 0.45 - 0.56 \cdot [NO_3^-]^{1/3} - 0.43 \cdot [NO_2^-]^{1/3}$

And E_{thm} is the activation energy for thermal reaction (89.3 kJ/mole)
E_{rad} is the pre-exponential factor for radiolytic reaction (44.3 kJ/mole)
a_{thm} is the pre-exponential factor for thermal reaction (2.76E+09 mole/kg-day)
a_{rad} is the pre-exponential factor for radiolytic reaction (2.49 E+06 H_2/100 eV)

G_{ORG}	is the hydrogen yield per 100eV energy from organic radiolysis
G_{H2O}	is the hydrogen yield per 100eV energy from water radiolysis (G_{H2O} has a minimum value of 0.005 H_2/100 eV)
r_f	is the total organic carbon (TOC) reactivity coefficient (average value is 0.7 for DSTs and 0.4 for SSTs)
R_{corr}	is the corrosion coefficient [1.83E-08 for DSTs and 3.6E-08 for SSTs ($m^3/min/m^2$) at 25 °C]
H_{load}	is the heat load (Watt/kg)
L_f	is the liquid weight fraction in the waste.
A_{wetted}	is the wetted surface area of the tank (m^2)
M_{tank}	is the total waste mass (kg) in the tank
CF_1	is the conversion factor to convert the units from (H_2/100eV)(Watts/kg) to (mole/kg-day)
CF_2	is the conversion factor to convert the units from (m^3/kg-min) to (mole/kg-day)

In general, the HGR due to chemical reaction follows Arrhenius behavior, and the rate from radiolysis is proportional to the radiation dose. In addition, the HGR's from radiation effects in tank waste samples have been observed to be temperature dependent (King and Bryan 1999). The analysis of all available gas generation data (Hu 2000) shows that this temperature-dependent reaction follows Arrhenius behavior, which may result from a multi-step degradation of organic compounds is initiated by radiolysis and followed by thermal reactions. The water radiolysis rate is assumed to be temperature-independent, with the G-value reduced by scavenging effects.

The numerical parameters in the equations are established by the analysis of 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 tanks. A detailed description of this model is given in Hu (2000).

3.0 METHODOLOGY TO ESTIMATE STEADY-STATE FLAMMABILITY LEVEL

This section describes the methodology to evaluate the steady-state flammability level in the tank dome space for all double-shell and single-shell tanks. The methodology also provides a technical basis for flammable gas control in tank farm operations. The evaluation will address the flammability level in the tank dome space at both normal and off-normal ventilation conditions. In the evaluation, the steady-state gas release rates and ventilation rates are required to derive the steady-state gas concentration at a given ventilation condition. Based on the flammable gas concentrations, the level of flammability of the mixture can be calculated. In general, at current normal ventilation conditions, the steady-state flammability level in the tank dome space is below 25% LFL for all tanks (Hu 1998). The primary evaluation is focused on the flammable gas level at the off-normal vent condition.

The major gases of concern were identified as hydrogen, ammonia, nitrous oxide, and methane in the tank dome space. Among these identified 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 Section 2.0. The other two flammable gases, ammonia and methane, have much lower concentrations in the headspace and have no general model for calculating the gas generation rate, thus, the steady-state gas release rates of ammonia and methane are estimated by their steady-state gas concentrations at normal vent conditions. Nitrous oxide is an oxidizer, and the concern is whether its concentration is high enough to lower the LFL of those flammable gases established in the air. The gas release rate of nitrous oxide is also derived by the steady-state gas concentration at normal ventilation conditions.

In the following sections, the LFL, the normal and off-normal ventilation condition in the dome space, time dependent gas concentration, gas release rates, and calculations of flammable gas levels will be discussed in detail. To evaluate the flammable gas level, a time-dependent gas concentration model is established. From this model, the steady-state flammability level can be calculated at a given ventilation condition. It also can estimate the time required to reach certain flammability levels in the dome space at different ventilation conditions and the minimum ventilation rate to keep the dome space below the specified flammability limit.

3.1 LOWER FLAMMABILITY LIMITS

The National Fire Protection Agency (NFPA) codes require that operations be terminated when the concentration of flammable gases exceeds 25% of the LFL. Based on the empirical rule developed by Le Chatelier in the later 19th century, the lower flammable limit of mixtures of multiple flammable gases in air can be determined. Le Chatelier's rule (Coward and Jones,1952) can be written in terms of the lower flammability limit concentration of the fuel mixture, LFL_m, as follows,

$$LFL_m = \frac{100}{\sum_i^n \left(\frac{C_i}{LFL_i} \right)} \tag{3-1}$$

Where	Ci	is the volume percent of fuel gas *i* in the fuel gas mixture
	LFLi	is the 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, and other gas fuels identified are ammonia and methane. Cashdollar et al. (1992) have shown experimentally 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 below

$$LFL_m = \frac{100}{\left(\frac{[H_2]}{LFL_{H2}} + \frac{[NH_3]}{LFL_{NH3}} + \frac{[CH_4]}{LFL_{CH4}} \right)} \tag{3-2}$$

Where	$[H_2]$	is the volume percent of hydrogen in the fuel gas mixture
	$[NH_3]$	is the volume percent of ammonia in the fuel gas mixture
	$[CH_4]$	is the volume percent of methane in the fuel gas mixture
	LFL_{H2}	is the volume percent of hydrogen at its LFL in air alone
	LFL_{NH3}	is the volume percent of ammonia at its LFL in air alone
	LFL_{CH4}	is the volume percent of methane at its LFL in air alone

The flammability of the individual gases in air is fairly well characterized. The volume percent of 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 the tank dome space, nitrous oxide was observed, in addition to the above flammable gases. Nitrous oxide plays the role of oxidizer in the mixture, and has the potential to decrease the minimum amount of fuel required to reach the LFL. The effect of the multiple oxidizers, e.g. N_2O and O_2, was not addressed in Equation 3-2.

Pfahl and Shepherd (1997) from the California Institute of Technology have conducted a series of flammability studies on gas mixtures from Hanford tank waste. The studies show that the established LFLs of individual fuels in the air will decrease, if concentrated N_2O 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%. This fuel-oxidizer mixture will be flammable with the ammonia volume percent

as low as 8% if the N_2O concentration is 65%. For NH_3-N_2O-Air mixtures, Pfahl and Shepherd (Figure 32 in 1997 report) suggest that the ammonia flammability limit will be 15% if the N_2O does not exceed 8%. All of these test results are for turbulent conditions, with an ignition energy of 8 J. For a CH_4-N_2O-Air mixture, the data shows that the ratio of 4.5-10.1-85.4 is not flammable. For a H_2-N_2O-Air mixture, the data shows a mixture with the ratio of 5.7-10-84.3 has incomplete combustion.

The above information and discussion suggests that the flammability limit established in the fuel-air mixture of each gas will not be reduced unless the N_2O volume percent exceeds eight percent. Shepherd (1999) confirmed this conclusion. 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 every considered case, the concentration of nitrous oxide will be evaluated to ensure that the above flammability limits are valid.

3.2 VENTILATION CONDITIONS IN TANK HEAD SPACE

In normal operating conditions, the ventilation conditions can be active ventilation or passive ventilation. For all double-shell tanks and some active gas-generating single-shell tanks, the tank headspace is equipped with an active ventilation system. The active vent rates range from 100 cubic feet per minute (cfm) to 700 cfm, while the passive vent rates range, typically, from 0.5 cfm to 10 cfm.

In abnormal conditions, there are three possible tank ventilation conditions: no ventilation flow, ventilation flow caused only by barometric breathing, and ventilation flow due to natural breathing, which is a combination of ventilation due barometric breathing plus thermal convection. The barometric breathing rate, V_{bb}, is estimated as 0.45% of headspace volume per day (Crippen 1993) and is given as

$$V_{bb} = 0.45\% \bullet Vol_{headspace} \left(\frac{ft^3}{day} \right) \tag{3-3}$$

Where $Vol_{headspace}$ is the volume of the tank headspace (ft^3)

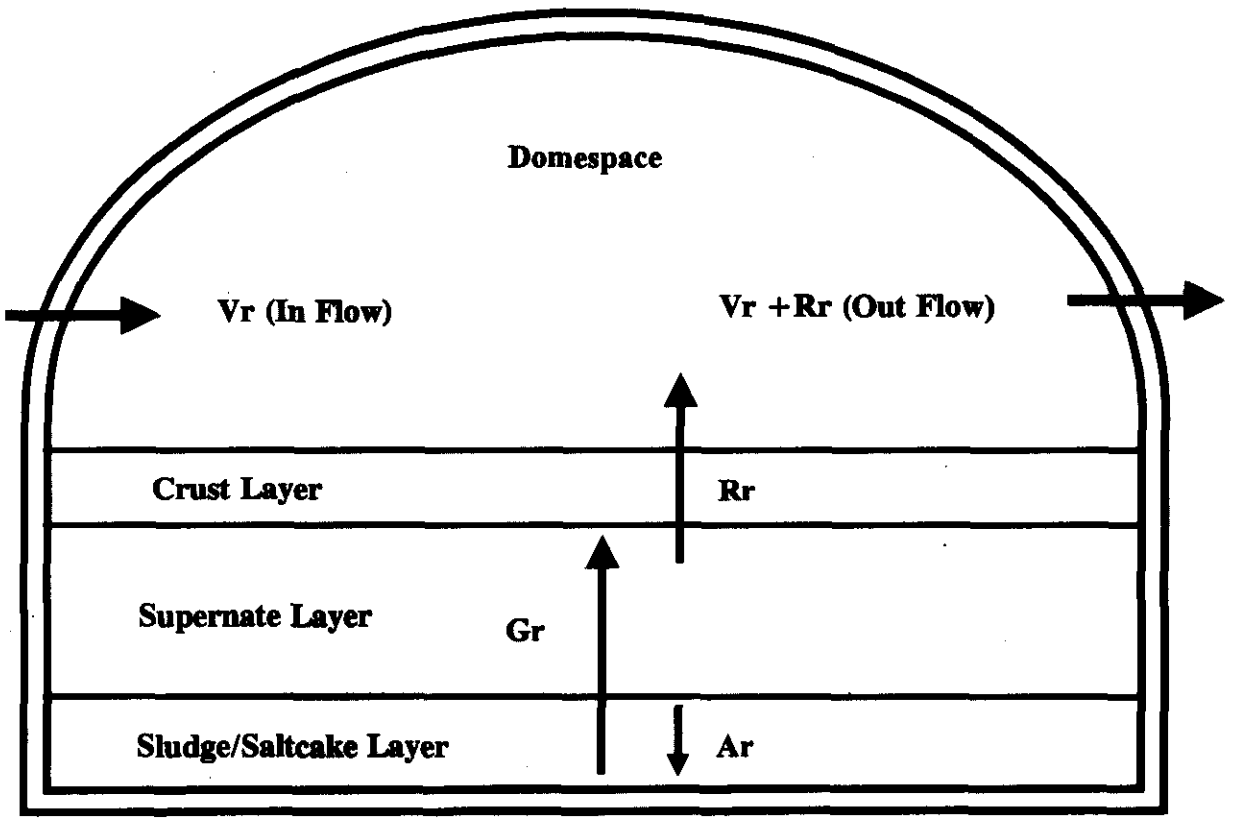
The natural breathing rate is estimated to be five to ten times the V_{bb}. During off-normal operating conditions, the most likely ventilation rate is either natural breathing or barometric breathing. The zero flow condition is considered to be impossible, because of the many openings into the tanks. An estimation of the thermal convection flow is not available; therefore, in this evaluation, the barometric breathing rate, which is more conservative but reasonable, will be used for the ventilation rate when active ventilation is not present. Based on Equation 3-3, the calculated barometric breathing rate is less than 1 cfm (as shown in Table B-2 of Appendix B) for

most tanks. Using helium and sulfur hexafluoride as tracer gases, the measured passive ventilation rates (Hukaby et al., 1998) in single-shell tanks is greater than 2.5 cfm. No similar measurements for passive rate are available for double-shell tanks. It appears that the calculated barometric vent rate is conservative compared to the available field measurements.

3.3 TIME-DEPENDENT GAS CONCENTRATION MODEL

An equation to calculate the time-dependent flammable gas concentration in the dome space was developed. The concentration is a function of the gas release rate and the ventilation rate. For a simplified tank dome space system, as shown in Figure 3-1,

Figure 3-1. A Simplified Tank System for Time Dependent Gas Concentration Model



In general, most of the tanks contain supernate, and sludge/saltcake layers. A few tanks, such as tank 241-AN-103, have a thin crust layer above the supernate. The gas release rate (Rr) is the net result of the generation rate (Gr) and the accumulation rate (Ar). Gas accumulation rate refers to

the rate gas trapped in the sludge/saltcake layer. The sum of the fresh air inflow rate (Vr) plus the Rr equals the ventilation out flow rate. The gas volume change rate can be formulated from a mass balance equation as

Gas Change Rate in Tank Dome Space
= Gas Release Rate from the Waste Surface - Gas Exit Rate (3-4)

Then, the mass balance equation can be written as a differential equation given below:

$$Vol\frac{\partial[C_g]}{\partial t} = [R_r - (R_r + V_r)].\ [C_g] \qquad (3\text{-}5)$$

Where	$[C_g]$	is the gas concentration (volume percent)
	Vol	is the volume of the tank dome space (volume)
	R_r	is the gas release rate from the waste surface (volume/time)
	V_r	is the ventilation rate in the dome space (volume/time)

By solving the differential equation (3-5), a time-dependent gas concentration at time t, $[G_2](t)$, in units of volume percent is given as follows:

$$[C_g]_{\%}(t) = [C_g]_{\%}(t_0)\exp(-\lambda t) + \left[\frac{R_r}{(R_r + V_r)}\right]_{\%}[1 - \exp(-\lambda t)] \qquad (3\text{-}6)$$

With λ $= (R_r + V_r)\ /\ Vol$

Where	R_r	is the hydrogen release rate from the waste surface (volume/time)
	V_r	is the ventilation rate in the dome space (volume/time)
	$[C_g](t_o)$	is the initial gas concentration at time t (volume percent)
	Vol	is the volume of the tank dome space (volume)
	λ	is the decay parameter from the venting (inverse time)

In Equation 3-6, the first term represents how the initial gas concentration phases out exponentially with the factor of $e^{(-\lambda t)}$ and second term shows how gas level builds up in the form of $[R_r/(R_r+V_r)]_{\%}$ with the factor of $[1- e^{(-\lambda t)}]$ as time goes on. The above equation is the same as Equation (1) in CN-117 (Hu 1997) and is rewritten in a format with physical meaning.

3.4 STEADY-STATE GAS CONCENTRATION AND GAS RELEASE RATE

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 as:

$$[C_g]_{\%}^{ss} = \left[\frac{R_r}{(R_r + V_r)}\right]_{\%} \times 100 \qquad (3\text{-}7)$$

Where	$[C_g]_{\%}^{ss}$	is the steady-state gas concentration
	R_r	is the gas release rate (volume/time)
	V_r	is the ventilation rate in the dome space (volume/time)

Using Equation 3-7, 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 can be estimated by subtracting the gas accumulation rate from the gas generation rate as follows:

$$R_r = G_r - A_r \qquad (3\text{-}8)$$

Where	G_r	is the gas generation rate from waste (volume/ time)
	A_r	is the gas accumulation rate due to gas trapping (volume/ time)

For hydrogen, the generation rate can be calculated using the semi-empirical rate equation described in Section 2.1. The accumulation rate (Hu 2000) can be determined in the field, based on the waste level change rate and the gas composition data from the retained gas sampler. If there is no noticeable waste level change, then the hydrogen release rate will be the same as the hydrogen generation rate.

For other gases, no gas generation rate model is available, so the steady-state gas release rate can be estimated from the known steady-state concentration in the headspace at normal vent conditions by rearranging Equation 3-7 as follows:

$$R_r = \left(\frac{[C_g]_{\%}^{ss}}{100}\right) \bullet \frac{V_r}{\left(1 - \frac{[C_g]_{\%}^{ss}}{100}\right)} \tag{3-9}$$

Where $[C_g]_{\%}^{ss}$ is the steady-state gas concentration
R_r is the gas release rate (volume/time)
V_r is the ventilation rate in the dome space (volume/time)

Using the release rate obtained from Equation 3-9, the steady-state concentration at different vent conditions can be calculated from Equation 3-7. For methane, the above method is used to obtain the gas release rate from the steady-state concentration under normal ventilation conditions. Then the calculated gas release rate is used to calculate the steady-state concentration for off-normal conditions. This methodology is a reasonable way to determine methane concentrations in off-normal conditions, since methane is very insoluble and whatever methane is generated is directly released to the headspace. However, the above method is a conservative approach for ammonia. Rather than a constant, the release rate of ammonia is function of the difference of ammonia concentrations in the liquid and vapor phases. This difference will decrease as the ventilation rate decreases. Thus, when the ventilation system switches from a higher, normal operating rate to a lower, off-normal rate the established ammonia release rate, found at normal ventilation conditions, will gradually decrease to a new, lower steady-state release rate as a new steady-state is achieved.

The steady-state flammability evaluation of this work is based on current tank waste data at storage conditions. For those tanks actively receiving waste, such as tanks 241-AP-108 and 241-AN-101 as dilute receiver tanks, the flammability level will be reevaluated during the compatibility assessment for waste transfer based on the predicted post-transfer condition of the tank waste. For hydrogen, the release rate can still be calculated based on the predicted tank waste condition using the rate equation model given here. For methane, since steady-state methane vapor data are not available prior to waste transfer, the release rate will be estimated as 10% of the model-calculated hydrogen generation rate. This is a reasonable estimate, because for all tanks, methane is less than 10 volume % of the hydrogen in the generated gas in either the gas generation study (King and Bryan 1999) or the retained gas sampler results (Mahoney et al., 1999). For ammonia, rather than estimating the release rate, ammonia vapor concentration at thermodynamic equilibrium for 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 Schumpe's model. The detailed methodology to calculate the steady-state ammonia vapor concentration is described in Hedengren et al. (2000). At the off-normal ventilation condition, which is about 0.5 cfm or lower, an equilibrium prediction of ammonia concentration is reasonable and conservative.

3.5 TIME TO REACH LOWER FLAMMABILITY LIMIT

For active ventilation system interruptions, the time it will take the dome space to build up flammable gas concentrations exceeding the LFL is one of main concerns of this evaluation. A time-dependent lower flammability limit, $LFL_m(t)$ of the mixture can be calculated using the time-dependent gas concentration (Equation 3-6) and the Le Chatelier's rule (Equation 3-2) as follows:

$$LFL_m(t) = \frac{100}{\left(\frac{[H_2](t)}{LFL_{H2}} + \frac{[NH_3](t)}{LFL_{NH3}} + \frac{[CH_4](t)}{LFL_{CH4}}\right)} \tag{3-10}$$

Where	$[H_2](t)$	is the hydrogen concentration at time t
	$[NH_3](t)$	is the ammonia concentration at time t
	$[CH_4](t)$	is the methane concentration at time t
	LFL_{H2}	is the volume percent of hydrogen at its LFL in air alone
	LFL_{NH3}	is the volume percent of ammonia at its LFL in air alone
	LFL_{CH4}	is the volume percent of methane at its LFL in air alone

The volume percent of the lower flammability limits; LFL_{H2}, LFL_{NH3}, and LFL_{CH4} are 4%, 15%, and 5%, respectively, which have been established for an fuel-air mixture.

The time to reach a specified gas concentration at a given ventilation condition can be obtained by rewriting Equation 3-6 and is given as follows:

$$t = \frac{\ln\left\{\frac{[R_r - (R_r + V_r) \bullet [C_g](t_0)]}{[R_r - (R_r + V_r) \bullet [C_g](t)]}\right\}}{\lambda} \tag{3-11}$$

with	λ	$= (R_r + V_r)/Vol$

Where	Rr	is the hydrogen release rate (volume/time)
	Vr	is the barometric breathing rate (volume/time)
	$[C_g](t_o)$	is the initial gas concentration at time t_o (ppmv)
	$[C_g](t)$	is the gas concentration at time t (ppmv)
	Vol	is the volume of the tank headspace (volume)

However, the time to reach a specified flammability limit of the mixture was not calculated explicitly. A customized macro function in EXCEL using Visual Basic, based on Equation 3-9, was developed to calculate the time to reach a specific flammability limit.

3.6 THE MINIMUM VENT RATE TO MAINTAIN HEADSPACE BELOW 25% LFL

Whether the headspace of a tank will reach the specified flammability limit or not is dependent upon 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 headspace can be calculated using Equation 3-2. The required steady-state gas concentrations in Equation 3-2 can be calculated using Equation 3-7, which is a function of the gas release rate and the ventilation rate. For a given set of gas release rates, if the vent rate is zero (i.e., no gas exits the tank), the system will always exceed the LFL. Equation 3-11 can be used to calculate the minimum ventilation rate needed to reach the specified flammability limit at steady-state. Again the vent rate is embedded in the equation, and a customized Macro function in EXCEL using Visual Basic code was developed to calculate the minimum vent to reach the specified flammability limit. If the headspace vent rate is larger than this minimum vent rate, then the system will never reach the specified flammability limit.

4.0 EVALUATIONS OF STEADY-STATE FLAMMABILITY LEVEL

In this section, gas steadily released from all 28 double-shell tanks and 149 single-shell tanks will be evaluated quantitatively against tank ventilation conditions using the methodology described in Sections 2 and 3 to see if the resulting flammability level becomes a safety concern.

In Section 4.1, hydrogen generation rates will be calculated. Details of input data collection and the EXCEL spreadsheet setup for rate calculation are discussed. In Section 4.2, the data collection, estimation of ventilation rates at both normal conditions and off-normal conditions, and the steady state gas concentrations at the normal vent rate will be discussed. Section 4.3 calculates 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 are extrapolated from steady-state concentrations at normal ventilation rates. Section 4.4 performs the evaluation of the flammability level in the tank headspace for all 177 tanks. The evaluations include: (1) calculation of total flammability level as well as the distribution from each flammable gas at both normal and off-normal ventilation conditions, (2) the time required for the flammable gases concentration in the tank headspace to reach various flammability levels when the normal ventilation system is shut down, and (3) the minimum ventilation rate required to keep the headspace concentration below the specified flammability limit.

Details of the results of the hydrogen generation rate calculations and flammability evaluations in the tank dome space for 177 tanks are given in Appendix A and Appendix B respectively. Demonstration of the hydrogen generation rate calculation from empirical rate equations and the flammability evaluations using tank 241-AN-104 as an example is given in Appendix C. In addition, a preliminary uncertainty analysis on both hydrogen generation rate calculation and flammability evaluation using Monte Carlo simulation for tank 241-AN-104 is also listed in Appendix C.

4.1 HYDROGEN GENERATION RATE MODEL CALCULATIONS

In the evaluation, the HGRs will be calculated for each tank based on the semi-empirical rate equation model. The total generation rate is calculated for each waste layer for each tank. The generation rate is a function of tank waste conditions; thus, a large tank waste database is needed. Some tanks have the analytical data and surveillance data necessary to perform the rate calculation. For those tanks that do not have current measured data, process history data and waste type information will be used to apply data from other tanks.

An EXCEL spreadsheet was set up to calculate hydrogen generation rates for all 177 Hanford double-shell and single-shell tanks. There are four sections in the spreadsheet including

an input data section, a derived data section, a calculated rates section, and rate validation section. The spreadsheet was setup to allow for easy upgrade and to facilitate checking the rate calculations. Details of the spreadsheet, data collection, data presentation, and data validation are discussed below.

4.1.1 Input Data

The data required to estimate hydrogen generation, include the concentration of TOC, NO_3, NO_2, and Al in liquid phase; total heat load in terms of Cs and Sr, liquid and bulk densities; total solids and supernatant tank waste volumes; weight percent water for liquid and sludge layers; tank waste temperature; and tank headspace temperature. The organic species is the source term for thermolysis and organic radiolysis, and the TOC data are used as an indicator of organic species. Aluminate plays a catalysis role in the thermal reaction and the aluminate concentration was 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 both the radiolysis G-value and to account for the Arrhenius behavior of the thermolysis rate. The Cs and Sr 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 were used to estimate the liquid fraction of the waste, because the model considers that gas generation reactions occur most effectively in the liquid phase. The density and waste volume are used to calculate the total mass of the waste, and are also used to estimate the wetted tank surface area to calculate the corrosion rates. The temperature in the tank headspace is used to estimate the total gas generation rate in cubic feet per second.

The Best Basis Inventory (BBI) database was queried to obtain the required waste properties and compositions. Missing data were estimated, based on the methodology presented by Barker, et al. (1999). Waste tanks are first classified into one of six groups, based on the volumes of the liquid, salt cake, and sludge layers. The criteria for the various tank classifications are also presented in Barker, et al. (1999). Data from tanks within a given classification are used to create a distribution, which is assumed to describe the total population of data for a given tank classification. This distribution is then used to provide a range of data, which is used to describe the missing data. In cases were there are insufficient data to create a statistically valid distribution, data from similar groups of tanks are combined to create a distribution to describe the data (Barker, et al., 1999). For single-point calculations, the mean of the distribution is used to describe the missing values. In Monte Carlo statistical analyses, the full range of data for the tank waste classification is used.

This methodology, for providing values and distributions for missing data, is not optimized to provide the "best" waste properties or compositions with respect to waste chemical makeup. This methodology was prepared from the standpoint of determining missing data for flammable gas safety analyses. Because of the lack of sufficient analytical data for the estimation of missing data, the methodology (Barker, et al., 1999) determined that finer resolution of data, than the general waste classifications used, was not statistically justified. As a result, the mean values used in this analysis are not optimized based on waste characteristics, but have been developed to fit the available data related to flammable gas safety analyses. All the required input data for the rate

calculation for 177 tanks are listed in Table A-1 of Appendix A. The tank 241-A-105 hydrogen generation rate has not been calculated. The waste remaining in 241-A-105 is outside the steel liner, but is within the concrete tank. The gases generated within the waste are able to enter the tank headspace. However, because of its location, the waste material cannot be sampled. Since waste in tank 241-A-105 is very hot (about 208 °F) and no moisture has been added to the tank for many years, the waste moisture content is expected to be very low, but is unknown. The hydrogen generation rate is very sensitive to moisture content (the main hydrogen source). Since this key parameter is unknown and cannot be estimated, no attempt is made to estimate the corresponding hydrogen generation rate.

4.1.2 Calculated Hydrogen Generation Rates

Once the input data were provided, the derived data were calculated prior to 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 derivation includes waste level, the tank surface area wetted by the waste, total mass, liquid fractions of the layers, layer head load, layer density, total heat load, conversion of NO_3 and NO_2 to units of "moles per liter," conversion of TOC and Al to units of "weight percent," and water radiolysis and total radiolysis G-values. The purpose of the derived data section is two folds. One purpose is that necessary unit conversions were built 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 cumbersomeness of the rate calculation formula and makes error checking easier and more effective. Details of the derived data are listed in Table A-2 of Appendix A.

The rates are calculated for total tank waste, as well as for different waste layers. The waste layers are convective layer (supernate) and non-convective layer (sludge/saltcake), and a few tanks have an extra crust layer on top of the convective layer. The rates for each layer are presented as radiolysis rates, thermolysis rates, corrosion rates, and total generation rates in the units of "mole per kg-day," and "moles per cubic meter-second." Details of the calculated rates are listed in the Table A-3 of Appendix A. The last section is rate validation. The generation rates are converted to units of "cubic feet per minute" to compare with field-estimated generation rates. The field estimated generation rate is the sum of the gas release rate plus the gas accumulation rate. As discussed in Section 3.4, the gas release rates are derived from the steady-state gas concentration and the ventilation rate. The gas accumulation rates are derived from any noticeable waste level increase, due to gas trapped in the waste, and retained gas sample data. Table A-4, Appendix A, lists the details of the total hydrogen release rates in the tank headspace and the comparison between model calculated and field-estimated generation rates.

Table 4-1 lists the ten tanks with the highest model-calculated hydrogen generation rates. Generation rates from radiolysis, thermolysis, and corrosion are also listed in Table 4-1 for solid and liquid layers for each tank. Tank 241-SY-101 has the largest hydrogen generation rate of 2.22E-2 cfm, primarily from water radiolysis. The contribution from thermolysis and radiolysis varied from tank to tank. For most listed tanks, corrosion contributed less than 10% to the overall hydrogen generation rate, except for tank 241-SX-103. Tanks without sample-based data, use the default data from the waste grouping analysis, which have a larger uncertainty.

Table 4-1 Tanks with Highest Model Calculated Hydrogen Generation Rates

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model
241-SY-101	3.82E-03	1.76E-02	7.71E-04	17.2%	79.3%	3.5%	2.22E-02
SY-101 liquid	1.96E-03	9.56E-03	2.58E-04	16.6%	81.2%	2.2%	1.18E-02
SY-101 solid	1.86E-03	8.05E-03	5.14E-04	17.8%	77.2%	4.9%	1.04E-02
241-A-101	1.09E-03	1.23E-02	1.40E-03	7.4%	83.1%	9.5%	1.48E-02
A-101 liquid	6.74E-04	8.40E-03	1.00E-03	6.7%	83.4%	9.9%	1.01E-02
A-101 solid	4.17E-04	3.87E-03	3.95E-04	8.9%	82.6%	8.4%	4.68E-03
241-AY-102	1.34E-02	1.117E-04	5.32E-04	95.4%	0.8%	3.8%	1.40E-02
AY-102 liquid	1.08E-04	4.44E-05	1.76E-04	32.9%	13.5%	53.5%	3.29E-04
AY-102 solid	1.33E-02	6.73E-05	3.56E-04	96.9%	0.5%	2.6%	1.37E-02
241-SX-105	8.70E-04	1.03E-02	1.11E-03	7.1%	83.8%	9.1%	1.22E-02
SX-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-105 solid	8.70E-04	1.03E-02	1.11E-03	7.1%	83.8%	9.1%	1.22E-02
241-A-103	9.10E-03	6.87E-04	8.62E-04	85.5%	6.5%	8.1%	1.07E-02
A-103 liquid	4.49E-06	1.77E-05	4.35E-06	16.9%	66.7%	16.4%	2.66E-05
A-103 solid	9.10E-03	6.70E-04	8.58E-04	85.6%	6.3%	8.1%	1.06E-02
241-AZ-102	8.72E-03	1.210E-03	6.82E-04	82.2%	11.4%	6.4%	1.06E-02
AZ-102 liquid	1.44E-03	7.84E-04	3.64E-04	55.7%	30.2%	14.0%	2.59E-03
AZ-102 solid	7.28E-03	4.26E-04	3.18E-04	90.7%	5.3%	4.0%	8.02E-03
241-AN-102	4.05E-03	5.33E-03	7.29E-04	40.0%	52.7%	7.2%	1.01E-02
AN-102 liquid	3.62E-03	4.93E-03	4.22E-04	40.4%	54.9%	4.7%	8.97E-03
AN-102 solid	4.29E-04	4.04E-04	3.08E-04	37.6%	35.4%	27.0%	1.14E-03
241-AN-107	6.96E-03	1.39E-03	7.15E-04	76.8%	15.4%	7.9%	9.07E-03
AN-107 liquid	5.16E-03	1.09E-03	3.43E-04	78.3%	16.5%	5.2%	6.59E-03
AN-107 solid	1.80E-03	3.07E-04	3.73E-04	72.6%	12.4%	15.0%	2.48E-03
241-AZ-101	7.04E-03	1.121E-03	6.44E-04	80.0%	12.7%	7.3%	8.80E-03
AZ-101 liquid	1.97E-03	1.03E-03	3.51E-04	58.8%	30.7%	10.5%	3.35E-03
AZ-101 solid	5.07E-03	8.99E-05	2.93E-04	93.0%	1.6%	5.4%	5.45E-03
241-SX-103	9.52E-04	6.15E-03	1.10E-03	11.6%	75.0%	13.4%	8.19E-03
SX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-103 solid	9.52E-04	6.15E-03	1.10E-03	11.6%	75.0%	13.4%	8.19E-03

Note: Liquid and solid layers refer to supernate and salt cake/sludge layers respectively.

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 Bingham, et al. (2000). Ventilation rates were determined by a number of methods, including tracer studies, Standard Hydrogen Monitoring System (SHMS) hydrogen composition decay curves, direct measurement, and calculations from earlier flammable gas hazard analyses.

Headspace gas composition data are based on analytical data (Bingham, et al. 2000), when available. The Tank Waste Information System (TWINS) database was queried to obtain all gas sample data. The data were reduced with mean values used for single-point calculations and derived distributions used for Monte Carlo analyses. Values for missing data were determined using the methodology described in Barker (1999). Details of the ventilation rate and the steady-state gas concentrations at normal operating conditions, along with waste volume, headspace volume for 177 tanks are listed in Table B-1 of Appendix B. For a number of tanks, specifically sludge tanks, vapor space gas concentrations are very small, less than 50 parts per million (ppm) hydrogen, methane, and ammonia. For these tanks, the ratios between the various gases are questionable, and do not lend themselves to an accurate analysis of gas generation rates.

4.3 STEADY STATE GAS RELEASE RATES FOR H_2, NH_3, CH_4, AND N_2O

In order to evaluate the steady-state flammability level at different ventilation conditions, the steady-state gas release rates are 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 generation rate. The hydrogen generation rates are calculated in Section 4.1 and are listed in Appendix A. There are a few tanks that have a noticeable waste level increase, and the waste level increase rate can be converted to a total waste volume increase rate, which is then multiplied by the hydrogen fraction obtained from the retained gas sample analysis. The steady-state gas release rates of NH_3, CH_4 and N_2O can be derived from the steady-state concentrations at normal vent rates using Equation 3-9. The calculated gas release rates of H_2, NH_3, CH_4 and N_2O are listed in Table B-1 of Appendix B.

4.4 FLAMMABILITY EVALUATION AND RESULTS

With the collected ventilation rates and gas concentrations (Section 4.3), the flammable gas concentration, as expressed as percent LFL, in the tank headspace at normal ventilation conditions can be calculated using Equation 3-12 and are listed in Table B-1 of Appendix B. The highest observed level is 4% LFL. This suggests that the tank dome space of all tanks at current ventilation rates, whether active or passively ventilated, will not exceed 25% of the LFL.

For off-normal ventilation rates, assuming only barometric breathing rate, V_{bb}, is available as discussed in Section 4.2, the steady-state concentration can be calculated using Equation 3-12,

and the results are listed in Table B-2 of Appendix B. In the calculation for off-normal condition, the initial concentrations are assumed to be steady-state concentration at normal ventilation conditions and are listed in Table B-1 of Appendix B. As listed in Table B-2, at the off-normal condition, 39 tanks will exceed 25% LFL when the system reaches steady-state, and 10 tanks will reach 100% LFL.

Equation 3-10 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). Since the "time" variable can't be expressed explicitly in an equation, a customized Macro in EXCEL was developed using Visual Basic to iterate the calculations by increasing the time until the specified lower flammability limits in Equation 10 are met. The calculated times to reach 25% and 100% LFL at the off-normal ventilation condition are listed in Table B-3 and B-4 of Appendix B respectively. In the calculations, the flammability level of each flammable gas is also calculated for each case to understand the distribution of each gas's contribution to the total LFL.

It is also interesting to know the minimum ventilation rate required to prevent the tank headspace from exceeding 25% of the LFL. Equation 3-12 will give the flammable gas concentration in terms of %LFL at steady-state, however the vent rate is embedded in the steady-state gas concentration as given in Equation 3-7. No explicit solution was developed to find the minimum vent rate in Equation 3-12. For those tanks exceeding the specified flammability level, the minimum vent rate can be found by gradually increasing the vent 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 Table B-3 and B-4 for 25% and 100% of the LFL respectively.

Table 4-2 lists the tanks with time to reach 25% of the LFL (time-to-25%LFL) less than 200 days for both DSTs and SSTs at the off-normal ventilation condition. Also listed in Table 4-2 are the previous calculated (Hu 1997, Stauffer 1997) time-to-25%LFL, current calculated time to reach 100% LFL, the hydrogen generation rates from current and previous calculation, and the gas concentrations and % LFL contribution of the different gases at time-to-25%LFL. Tanks 241-SY-101 and 241-A-101 give the shortest time-to-25%LFL of 9 and 22 days for DSTs and SSTs respectively at the off-normal condition. Overall, there are six tanks from DSTs and four tanks from SSTs will reach 100% of the LFL. It takes 39 and 110 days to reach 100% LFL for tanks 241-SY-101 and 241-A-101 respectively.

Table 4-2 Comparison of Shorest Time-to-25%LFL Between Current and Previous Calculations

Tank Name	Time to 25% LFL $t_{25\%}$ (day) (This work)	Time to 25% LFL $t_{25\%}$ (day) (CN-116&7)	Time to 25% LFL $t_{100\%}$ (day) (This work)	Hydrogen Generation Rate (cfm) (This work)	Hydrogen Generation Rate (cfm) (CN-116&7)	HGR Ratio Between This Work / CN-116&7
Double Shell Tanks						
241-SY-101	9	7	39	2.22E-02	3.65E-02	0.61
241-AN-107	15	11	69	9.07E-03	2.92E-02	0.31
241-AN-102	17	18	79	1.01E-02	1.64E-02	0.62
241-AZ-102	42	27	276	1.06E-02	1.71E-02	0.62
241-AN-105	54	36	497	4.82E-03	7.40E-03	0.65
241-AY-102	57	29	581	1.40E-02	1.83E-02	0.77
241-AZ-101	63	24	not occur	8.80E-03	2.01E-02	0.44
241-AP-101	64	217	not occur	1.06E-03	1.85E-03	0.57
241-AW-101	73	66	not occur	3.93E-03	4.31E-03	0.91
241-AP-102	86	151	not occur	1.15E-03	2.49E-03	0.46
241-AN-104	92	59	not occur	3.66E-03	5.91E-03	0.62
241-SY-103	168	129	not occur	3.13E-03	5.90E-03	0.53
241-AN-103	171	96	not occur	3.17E-03	5.05E-03	0.63
Single Shell Tanks						
241-A-101	22	25	110	1.48E-02	1.04E-02	1.41
241-B-204	36	63	215	2.47E-04	1.75E-04	1.41
241-B-203	42	57	278	1.91E-04	1.75E-04	1.09
241-SX-105	55	not occur	516	1.22E-02	1.30E-03	9.41
241-SX-103	84	not occur	not occur	8.19E-03	1.50E-03	5.46
241-A-103	91	288	not occur	1.07E-02	4.74E-03	2.25
241-U-105	102	82	not occur	1.70E-03	5.29E-03	0.32
241-T-204	140	161	not occur	1.57E-04	1.75E-04	0.90
241-AX-101	147	not occur	not occur	4.83E-03	6.40E-04	7.55
241-S-101	179	173	not occur	3.32E-03	4.42E-03	0.75
241-T-203	180	194	not occur	1.46E-04	1.75E-04	0.84
241-SX-108	not occur	17	not occur	7.59E-04	6.14E-02	0.01
241-SX-107	not occur	20	not occur	2.42E-03	5.23E-02	0.05
241-SX-114	not occur	22	not occur	3.84E-03	4.39E-02	0.09
241-SX-110	not occur	28	not occur	1.12E-03	3.96E-02	0.03
241-C-106	not occur	30	not occur	5.57E-04	2.26E-02	0.02
241-SX-111	not occur	30	not occur	3.94E-03	3.56E-02	0.11
241-C-105	not occur	35	not occur	7.77E-04	1.92E-02	0.04
241-SX-112	not occur	36	not occur	1.21E-03	3.04E-02	0.04

4.5 UNCERTAINTY ANALYSIS

A Monte-Carlo analysis was performed to investigate the sensitivity of the model presented. Appendix C contains a MathCad™ model which performs a preliminary analysis of the model as applied to tank 241-AN-104. The evaluation was limited in scope and is not statistically valid, since the number of samples was limited to 100. 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. Due to the exponential relationship between temperature and the hydrogen generation rate by thermolysis, the uncertainty in the results were amplified to about 50% for the thermolysis hydrogen generation rate term. In addition, the mean of the thermolysis generation rate distribution increased by approximately 25%. Although the radiolysis term also has a exponential relationship to temperature, the structure of the formula dampens the effect (this is a result of the non-temperature-dependant G_{H2O} term being added to the temperature-dependant G_{org} term). For the total waste in tank 241-AN-104, Table 4-3 summarizes the differences in hydrogen generation rates, 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 4-3 Preliminary Sensitivity Study Results (Tank 241-AN-104)

	Single-Point Calculation	Monte Carlo Analysis Mean	Monte Carlo Analysis Standard Deviation
HGR - Radiolysis	1.2×10^{-3} cfm	1.3×10^{-3} cfm	1.4×10^{-4} cfm
HGR - Thermolysis	1.7×10^{-3} cfm	2.2×10^{-3} cfm	1.1×10^{-3} cfm
HGR - Corrosion	7.3×10^{-4} cfm	7.3×10^{-4} cfm	1.0×10^{-5} cfm
HGR - Total	3.7×10^{-3} cfm	4.2×10^{-3} cfm	1.2×10^{-3} cfm
$[H_2]^{SS}$	0.093 %LFL	0.104 %LFL	0.029 %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)	61 %LFL	68 %LFL	18 %LFL
$[NH_3]^{SS}$ (loss of ventilation)	9.3 %LFL	9.3 %LFL	0.93 %LFL
$[CH_4]^{SS}$ (loss of ventilation)	2.6 %LFL	2.8 %LFL	0.26 %LFL
Time to reach 25 %LFL	91 days	87 days	5 days
Time to reach 50 %LFL	250 days	233 days	26 days
Min Ventilation Rate to maintain <25 %LFL	0.44 cfm	0.46 cfm	0.03 cfm
Min Ventilation Rate to maintain <100 %LFL	0.11 cfm	0.11 cfm	0.03 cfm

Note: nc is not calculated

4.6 DISCUSSION

Hydrogen generation rates are very sensitive to temperature and are temperature-dependent exponentially for both thermolysis rate and radiolysis rate. The temperature used in the calculation is an average value of the available thermocouple tree in a given tank. This method is reasonable for most tanks, whose temperature gradient is not too large, about few degrees Celsius throughout the tank. However, for a few tanks in the SX farm, such as 241-SX-104 and 241-SX-107, the temperatures from the tank top to the tank bottom range from 70 to140 °F. For tanks with large temperature variations, the optimum way to calculate hydrogen generation rate would be to integrate generation rates over the depth and radius of the tank. This calculation, if feasible, could give a generation rate that is a factor of two larger than if the overall rate is determined from a rate calculation using the average bulk-waste temperature as provided here. Comparisons of the generation rates between current model calculation and field estimated data shows that the current model calculation, using averaged bulk waste temperature, still over estimate the observed generation rates, thus no further optimization analyses were performed for these tanks. Another issue involves tanks where thermocouples are only available in the bottom half of the waste. Linear fit of the available temperature data was conducted to extrapolate the average temperature for the tank waste, details of the analysis is documented in Bingham et al. (2000).

These hydrogen generation models assume that hydrogen generation occurs in the liquid phase. This model uses the liquid layer composition data when calculating generation rates. However, many single-shell tanks do not have a supernatant layer. The liquid information for these tanks are determined either from the drainable liquid sample data or statistically determined from the tanks in 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. In addition, there are two dozen tanks which have liquid observation well (LOW) data. LOW data are used to refine the volume of the solid waste containing the interstitial liquid.

A comparison of time-to-25%LFL between the current work and the previous calculation note, CN-116 (Stauffer 1997) and CN-117 (Hu 1997) was made. CN-117 calculated hydrogen generation rates for all DSTs using the hydrogen generation rate model, which is tank waste composition and condition based. Based on additional gas generation data, that model was further refined to the revised rate equation model (Hu 2000), which is summarized in Section 2.1 and used in the current calculation. One of the main differences between the current and the previous model involves the basis for the generation term (G-value). 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, thus the radiolysis rates were previously over-estimated. The current model incorporates a radiolysis rate equation that is a function of temperature. In addition, the updated tank data also show cooler waste temperatures, reduced heat loads due to the decay of radionuclides, and also the organic reactants consumed as time goes on. Thus, in general for DSTs, it is expected that current hydrogen generation rates would be lower than the previously calculated values. As shown in Table 4-2, the ratios between the current and previous generation rates are all less one, and current rates reduce about 40% for most tanks compared to the previous calculations. Tank 241-SY-101 waste was being

transferred, as this document was prepared. The data presented here is based on pre-transfer conditions and thus tank 241-SY-101 still has the shortest time-to-25%LFL.

For the flammability evaluation, the major difference between current and previous calculation is that the time-to 25%LFL of the mixture was calculated by fixing the ammonia and methane contribution to 2% of the LFL and 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 headspace. The current model considers all three fuels, hydrogen, ammonia, and methane, as a function of time at the off-normal condition. Thus the flammability contributions from each gas depends the size of derived gas release rates. In the time-to-25%LFL evaluation, for tanks 241-AP-101 and 241-AP-102, ammonia and methane contribute 14%LFL or higher to the overall flammable gas composition. Thus the time-to-25%LFL, for tanks 241-AP-101 and 241-AP-102, were 64 and 86 days and were shorter than the previous values of 217 and 151 days, even though the current hydrogen generation rates were reduced by about 50% when compared to the previous value. A similar argument applies to tank 241-AN-102. Tank 241-AN-102 has a current time-to-25% LFL of 17 days, which is one day shorter than previously calculated, due to the high contribution from ammonia.

For single-shell tanks, the CN-116 calculation and the current model calculation have totally different approaches, bases, and assumptions, and it is hard to compare the results from these two calculations. CN-116 calculates the hydrogen release rates for all 149 SSTs using two pieces of information, the hydrogen concentration and the ventilation rate data as discussed in Section 3.4. Ideally, the CN-116 derived gas release rate required both gas concentration and ventilation rate to be measured simultaneously, because the hydrogen headspace concentration is a function of the ventilation rate. It is rare to find both pieces data measured at the same time. Due to the lack of measured data, CN-116 used the best estimated or conservative bounding values to calculate the hydrogen generation rates for many tanks, thus 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 three to four hundred cfm, and were all assigned a bounding value of 140 ppm for hydrogen concentration. Thus the resulting time-to-25% LFL calculation results ranged from 17 to 36 days as summarized in Table 4-2. This resulted in a large conservatism being built into these calculations, because the calculated release rates were two to five times the generation rate from tank 241-SY-101. For these tanks, the hydrogen generation rates calculated by the current rate equation model are all an order of magnitude smaller than CN-116 calculated generation rates and the loss-of-ventilation-case headspace gas compositions in these tanks will not reach 25% of the LFL. On the other hand, tanks 241-SX-105 and 241-SX-103 will not reach 25% LFL based on CN-116 reported generation rates, but will reach 25% LFL in 55 and 84 days, respectively, in the current model calculation. In this calculation, these tanks experience not only an increase in the hydrogen generation rates, but also an increase in the contribution from ammonia, ranging from 4.4 to 20.9%, as compared to the 2% contribution used in CN-116.

Notice that tanks, like 241-B-204, 241-B-203, have a relatively short time-to-25% LFL, 36 and 42 days, respectively, in the current model calculations. For these two tanks, although the generation rate is very low (in the order of 2E-4 cfm), it is easy to reach 25% LFL, because the calculated off-normal ventilation rate is very small, due to the very small tank headspace volume. Similar situation also occurred for tanks 241-T-203 and 241-T-204.

5.0 SUMMARY AND CONCLUSION

Hydrogen generation rates are calculated for 177 single and double-shell tanks using the rate equation model and tank waste data. For some tanks, which do not have complete information, a waste grouping method was used to obtain the missing data. Flammable gas concentrations, in terms of % LFL in the tank headspace, are evaluated at both normal and off-normal condition for all 177 tanks. At normal ventilation conditions, all tanks are well below 25% of the LFL, the highest flammable gas concentration level is 4% LFL in tank 241-U-105. Under off-normal conditions, the shortest time to reach 25 % LFL is 9 days for double-shell tank 241-SY-101, and is 22 days for single-shell tank 241-A-101.

Calculated hydrogen generation rates for double-shell tanks ranged from 2.2 E-2 to 2.7 E-4 cfm with the highest rate found in tank 241-SY-101, and for single-shell tanks ranged from 1.5 E-2 to 4.0 E-5 cfm, where tank 241-A-101 has the highest rate. For most double-shell tanks, the tank data is sample based. For quite a few single-shell tanks, the tanks were stabilized and no liquid sample were available. The waste grouping method was used to generate default values for missing tank waste data using a Monte Carol statistical fit.

The steady-state flammability level in the tank dome space was evaluated based on the steady-state gas concentrations of hydrogen, ammonia, and methane using Le Chatelier's rule. In the calculation of off-normal conditions, 39 tanks will reach 25% of the LFL and 10 tanks will reach 100% of the LFL when the tanks reach steady-state. For the 25 %LFL and 100 % LFL evaluations under off-normal conditions, the concentrations of nitrous oxide are all below 8% with the highest value of 7.2% found in tank 241-U-105. Thus the LFL values of the fuel in air used in Equation 3-10 were valid throughout the calculation.

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APPENDIX A

Hydrogen Generation Rates Calculations from Empirical Rate Equation Model for 177 Hanford Tanks

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-AN-101	1.02E+03	2.98E+04	6.09E+04	6.90E+03	5.04E+02	8.48E+01	1.22	606	67%	18	18
AN-101 liquid	1.02E+03	2.98E+04	6.09E+04	6.90E+03	3.84E-02	7.65E+01	1.16	481	70%	18	18
AN-101 solid	1.02E+03	2.98E+04	6.09E+04	6.90E+03	2.04E+03	1.10E+02	1.46	125	56%	18	18
241-AN-102	2.62E+04	8.26E+04	2.25E+05	1.51E+04	6.36E+01	2.58E+02	1.42	4013	48%	31	29
AN-102 liquid	2.62E+04	8.26E+04	2.25E+05	1.51E+04	5.46E+01	2.57E+02	1.41	3676	49%	31	29
AN-102 solid	2.62E+04	8.26E+04	2.25E+05	1.51E+04	1.56E+02	2.63E+02	1.50	337	41%	31	29
241-AN-103	3.05E+03	1.65E+05	1.68E+05	3.02E+04	1.33E+00	4.43E+02	1.58	3626	41%	38	28
AN-103 liquid	3.05E+03	1.65E+05	1.68E+05	3.02E+04	1.50E-02	5.98E+02	1.49	2074	49%	38	28
AN-103 solid	3.05E+03	1.65E+05	1.68E+05	3.02E+04	2.86E+00	2.63E+02	1.71	1552	32%	38	28
241-AN-104	3.11E+03	1.25E+05	1.70E+05	3.86E+04	1.70E+01	4.67E+02	1.48	3986	49%	36	29
AN-104 liquid	3.11E+03	1.25E+05	1.70E+05	3.86E+04	7.31E-02	5.38E+02	1.40	2286	51%	36	29
AN-104 solid	3.11E+03	1.25E+05	1.70E+05	3.86E+04	3.70E+01	3.83E+02	1.59	1700	46%	36	29
241-AN-105	6.10E+03	1.21E+05	1.62E+05	4.11E+04	7.70E+00	3.01E+02	1.49	4262	48%	34	28
AN-105 liquid	6.10E+03	1.21E+05	1.62E+05	4.11E+04	3.11E-02	2.95E+02	1.42	2411	50%	34	28
AN-105 solid	6.10E+03	1.21E+05	1.62E+05	4.11E+04	1.67E+01	3.08E+02	1.58	1851	44%	34	28
241-AN-106	4.39E+03	1.76E+04	6.58E+04	3.22E+03	2.12E+01	1.13E+02	1.39	148	52%	17	18
AN-106 liquid	4.39E+03	1.76E+04	6.58E+04	3.22E+03	3.24E-02	6.55E+01	1.19	83	65%	17	18
AN-106 solid	4.39E+03	1.76E+04	6.58E+04	3.22E+03	4.10E+01	1.58E+02	1.64	64	40%	17	18
241-AN-107	4.12E+04	6.59E+04	2.38E+05	2.93E+02	1.11E+02	2.87E+02	1.41	3952	48%	29	26
AN-107 liquid	4.12E+04	6.59E+04	2.38E+05	2.93E+02	8.50E+01	2.99E+02	1.37	3017	50%	29	26
AN-107 solid	4.12E+04	6.59E+04	2.38E+05	2.93E+02	1.87E+02	2.53E+02	1.56	935	40%	29	26
241-AP-101	3.22E+03	4.11E+04	1.34E+05	9.88E+03	1.09E-01	1.39E+02	1.27	4221	58%	19	19
AP-101 liquid	3.22E+03	4.11E+04	1.34E+05	9.88E+03	1.09E-01	1.39E+02	1.27	4221	58%	19	19
AP-101 solid	3219.4	41105.8	134404.3	9878.1	0.0	0.0	0.0	0.0	0.0	not exist	not exist

Author [illegible] Date 4-24-00 Checked by E. Bai[illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-AP-102	3.28E+03	3.59E+04	7.60E+04	1.15E+04	1.19E+00	1.88E+02	1.20	4134	75%	20	20
AP-102 liquid	3.28E+03	3.59E+04	7.60E+04	1.15E+04	1.19E+00	1.88E+02	1.20	4134	75%	20	20
AP-102 solid	3280.0	35900.0	76000.0	11500.0	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AP-103	4.28E+03	9.10E+04	1.12E+05	7.43E+03	2.95E-01	2.04E+02	1.38	1079	98%	15	16
AP-103 liquid	4.28E+03	9.10E+04	1.12E+05	7.43E+03	2.95E-01	2.04E+02	1.38	1075	98%	15	16
AP-103 solid	4280.0	91000.0	112000.0	7430.0	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AP-104	1.18E+02	1.09E+03	2.62E+03	4.14E+01	8.23E-02	3.86E+00	1.00	91	97%	15	15
AP-104 liquid	1.18E+02	1.09E+03	2.62E+03	4.14E+01	8.23E-02	3.86E+00	1.00	91	97%	15	15
AP-104 solid	118.0	1090.0	2619.2	41.4	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AP-105	2.01E+03	1.27E+05	2.84E+05	2.57E+04	3.48E+00	1.44E+02	1.37	2896	60%	19	19
AP-105 liquid	2.01E+03	1.27E+05	2.84E+05	2.57E+04	1.96E-01	1.13E+02	1.34	2559	62%	19	19
AP-105 solid	2.01E+03	1.27E+05	2.84E+05	2.57E+04	2.46E+01	3.41E+02	1.58	337	45%	19	19
241-AP-106	9.72E+02	1.35E+04	4.47E+04	3.72E+03	3.20E-01	6.61E+01	1.11	352	94%	17	17
AP-106 liquid	9.72E+02	1.35E+04	4.47E+04	3.72E+03	3.20E-01	6.61E+01	1.11	352	94%	17	17
AP-106 solid	972.0	13500.0	44700.0	3720.0	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AP-107	5.78E+02	2.46E+04	7.54E+04	7.13E+03	3.24E-01	7.06E+01	1.13	3695	89%	14	15
AP-107 liquid	5.78E+02	2.46E+04	7.54E+04	7.13E+03	3.24E-01	7.06E+01	1.13	3695	89%	14	15
AP-107 solid	578.0	24600.0	75400.0	7130.0	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AP-108	9.41E+02	3.07E+04	6.72E+04	8.51E+03	8.44E-01	8.46E+01	1.14	1397	84%	16	16
AP-108 liquid	9.41E+02	3.07E+04	6.72E+04	8.51E+03	8.44E-01	8.46E+01	1.14	1397	84%	16	16
AP-108 solid	941.0	30700.0	67200.0	8510.0	0.0	0.0	0.0	0.0	0.0	not exist	not exist
241-AW-101	3.44E+03	9.87E+04	1.57E+05	3.21E+04	9.17E+00	3.36E+02	1.46	4262	47%	34	26
AW-101 liquid	3.44E+03	9.87E+04	1.57E+05	3.21E+04	3.22E-02	3.58E+02	1.40	3104	49%	34	26
AW-101 solid	3.44E+03	9.87E+04	1.57E+05	3.21E+04	3.02E+01	2.84E+02	1.63	1158	43%	34	26

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-AW-102	5.73E+02	2.37E+04	7.26E+04	6.86E+03	5.13E+02	1.01E+02	1.29	303	59%	20	19
AW-102 liquid	5.73E+02	2.37E+04	7.26E+04	6.86E+03	3.51E-01	7.77E+01	1.13	151	88%	20	19
AW-102 solid	5.73E+02	2.37E+04	7.26E+04	6.86E+03	9.12E+02	1.19E+02	1.45	151	40%	20	19
241-AW-103	9.54E+02	1.78E+03	4.22E+03	6.46E+01	7.47E+00	5.09E+01	1.20	1931	65%	17	17
AW-103 liquid	9.54E+02	1.78E+03	4.22E+03	6.46E+01	2.24E-04	2.10E+01	1.02	613	93%	17	17
AW-103 solid	9.54E+02	1.78E+03	4.22E+03	6.46E+01	1.02E+01	6.19E+01	1.29	1317	55%	17	17
241-AW-104	3.84E+03	4.44E+04	7.32E+04	1.18E+04	9.91E+00	8.35E+01	1.30	4236	75%	21	19
AW-104 liquid	3.84E+03	4.44E+04	7.32E+04	1.18E+04	1.29E+01	1.09E+02	1.25	3361	82%	21	19
AW-104 solid	3.84E+03	4.44E+04	7.32E+04	1.18E+04	1.69E-01	2.00E-01	1.47	874	53%	21	19
241-AW-105	2.14E+03	1.28E+03	2.70E+04	4.34E+01	4.50E+01	2.55E+01	1.21	1624	73%	16	16
AW-105 liquid	2.14E+03	1.28E+03	2.70E+04	4.34E+01	4.61E-02	2.25E+00	1.02	564	93%	16	16
AW-105 solid	2.14E+03	1.28E+03	2.70E+04	4.34E+01	6.36E+01	3.51E+01	1.31	1060	66%	16	16
241-AW-106	3.44E+03	6.98E+04	1.18E+05	8.16E+03	1.63E+01	2.06E+02	1.45	1791	57%	31	26
AW-106 liquid	3.44E+03	6.98E+04	1.18E+05	8.16E+03	2.32E-01	2.26E+02	1.38	927	59%	31	26
AW-106 solid	3.44E+03	6.98E+04	1.18E+05	8.16E+03	3.18E+01	1.86E+02	1.53	863	55%	31	26
241-AY-101	4.91E+03	3.53E+04	2.60E+04	1.21E+01	2.93E+03	9.80E+01	1.23	583	58%	38	27
AY-101 liquid	4.91E+03	3.53E+04	2.60E+04	1.21E+01	1.75E+00	1.01E+02	1.08	174	84%	33	27
AY-101 solid	4.91E+03	3.53E+04	2.60E+04	1.21E+01	3.97E+03	9.70E+01	1.30	409	48%	40	27
241-AY-102	9.42E+02	6.50E+03	4.92E+02	1.85E+03	2.83E+03	1.20E+02	1.18	2355	82%	37	25
AY-102 liquid	9.42E+02	6.50E+03	4.92E+02	1.85E+03	8.29E-01	3.18E+01	1.09	1556	98%	33	25
AY-102 solid	9.42E+02	6.50E+03	4.92E+02	1.85E+03	7.28E+03	2.58E+02	1.35	799	56%	45	25
241-AZ-101	1.03E+03	5.68E+04	6.60E+04	4.94E+03	2.55E+03	1.35E+03	1.22	3199	72%	51	33
AZ-101 liquid	1.03E+03	5.68E+04	6.60E+04	4.94E+03	1.01E+00	1.34E+03	1.19	3021	73%	51	33
AZ-101 solid	1.03E+03	5.68E+04	6.60E+04	4.94E+03	3.34E+04	1.48E+03	1.67	178	56%	54	33

Author [illegible] Date 4-21-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-AZ-102	1.51E+03	2.87E+04	2.38E+04	4.94E+03	2.30E+03	9.31E+02	1.14	3524	80%	46	33
AZ-102 liquid	1.51E+03	2.87E+04	2.38E+04	4.94E+03	5.96E+00	9.46E+02	1.10	3131	84%	44	33
AZ-102 solid	1.51E+03	2.87E+04	2.38E+04	4.94E+03	1.58E+04	8.43E+02	1.49	394	56%	60	33
241-SY-101	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.35E+01	3.14E+02	1.50	4501	38%	47	24
SY-101 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	2286	41%	47	24
SY-101 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.85E+01	3.26E+02	1.61	2214	35%	47	24
241-SY-102	1.29E+03	4.45E+04	8.77E+04	1.21E+04	1.62E+01	9.54E+01	1.22	2317	81%	22	21
SY-102 liquid	1.29E+03	4.45E+04	8.77E+04	1.21E+04	1.21E+00	1.09E+02	1.18	1984	87%	22	21
SY-102 solid	1.29E+03	4.45E+04	8.77E+04	1.21E+04	8.96E+01	2.77E+01	1.44	333	51%	22	21
241-SY-103	9.20E+03	1.43E+05	1.79E+05	4.14E+04	1.71E+00	2.38E+02	1.49	2816	40%	31	27
SY-103 liquid	9.20E+03	1.43E+05	1.79E+05	4.14E+04	2.08E+00	2.95E+02	1.47	1446	47%	31	27
SY-103 solid	9.20E+03	1.43E+05	1.79E+05	4.14E+04	1.33E+00	1.80E+02	1.51	1370	34%	31	27
241-A-101	3.34E+03	1.37E+05	1.36E+05	4.46E+04	2.72E+01	2.45E+02	1.52	3608	45%	60.1	35.6
A-101 liquid	3.34E+03	1.37E+05	1.36E+05	4.46E+04	5.73E-02	2.77E+02	1.40	1923	53%	62.2	35.6
A-101 solid	3.34E+03	1.37E+05	1.36E+05	4.46E+04	5.34E+01	2.14E+02	1.66	1685	37%	57.7	35.6
241-A-102	9.58E+03	1.05E+05	2.07E+05	3.21E+04	7.49E+02	1.31E+02	1.61	155	36%	32.8	31.5
A-102 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	15	55%	32.8	31.5
A-102 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	8.18E+02	1.17E+02	1.63	140	34%	32.8	31.5
241-A-103	8.30E+03	3.60E+04	1.33E+05	3.56E+04	8.21E+03	6.38E+02	1.30	1404	44%	39.6	29.4
A-103 liquid	8.30E+03	3.60E+04	1.33E+05	3.56E+04	1.67E+00	2.30E+02	1.48	19	75%	39.6	29.4
A-103 solid	8.30E+03	3.60E+04	1.33E+05	3.56E+04	8.34E+03	6.44E+02	1.30	1385	44%	39.6	29.4
241-A-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.69E+04	4.49E+02	1.64	106	44%	74.4	34.1
A-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	74.4	34.1
A-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.69E+04	4.49E+02	1.64	106	44%	74.4	34.1

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A-105 liquid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A-105 solid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.73E+02	1.25E+02	1.55	473	44%	54.8	39.9
A-106 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	54.8	39.9
A-106 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.73E+02	1.25E+02	1.55	473	44%	54.8	39.9
241-AX-101	3.48E+03	1.62E+05	1.49E+05	5.36E+04	3.06E+01	2.37E+02	1.57	2831	42%	49.4	28.9
AX-101 liquid	3.48E+03	1.62E+05	1.49E+05	5.36E+04	1.80E-01	2.77E+02	1.48	1461	48%	49.4	28.9
AX-101 solid	3.48E+03	1.62E+05	1.49E+05	5.36E+04	5.93E+01	2.00E+02	1.67	1370	36%	49.4	28.9
241-AX-102	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.58E+03	2.67E+02	1.45	114	34%	23.8	23.7
AX-102 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	23.8	23.7
AX-102 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.58E+03	2.67E+02	1.45	114	34%	23.8	23.7
241-AX-103	9.20E+03	1.07E+05	1.76E+05	2.75E+04	7.41E+02	2.02E+02	1.62	424	43%	39.6	31.9
AX-103 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	39.6	31.9
AX-103 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	7.41E+02	2.02E+02	1.62	424	43%	39.6	31.9
241-AX-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.18E+04	1.24E+03	1.80	30	7%	31.6	30.6
AX-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	31.6	30.6
AX-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.18E+04	1.24E+03	1.80	30	7%	31.6	30.6
241-B-101	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.48	428	29%	39.4	32.2
B-101 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	50%	39.4	32.2
B-101 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.48	428	29%	39.4	32.2
241-B-102	9.20E+03	1.07E+05	1.76E+05	2.75E+04	3.36E+00	4.86E+01	1.73	121	21%	18.1	18.2
B-102 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	15	51%	18.1	18.2
B-102 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.84E+00	2.04E+01	1.78	106	18%	18.1	18.2

Author [illegible] Date 4-26-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-B-103	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.92E+00	1.38E+01	1.78	223	45%	17.3	17.1
B-103 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	17.3	17.1
B-103 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.92E+00	1.38E+01	1.78	223	45%	17.3	17.1
241-B-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.22	1404	47%	20.3	19.6
B-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	52%	20.3	19.6
B-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.22	1401	47%	20.3	19.6
241-B-105	9.20E+03	1.07E+05	1.76E+05	2.75E+04	3.08E+02	1.52E+02	1.64	598	32%	18.3	17.9
B-105 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	18.3	17.9
B-105 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	3.08E+02	1.52E+02	1.64	598	32%	18.3	17.9
241-B-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.03E+03	1.10E+02	1.46	443	60%	17.6	18.6
B-106 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	67%	17.6	18.6
B-106 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	439	60%	17.6	18.6
241-B-107	9.58E+03	1.05E+05	2.07E+05	3.21E+04	7.25E+02	1.30E+02	1.66	625	36%	16.0	15.2
B-107 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	4	57%	16.0	15.2
B-107 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	7.28E+02	1.30E+02	1.66	621	36%	16.0	15.2
241-B-108	9.58E+03	1.05E+05	2.07E+05	3.21E+04	1.88E+01	2.13E+01	1.60	356	31%	17.0	17.0
B-108 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	79%	17.0	17.0
B-108 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	1.88E+01	2.13E+01	1.60	356	31%	17.0	17.0
241-B-109	9.58E+03	1.05E+05	2.07E+05	3.21E+04	6.49E+02	1.32E+02	1.87	481	40%	19.0	18.9
B-109 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	55%	19.0	18.9
B-109 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	6.49E+02	1.32E+02	1.87	481	40%	19.0	18.9
241-B-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.87E+01	1.40E+01	1.36	931	44%	21.4	22.7
B-110 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	75%	21.4	22.7
B-110 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.90E+01	1.37E+01	1.36	927	44%	21.4	22.7

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-B-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.47E+02	1.58E+02	1.19	897	44%	22.7	21.6
B-111 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	75%	22.7	21.6
B-111 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.48E+02	1.58E+02	1.19	893	44%	22.7	21.6
241-B-112	7.98E+02	3.51E+04	1.71E+05	1.29E+03	1.65E+02	8.03E+01	1.27	125	47%	18.1	18.3
B-112 liquid	7.98E+02	3.51E+04	1.71E+05	1.29E+03	1.65E+02	8.03E+01	1.27	11	75%	18.1	18.3
B-112 solid	7.98E+02	3.51E+04	1.71E+05	1.29E+03	1.65E+02	8.03E+01	1.27	114	44%	18.1	18.3
241-B-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.35E+00	4.26E+00	1.25	110	45%	13.4	13.8
B-201 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	75%	13.4	13.8
B-201 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.99E+00	7.64E-01	1.25	106	44%	13.4	13.8
241-B-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.82E+00	9.61E-02	1.30	102	68%	16.0	16.1
B-202 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	83%	16.0	16.1
B-202 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.82E+00	9.61E-02	1.30	102	68%	16.0	16.1
241-B-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.86E-01	2.26E+00	1.19	193	76%	11.9	12.2
B-203 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	89%	11.9	12.2
B-203 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.40E-01	1.59E-01	1.19	189	76%	11.9	12.2
241-B-204	2.98E+03	1.82E+03	4.82E+04	4.94E+03	2.01E+03	1.10E+02	1.19	189	45%	13.4	13.9
B-204 liquid	2.98E+03	1.82E+03	4.82E+04	4.94E+03	1.29E+01	1.09E+02	1.05	4	89%	13.4	13.9
B-204 solid	2.98E+03	1.82E+03	4.82E+04	4.94E+03	2.04E+03	1.10E+02	1.19	185	44%	13.4	13.9
241-BX-101	4.98E+03	6.43E+04	1.21E+05	5.17E+03	2.17E+02	8.33E+01	1.72	163	20%	20.6	20.4
BX-101 liquid	4.98E+03	6.43E+04	1.21E+05	5.17E+03	2.56E+00	8.36E+01	1.28	4	75%	20.6	20.4
BX-101 solid	4.98E+03	6.43E+04	1.21E+05	5.17E+03	2.20E+02	8.33E+01	1.73	159	19%	20.6	20.4
241-BX-102	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.72E+01	3.07E+01	0.76	363	44%	18.6	18.1
BX-102 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	18.6	18.1
BX-102 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.72E+01	3.07E+01	0.76	363	44%	18.6	18.1

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-BX-103	4.98E+03	6.43E+04	1.21E+05	5.17E+03	1.07E+02	5.07E+01	1.64	269	50%	19.6	19.3
BX-103 liquid	4.98E+03	6.43E+04	1.21E+05	5.17E+03	2.56E+00	8.36E+01	1.28	34	75%	19.6	19.3
BX-103 solid	4.98E+03	6.43E+04	1.21E+05	5.17E+03	1.18E+02	4.71E+01	1.69	235	47%	19.6	19.3
241-BX-104	3.19E+03	6.38E+04	1.35E+05	2.84E+03	2.24E+02	8.13E+01	1.72	375	45%	29.5	24.5
BX-104 liquid	3.19E+03	6.38E+04	1.35E+05	2.84E+03	1.78E+00	1.29E+02	1.29	11	75%	29.5	24.5
BX-104 solid	3.19E+03	6.38E+04	1.35E+05	2.84E+03	2.29E+02	8.02E+01	1.73	363	44%	29.5	24.5
241-BX-105	9.43E+03	6.48E+04	1.17E+05	5.93E+03	1.10E+02	5.24E+01	1.65	193	18%	18.6	18.5
BX-105 liquid	9.43E+03	6.48E+04	1.17E+05	5.93E+03	7.44E+00	1.16E+02	1.29	19	75%	18.6	18.5
BX-105 solid	9.43E+03	6.48E+04	1.17E+05	5.93E+03	1.18E+02	4.71E+01	1.69	174	13%	18.6	18.5
241-BX-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.18E+02	4.71E+01	1.69	144	39%	18.5	18.5
BX-106 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	18.5	18.5
BX-106 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.18E+02	4.71E+01	1.69	144	39%	18.5	18.5
241-BX-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.59E+00	1.71E+01	1.44	1306	51%	19.0	18.7
BX-107 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	75%	19.0	18.7
BX-107 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	9.58E+00	1.69E+01	1.44	1302	51%	19.0	18.7
241-BX-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.18E+02	1.45E+01	1.46	98	28%	17.9	18.0
BX-108 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	17.9	18.0
BX-108solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.18E+02	1.45E+01	1.46	98	28%	17.9	18.0
241-BX-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.84E+02	1.30E+01	1.48	731	51%	21.0	19.6
BX-109 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	72%	21.0	19.6
BX-109 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.84E+02	1.30E+01	1.48	731	51%	21.0	19.6
241-BX-110	9.58E+03	3.57E+04	7.46E+05	4.95E+03	2.36E+01	7.67E+01	1.83	784	39%	18.3	18.5
BX-110 liquid	9.58E+03	3.57E+04	7.46E+05	4.95E+03	1.00E-02	9.05E+01	1.40	11	53%	18.3	18.5
BX-110 solid	9.58E+03	3.57E+04	7.46E+05	4.95E+03	2.38E+01	7.65E+01	1.84	772	39%	18.3	18.5

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-BX-111	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.58E+01	7.79E+01	1.38	613	20%	18.1	17.6
BX-111 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	4	51%	18.1	17.6
BX-111 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.59E+01	7.65E+01	1.38	609	20%	18.1	17.6
241-BX-112	2.98E+03	3.53E+04	9.85E+04	4.78E+01	6.09E+00	5.22E+01	1.31	625	62%	17.7	17.5
BX-112 liquid	2.98E+03	3.53E+04	9.85E+04	4.78E+01	1.29E+01	1.09E+02	1.18	4	75%	17.7	17.5
BX-112 solid	2.98E+03	3.53E+04	9.85E+04	4.78E+01	6.05E+00	5.18E+01	1.31	621	62%	17.7	17.5
241-BY-101	9.20E+03	1.07E+05	1.76E+05	2.75E+04	9.12E+01	1.17E+02	1.66	1465	26%	22.9	20.8
BY-101 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	22.9	20.8
BY-101 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	9.12E+01	1.17E+02	1.66	1465	26%	22.9	20.8
241-BY-102	1.80E+03	7.98E+04	1.75E+05	5.08E+04	2.36E+01	8.70E+01	1.50	1049	29%	21.9	22.3
BY-102 liquid	1.80E+03	7.98E+04	1.75E+05	5.08E+04	8.00E+00	3.01E+02	1.44	0	51%	21.9	22.3
BY-102 solid	1.80E+03	7.98E+04	1.75E+05	5.08E+04	2.36E+01	8.70E+01	1.50	1049	29%	21.9	22.3
241-BY-103	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.88E+01	8.78E+01	1.71	1514	32%	23.4	21.2
BY-103 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	59%	23.4	21.2
BY-103 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.88E+01	8.78E+01	1.71	1514	32%	23.4	21.2
241-BY-104	9.58E+03	1.05E+05	2.07E+05	3.21E+04	6.05E+02	1.34E+02	1.64	1234	23%	40.0	24.9
BY-104 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	49%	40.0	24.9
BY-104 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	6.05E+02	1.34E+02	1.64	1234	23%	40.0	24.9
241-BY-105	2.43E+03	6.88E+04	1.99E+05	3.92E+04	6.23E+01	5.26E+01	1.92	1904	17%	36.1	24.3
BY-105 liquid	2.43E+03	6.88E+04	1.99E+05	3.92E+04	8.56E-02	1.65E+02	1.44	0	52%	36.1	24.3
BY-105 solid	2.43E+03	6.88E+04	1.99E+05	3.92E+04	6.23E+01	5.26E+01	1.92	1904	17%	36.1	24.3
241-BY-106	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.26E+02	1.75E+02	1.72	2127	26%	39.4	25.1
BY-106 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	59%	39.4	25.1
BY-106 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.26E+02	1.75E+02	1.72	2127	26%	39.4	25.1

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-BY-107	3.50E+03	1.66E+05	1.87E+05	7.50E+04	3.75E+01	1.55E+02	1.66	1007	40%	30.7	24.1
BY-107 liquid	3.50E+03	1.66E+05	1.87E+05	7.50E+04	8.00E+00	3.01E+02	1.46	0	49%	30.7	24.1
BY-107 solid	3.50E+03	1.66E+05	1.87E+05	7.50E+04	3.75E+01	1.55E+02	1.66	1007	40%	30.7	24.1
241-BY-108	9.58E+03	1.05E+05	2.07E+05	3.21E+04	9.21E+02	1.60E+02	1.58	863	29%	34.7	27.1
BY-108 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	33%	34.7	27.1
BY-108 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	9.21E+02	1.60E+02	1.58	863	29%	34.7	27.1
241-BY-109	9.20E+03	1.07E+05	1.76E+05	2.75E+04	6.13E+01	7.87E+01	1.66	1098	39%	18.5	17.2
BY-109 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	53%	18.5	17.2
BY-109 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	6.13E+01	7.87E+01	1.66	1098	39%	18.5	17.2
241-BY-110	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.15E+02	8.53E+01	1.73	1507	26%	36.4	23.4
BY-110 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	41%	36.4	23.4
BY-110 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.15E+02	8.53E+01	1.73	1507	26%	36.4	23.4
241-BY-111	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.57	1738	36%	26.1	21.2
BY-111 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	54%	26.1	21.2
BY-111 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.57	1738	36%	26.1	21.2
241-BY-112	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.46	1102	29%	28.7	22.0
BY-112 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	49%	28.7	22.0
BY-112 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.46	1102	29%	28.7	22.0
241-C-101	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.33E+02	8.20E+01	1.54	333	28%	31.5	30.4
C-101 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	74%	31.5	30.4
C-101 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.33E+02	8.20E+01	1.54	333	28%	31.5	30.4
241-C-102	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.80	1196	44%	25.7	23.7
C-102 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	25.7	23.7
C-102 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.80	1196	44%	25.7	23.7

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-C-103	7.12E+03	2.43E+04	4.30E+03	1.16E+01	2.02E+03	1.05E+02	1.23	750	67%	43.1	37.6
C-103 liquid	7.12E+03	2.43E+04	4.30E+03	1.16E+01	1.29E+01	1.09E+02	1.08	299	86%	43.1	37.6
C-103 solid	7.12E+03	2.43E+04	4.30E+03	1.16E+01	3.10E+03	1.03E+02	1.34	450	57%	43.1	37.6
241-C-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.31E+02	5.43E+01	1.70	1117	52%	34.6	29.8
C-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	81%	34.6	29.8
C-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.31E+02	5.43E+01	1.70	1117	52%	34.6	29.8
241-C-105	2.87E+03	3.60E+04	3.43E+04	9.02E+00	5.24E+02	1.79E+02	1.44	496	37%	38.6	31.0
C-105 liquid	2.87E+03	3.60E+04	3.43E+04	9.02E+00	3.55E+00	3.08E+02	1.23	0	67%	38.6	31.0
C-105 solid	2.87E+03	3.60E+04	3.43E+04	9.02E+00	7.37E+02	1.26E+02	1.55	496	25%	38.6	31.0
241-C-106	9.42E+02	6.50E+03	4.92E+02	1.85E+03	8.00E+01	1.20E+02	1.16	189	59%	16.2	12.4
C-106 liquid	9.42E+02	6.50E+03	4.92E+02	1.85E+03	8.29E-01	3.18E+01	1.09	159	69%	16.2	12.4
C-106 solid	9.42E+02	6.50E+03	4.92E+02	1.85E+03	3.72E+02	4.45E+02	1.55	30	26%	16.2	12.4
241-C-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.23E+03	2.24E+01	1.40	973	54%	44.5	42.3
C-107 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	79%	44.5	42.3
C-107 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.23E+03	2.24E+01	1.40	973	54%	44.5	42.3
241-C-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.70E+01	2.59E+02	1.40	250	43%	23.7	23.0
C-108 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	23.7	23.0
C-108 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.70E+01	2.59E+02	1.40	250	43%	23.7	23.0
241-C-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.22E+02	7.79E+02	1.23	250	46%	24.3	23.8
C-109 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	15	75%	24.3	23.8
C-109 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	7.66E+02	8.20E+02	1.23	235	44%	24.3	23.8
241-C-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.78E+00	1.92E+01	1.45	674	58%	19.4	19.5
C-110 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	75%	19.4	19.5
C-110 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.75E+00	1.88E+01	1.45	670	58%	19.4	19.5

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-C-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.16E+03	4.32E+01	1.30	216	24%	22.5	22.5
C-111 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	22.5	22.5
C-111 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.16E+03	4.32E+01	1.30	216	24%	22.5	22.5
241-C-112	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.93E+03	3.81E+02	1.65	394	44%	26.1	25.2
C-112 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	26.1	25.2
C-112 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.93E+03	3.81E+02	1.65	394	44%	26.1	25.2
241-C-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.24E+01	2.75E+00	1.33	8	44%	16.1	16.1
C-201 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	16.1	16.1
C-201 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.24E+01	2.75E+00	1.33	8	44%	16.1	16.1
241-C-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.57E+03	1.61E+01	1.50	4	6%	15.7	15.7
C-202 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	15.7	15.7
C-202 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.57E+03	1.61E+01	1.50	4	6%	15.7	15.7
241-C-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	2.70E+00	1.16	19	39%	15.2	15.4
C-203 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	15.2	15.4
C-203 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	2.70E+00	1.16	19	39%	15.2	15.4
241-C-204	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.43E+01	2.70E+00	1.16	11	44%	17.5	15.5
C-204 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	17.5	15.5
C-204 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.43E+01	2.70E+00	1.16	11	44%	17.5	15.5
241-S-101	9.58E+03	9.40E+04	1.81E+05	2.45E+04	1.57E+02	1.49E+02	1.64	1616	40%	43.3	30.8
S-101 liquid	9.58E+03	9.40E+04	1.81E+05	2.45E+04	4.00E+00	2.83E+02	1.36	45	63%	43.3	30.8
S-101 solid	9.58E+03	9.40E+04	1.81E+05	2.45E+04	1.61E+02	1.45E+02	1.65	1571	39%	43.3	30.8
241-S-102	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.38E+02	1.38E+02	1.67	1946	28%	38.9	27.3
S-102 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	38.9	27.3
S-102 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.38E+02	1.38E+02	1.67	1946	28%	38.9	27.3

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-S-103	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.93E+01	1.74E+02	1.59	874	32%	27.8	23.4
S-103 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	50%	27.8	23.4
S-103 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.93E+01	1.74E+02	1.59	874	32%	27.8	23.4
241-S-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.00E+02	6.05E+01	1.64	1113	38%	37.6	29.7
S-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	56%	37.6	29.7
S-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.00E+02	6.04E+01	1.64	1109	38%	37.6	29.7
241-S-105	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.82E+01	1.58E+02	1.63	1726	32%	23.1	20.8
S-105 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	23.1	20.8
S-105 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.82E+01	1.58E+02	1.63	1726	32%	23.1	20.8
241-S-106	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.64E+01	1.15E+02	1.72	1613	30%	24.6	20.4
S-106 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	24.6	20.4
S-106 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.64E+01	1.15E+02	1.72	1613	30%	24.6	20.4
241-S-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.61E+02	8.82E+01	1.43	1423	35%	38.3	27.0
S-107 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	53	68%	38.3	27.0
S-107 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.66E+02	8.76E+01	1.44	1370	34%	38.3	27.0
241-S-108	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.33E+01	1.34E+02	1.65	1703	32%	26.7	21.4
S-108 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	26.7	21.4
S-108 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.33E+01	1.34E+02	1.65	1703	32%	26.7	21.4
241-S-109	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.94E+01	1.57E+02	1.31	1919	10%	27.4	20.6
S-109 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	52%	27.4	20.6
S-109 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.94E+01	1.57E+02	1.31	1919	10%	27.4	20.6
241-S-110	6.53E+03	8.59E+04	2.17E+05	3.09E+04	1.61E+02	9.91E+01	1.70	1476	26%	41.7	25.4
S-110 liquid	6.53E+03	8.59E+04	2.17E+05	3.09E+04	7.11E-01	2.79E+02	1.43	0	50%	41.7	25.4
S-110 solid	6.53E+03	8.59E+04	2.17E+05	3.09E+04	1.61E+02	9.91E+01	1.70	1476	26%	41.7	25.4

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-S-111	1.38E+03	6.46E+04	1.90E+05	2.55E+04	2.34E+02	1.26E+02	1.58	2044	34%	28.6	23.2
S-111 liquid	1.38E+03	6.46E+04	1.90E+05	2.55E+04	2.29E-01	1.92E+02	1.39	420	53%	28.6	23.2
S-111 solid	1.38E+03	6.46E+04	1.90E+05	2.55E+04	2.85E+02	1.12E+02	1.63	1624	30%	28.6	23.2
241-S-112	9.20E+03	1.07E+05	1.76E+05	2.75E+04	9.27E+01	1.52E+02	1.63	1980	32%	27.1	21.0
S-112 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	27.1	21.0
S-112 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	9.27E+01	1.52E+02	1.63	1980	32%	27.1	21.0
241-SX-101	3.35E+02	7.80E+04	1.05E+05	7.56E+04	1.33E+02	1.13E+02	1.91	1696	31%	51.8	38.2
SX-101 liquid	3.35E+02	7.80E+04	1.05E+05	7.56E+04	8.00E+00	2.10E+01	1.50	0	49%	51.8	38.2
SX-101 solid	3.35E+02	7.80E+04	1.05E+05	7.56E+04	1.33E+02	1.13E+02	1.91	1696	31%	51.8	38.2
241-SX-102	1.51E+03	1.51E+05	1.58E+05	4.56E+04	8.87E+01	2.05E+02	1.66	1946	41%	55.2	32.9
SX-102 liquid	1.51E+03	1.51E+05	1.58E+05	4.56E+04	1.80E-02	3.36E+02	1.45	507	48%	55.0	32.9
SX-102 solid	1.51E+03	1.51E+05	1.58E+05	4.56E+04	1.15E+02	1.66E+02	1.73	1438	39%	55.2	32.9
241-SX-103	2.66E+03	1.58E+05	1.59E+05	4.41E+04	2.43E+02	1.46E+02	1.77	2400	31%	61.9	30.9
SX-103 liquid	2.66E+03	1.58E+05	1.59E+05	4.41E+04	8.49E-02	3.24E+02	1.47	0	47%	61.9	30.9
SX-103 solid	2.66E+03	1.58E+05	1.59E+05	4.41E+04	2.43E+02	1.46E+02	1.77	2400	31%	61.9	30.9
241-SX-104	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.62E+02	1.29E+02	1.65	1768	35%	46.3	28.6
SX-104 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	46.3	28.6
SX-104 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.62E+02	1.29E+02	1.65	1768	35%	46.3	28.6
241-SX-105	3.26E+03	1.43E+05	1.65E+05	4.41E+04	1.11E+02	1.45E+02	1.64	2411	35%	63.4	34.1
SX-105 liquid	3.26E+03	1.43E+05	1.65E+05	4.41E+04	1.21E-01	2.89E+02	1.47	0	43%	63.4	34.1
SX-105 solid	3.26E+03	1.43E+05	1.65E+05	4.41E+04	1.11E+02	1.45E+02	1.64	2411	35%	63.4	34.1
241-SX-106	4.05E+03	1.32E+05	2.10E+05	2.59E+04	3.23E+00	2.04E+02	1.57	1601	42%	36.7	25.9
SX-106 liquid	4.05E+03	1.32E+05	2.10E+05	2.59E+04	2.67E-01	2.95E+02	1.42	379	46%	36.7	25.9
SX-106 solid	4.05E+03	1.32E+05	2.10E+05	2.59E+04	4.04E+00	1.79E+02	1.61	1223	40%	36.7	25.9

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-SX-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	394	44%	64.7	45.2
SX-107 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	64.7	45.2
SX-107 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	394	44%	64.7	45.2
241-SX-108	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	329	2%	71.5	53.1
SX-108 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	71.5	53.1
SX-108 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	329	2%	71.5	53.1
241-SX-109	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.94E+02	1.48E+02	1.64	946	32%	53.4	48.3
SX-109 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	53.4	48.3
SX-109 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.94E+02	1.48E+02	1.64	946	32%	53.4	48.3
241-SX-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	235	44%	61.9	49.6
SX-110 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	61.9	49.6
SX-110 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	235	44%	61.9	49.6
241-SX-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	462	44%	76.7	51.2
SX-111 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	76.7	51.2
SX-111 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	462	44%	76.7	51.2
241-SX-112	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	409	44%	56.6	47.1
SX-112 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	56.6	47.1
SX-112 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	409	44%	56.6	47.1
241-SX-113	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	117	48%	25.3	25.3
SX-113 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	25.3	25.3
SX-113 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.89E+02	7.75E+01	1.77	117	48%	25.3	25.3
241-SX-114	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.19	685	44%	67.9	52.3
SX-114 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	67.9	52.3
SX-114 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.19	685	44%	67.9	52.3

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-SX-115	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.86E+03	2.07E+02	1.73	45	44%	25.4	25.3
SX-115 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	25.4	25.3
SX-115 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.86E+03	2.07E+02	1.73	45	44%	25.4	25.3
241-T-101	9.58E+03	1.05E+05	2.07E+05	3.21E+04	5.20E+02	1.38E+02	1.56	386	35%	18.9	17.7
T-101 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	4	55%	18.9	17.7
T-101 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	5.25E+02	1.37E+02	1.56	382	35%	18.9	17.7
241-T-102	4.49E+02	2.30E+04	1.09E+05	4.94E+03	1.66E+02	3.95E+01	1.53	121	53%	17.8	18.2
T-102 liquid	4.49E+02	2.30E+04	1.09E+05	4.94E+03	1.09E+00	5.69E+01	1.14	49	75%	17.8	18.2
T-102 solid	4.49E+02	2.30E+04	1.09E+05	4.94E+03	2.38E+02	3.19E+01	1.79	72	44%	17.8	18.2
241-T-103	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.80E+03	1.10E+02	1.42	102	47%	15.9	15.6
T-103 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	15	72%	15.9	15.6
T-103 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	87	44%	15.9	15.6
241-T-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.15E+00	1.83E-01	1.27	1234	64%	17.1	16.1
T-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	84%	17.1	16.1
T-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.15E+00	1.83E-01	1.27	1234	64%	17.1	16.1
241-T-105	2.98E+03	5.42E+04	3.71E+04	3.62E+02	2.81E+02	3.23E+01	1.45	371	54%	16.6	15.9
T-105 liquid	2.98E+03	5.42E+04	3.71E+04	3.62E+02	1.29E+01	1.09E+02	1.18	0	80%	16.6	15.9
T-105 solid	2.98E+03	5.42E+04	3.71E+04	3.62E+02	2.81E+02	3.23E+01	1.45	371	54%	16.6	15.9
241-T-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.62E+01	2.40E+01	1.46	79	21%	16.2	15.7
T-106 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	8	75%	16.2	15.7
T-106 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.73E+01	1.70E+01	1.49	72	17%	16.2	15.7
241-T-107	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.06E+02	1.21E+01	1.51	655	45%	17.3	16.6
T-107 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	84%	17.3	16.6
T-107 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.06E+02	1.21E+01	1.51	655	45%	17.3	16.6

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-T-108	9.58E+03	1.05E+05	2.07E+05	3.21E+04	5.66E+02	3.81E+00	1.58	167	37%	16.2	16.0
T-108 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	55%	16.2	16.0
T-108 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	5.66E+02	3.81E+00	1.58	167	37%	16.2	16.0
241-T-109	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.55	220	42%	16.2	15.9
T-109 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	16.2	15.9
T-109 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.55	220	42%	16.2	15.9
241-T-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.24E+01	5.25E+01	1.26	1465	75%	16.6	15.8
T-110 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	87%	16.6	15.8
T-110 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.24E+01	5.25E+01	1.26	1465	75%	16.6	15.8
241-T-111	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.16E+00	1.58E-01	1.28	1688	71%	16.6	15.7
T-111 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	16.6	15.7
T-111 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.16E+00	1.58E-01	1.28	1688	71%	16.6	15.7
241-T-112	2.98E+03	3.88E+04	2.33E+04	1.01E+01	1.91E+01	1.05E+01	1.26	254	77%	16.6	16.2
T-112 liquid	2.98E+03	3.88E+04	2.33E+04	1.01E+01	1.29E+01	1.09E+02	1.10	26	85%	16.6	16.2
T-112 solid	2.98E+03	3.88E+04	2.33E+04	1.01E+01	1.97E+01	6.09E-01	1.28	227	77%	16.6	16.2
241-T-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.59E-01	3.52E+00	1.27	110	70%	16.5	15.2
T-201 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	91%	16.5	15.2
T-201 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.53E-01	4.95E-02	1.27	106	69%	16.5	15.2
241-T-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.70E-03	3.05E-02	1.24	79	76%	16.1	15.8
T-202 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	16.1	15.8
T-202 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.70E-03	3.05E-02	1.24	79	76%	16.1	15.8
241-T-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.79E-03	1.96E-02	1.23	132	76%	16.9	14.6
T-203 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	85%	16.9	14.6
T-203 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.79E-03	1.96E-02	1.23	132	76%	16.9	14.6

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-T-204	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.99E-03	8.40E-03	1.21	144	76%	17.5	16.6
T-204 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	17.5	16.6
T-204 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	4.99E-03	8.40E-03	1.21	144	76%	17.5	16.6
241-TX-101	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.77E+03	8.20E+01	1.74	329	45%	25.2	23.5
TX-101 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	11	75%	25.2	23.5
TX-101 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.81E+03	8.14E+01	1.76	318	44%	25.2	23.5
241-TX-102	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	821	32%	26.4	23.5
TX-102 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	26.4	23.5
TX-102 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	821	32%	26.4	23.5
241-TX-103	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.70	594	32%	21.2	19.5
TX-103 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	21.2	19.5
TX-103 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.70	594	32%	21.2	19.5
241-TX-104	1.36E+03	9.42E+04	3.55E+05	3.19E+03	4.53E+02	1.47E+02	1.72	246	46%	18.9	18.4
TX-104 liquid	1.36E+03	9.42E+04	3.55E+05	3.19E+03	4.00E+00	2.83E+02	1.45	19	52%	18.9	18.4
TX-104 solid	1.36E+03	9.42E+04	3.55E+05	3.19E+03	4.84E+02	1.38E+02	1.74	227	46%	18.9	18.4
241-TX-105	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	2305	32%	34.6	23.4
TX-105 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	34.6	23.4
TX-105 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	2305	32%	34.6	23.4
241-TX-106	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	1291	32%	25.4	22.1
TX-106 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	25.4	22.1
TX-106 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.11E+02	1.70	1291	32%	25.4	22.1
241-TX-107	9.20E+03	1.07E+05	1.76E+05	2.75E+04	3.90E+02	1.08E+02	1.71	136	23%	20.3	19.8
TX-107 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	4	51%	20.3	19.8
TX-107 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	3.99E+02	1.03E+02	1.72	132	22%	20.3	19.8

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-TX-108	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.01E+02	1.07E+02	1.69	507	32%	17.0	16.5
TX-108 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	17.0	16.5
TX-108 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.01E+02	1.07E+02	1.69	507	32%	17.0	16.5
241-TX-109	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.43E+01	6.14E+00	1.40	1454	44%	30.7	23.8
TX-109 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	30.7	23.8
TX-109 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	5.43E+01	6.14E+00	1.40	1454	44%	30.7	23.8
241-TX-110	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.42E+02	1.04E+02	1.68	1749	32%	27.5	21.8
TX-110 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	27.5	21.8
TX-110 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.42E+02	1.04E+02	1.68	1749	32%	27.5	21.8
241-TX-111	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.89E+02	1.01E+02	1.67	1401	32%	24.4	19.8
TX-111 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	24.4	19.8
TX-111 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.89E+02	1.01E+02	1.67	1401	32%	24.4	19.8
241-TX-112	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.07E+02	1.70	2457	32%	20.9	17.5
TX-112 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	20.9	17.5
TX-112 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.07E+02	1.70	2457	32%	20.9	17.5
241-TX-113	9.58E+03	1.05E+05	2.07E+05	3.21E+04	3.70E+02	8.38E+01	1.61	2298	35%	21.5	18.2
TX-113 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	55%	21.5	18.2
TX-113 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	3.70E+02	8.38E+01	1.61	2298	35%	21.5	18.2
241-TX-114	9.20E+03	1.07E+05	1.76E+05	2.75E+04	5.03E+01	9.87E+01	1.70	2025	32%	20.9	17.9
TX-114 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	20.9	17.9
TX-114 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	5.03E+01	9.87E+01	1.70	2025	32%	20.9	17.9
241-TX-115	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.70	2150	32%	20.3	17.5
TX-115 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	20.3	17.5
TX-115 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.70	2150	32%	20.3	17.5

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-TX-116	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.98E+02	2.81E+01	1.69	2389	32%	21.1	19.5
TX-116 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	21.1	19.5
TX-116 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.98E+02	2.81E+01	1.69	2389	32%	21.1	19.5
241-TX-117	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.08E+02	7.74E+01	1.71	2370	32%	21.1	19.5
TX-117 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	21.1	19.5
TX-117 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.08E+02	7.74E+01	1.71	2370	32%	21.1	19.5
241-TX-118	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.15E+02	1.11E+02	1.70	1136	47%	22.2	19.5
TX-118 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	22.2	19.5
TX-118 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	2.15E+02	1.11E+02	1.70	1136	47%	22.2	19.5
241-TY-101	9.58E+03	1.05E+05	2.07E+05	3.21E+04	2.62E+01	6.00E+01	1.64	447	35%	17.8	17.1
TY-101 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	55%	17.8	17.1
TY-101 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	2.62E+01	6.00E+01	1.64	447	35%	17.8	17.1
241-TY-102	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.72	242	32%	16.0	15.7
TY-102 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	16.0	15.7
TY-102 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	4.10E+01	1.58E+02	1.72	242	32%	16.0	15.7
241-TY-103	1.95E+03	1.42E+04	2.26E+05	4.94E+03	9.06E+01	1.47E+01	1.70	613	44%	20.0	17.7
TY-103 liquid	1.95E+03	1.42E+04	2.26E+05	4.94E+03	1.29E+01	1.30E+00	1.23	0	75%	20.0	17.7
TY-103 solid	1.95E+03	1.42E+04	2.26E+05	4.94E+03	9.06E+01	1.47E+01	1.70	613	44%	20.0	17.7
241-TY-104	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.94E+03	1.10E+02	1.44	174	53%	17.0	16.7
TY-104 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	11	75%	17.0	16.7
TY-104 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	163	52%	17.0	16.7
241-TY-105	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.88E+02	7.86E+00	1.53	874	44%	24.7	19.8
TY-105 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	24.7	19.8
TY-105 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.88E+02	7.86E+00	1.53	874	44%	24.7	19.8

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-TY-106	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.12E+02	1.81E+01	1.37	79	35%	16.0	15.9
TY-106 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	16.0	15.9
TY-106 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.12E+02	1.81E+01	1.37	79	35%	16.0	15.9
241-U-101	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.84E+03	1.10E+02	1.43	95	34%	19.2	18.9
U-101 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	11	76%	19.2	18.9
U-101 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	83	30%	19.2	18.9
241-U-102	1.51E+04	1.04E+05	2.44E+05	1.80E+04	7.13E+01	1.56E+02	1.68	1420	37%	27.7	23.9
U-102 liquid	1.51E+04	1.04E+05	2.44E+05	1.80E+04	6.78E+00	2.61E+02	1.38	68	48%	27.7	23.9
U-102 solid	1.51E+04	1.04E+05	2.44E+05	1.80E+04	7.40E+01	1.52E+02	1.69	1351	36%	27.7	23.9
241-U-103	1.23E+04	1.39E+05	1.97E+05	3.25E+04	2.30E+01	2.11E+02	1.66	1772	40%	28.3	25.0
U-103 liquid	1.23E+04	1.39E+05	1.97E+05	3.25E+04	8.28E+00	3.90E+02	1.41	49	50%	28.3	25.0
U-103 solid	1.23E+04	1.39E+05	1.97E+05	3.25E+04	2.33E+01	2.06E+02	1.66	1722	40%	28.3	25.0
241-U-104	9.58E+03	1.05E+05	2.07E+05	3.21E+04	8.25E+02	1.26E+02	1.65	462	35%	28.0	24.4
U-104 liquid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	4.00E+00	2.83E+02	1.40	0	55%	28.0	24.4
U-104 solid	9.58E+03	1.05E+05	2.07E+05	3.21E+04	8.25E+02	1.26E+02	1.65	462	35%	28.0	24.4
241-U-105	1.64E+04	1.08E+05	1.81E+05	2.98E+04	9.43E+00	2.95E+02	1.63	1582	32%	29.9	25.2
U-105 liquid	1.64E+04	1.08E+05	1.81E+05	2.98E+04	1.96E+01	5.96E+02	1.46	140	63%	29.9	25.2
U-105 solid	1.64E+04	1.08E+05	1.81E+05	2.98E+04	8.55E+00	2.69E+02	1.64	1442	29%	29.9	25.2
241-U-106	4.41E+04	9.28E+04	2.33E+05	1.13E+04	7.81E+01	1.74E+02	1.60	856	41%	26.0	23.5
U-106 liquid	4.41E+04	9.28E+04	2.33E+05	1.13E+04	8.00E+00	3.01E+02	1.35	57	49%	26.0	23.5
U-106 solid	4.41E+04	9.28E+04	2.33E+05	1.13E+04	8.22E+01	1.67E+02	1.62	799	40%	26.0	23.5
241-U-107	3.85E+03	1.11E+05	2.27E+05	2.64E+04	2.90E+00	9.33E+01	1.67	1544	29%	24.3	22.7
U-107 liquid	3.85E+03	1.11E+05	2.27E+05	2.64E+04	2.94E-01	2.69E+02	1.41	125	50%	24.3	22.7
U-107 solid	3.85E+03	1.11E+05	2.27E+05	2.64E+04	3.09E+00	8.04E+01	1.70	1420	27%	24.3	22.7

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-U-108	7.16E+03	1.30E+05	1.81E+05	3.29E+04	1.02E+02	1.55E+02	1.72	1772	36%	28.1	23.8
U-108 liquid	7.16E+03	1.30E+05	1.81E+05	3.29E+04	8.00E+00	3.09E+02	1.39	91	50%	28.1	23.8
U-108 solid	7.16E+03	1.30E+05	1.81E+05	3.29E+04	1.06E+02	1.48E+02	1.73	1681	36%	28.1	23.8
241-U-109	6.53E+03	1.28E+05	1.85E+05	2.92E+04	9.29E+00	1.34E+02	1.66	1760	27%	26.2	23.0
U-109 liquid	6.53E+03	1.28E+05	1.85E+05	2.92E+04	7.11E-01	2.79E+02	1.47	72	51%	26.2	23.0
U-109 solid	6.53E+03	1.28E+05	1.85E+05	2.92E+04	9.61E+00	1.29E+02	1.67	1688	26%	26.2	23.0
241-U-110	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	704	34%	24.4	23.3
U-110 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	0	75%	24.4	23.3
U-110 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.04E+03	1.10E+02	1.46	704	34%	24.4	23.3
241-U-111	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.48E+02	1.22E+02	1.63	1245	32%	24.9	22.9
U-111 liquid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	8.00E+00	3.01E+02	1.39	0	51%	24.9	22.9
U-111 solid	9.20E+03	1.07E+05	1.76E+05	2.75E+04	1.48E+02	1.22E+02	1.63	1245	32%	24.9	22.9
241-U-112	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.15E+02	6.67E+01	1.63	185	29%	18.4	18.1
U-112 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	15	75%	18.4	18.1
U-112 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	2.27E+02	6.41E+01	1.67	170	26%	18.4	18.1
241-U-201	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.65E+02	5.54E+01	1.53	19	34%	16.8	17.0
U-201 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	70%	16.8	17.0
U-201 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.92E+02	4.57E+01	1.62	15	27%	16.8	17.0
241-U-202	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.65E+02	5.54E+01	1.53	19	36%	16.9	17.0
U-202 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	73%	16.9	17.0
U-202 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.92E+02	4.57E+01	1.62	15	29%	16.9	17.0
241-U-203	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.45E+02	6.25E+01	1.47	11	48%	16.3	16.1
U-203 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	70%	16.3	16.1
U-203 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.92E+02	4.57E+01	1.62	8	40%	16.3	16.1

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Table A-1 Input Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	[TOC] (ug/ml) TOC in Liquid	[NO_2] (ug/ml) NO_2 in Liquid	[NO_3] (ug/ml) NO_3 in Liquid	[Al] (ug/ml) Aluminum in Liquid	[Sr] (uCi/g) ^{90}Sr in Waste	[Cs] (uCi/g) ^{137}Cs in Waste	D (g/ml) Bulk Density	V (kL) Waste Volume	[H_2O] (wt%) Bulk Water	T_w (°C) Waste Temp.	T_d (°C) Dome Temp.
241-U-204	2.98E+03	3.60E+04	7.96E+04	4.94E+03	3.98E+00	3.54E+01	1.26	11	45%	16.2	16.3
U-204 liquid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	1.29E+01	1.09E+02	1.17	4	87%	16.2	16.3
U-204 solid	2.98E+03	3.60E+04	7.96E+04	4.94E+03	6.00E-03	2.60E+00	1.31	8	26%	16.2	16.3

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-AN-101	58.1	7.40E+05	95%	5559	3.77E-03	2.79E+03	0.98	0.65	0.09	0.59	0.005	0.007
AN-101 liquid	46.1	5.58E+05	100%	905	3.62E-04	2.02E+02	0.98	0.65	0.09	0.59	0.005	0.007
AN-101 solid	12.0	1.82E+05	79%	4653	1.42E-02	2.59E+03	0.98	0.65	0.09	0.59	0.005	0.007
241-AN-102	384.9	5.69E+06	99%	11975	1.64E-03	9.36E+03	3.63	1.80	1.86	1.07	0.005	0.081
AN-102 liquid	352.6	5.18E+06	100%	6923	1.58E-03	8.20E+03	3.63	1.80	1.86	1.07	0.005	0.081
AN-102 solid	32.3	5.05E+05	84%	5052	2.29E-03	1.16E+03	3.63	1.80	1.86	1.07	0.005	0.081
241-AN-103	347.9	5.74E+06	84%	11248	2.11E-03	1.21E+04	2.72	3.60	0.20	2.03	0.005	0.018
AN-103 liquid	199.0	3.09E+06	100%	3907	2.83E-03	8.75E+03	2.72	3.60	0.20	2.03	0.005	0.018
AN-103 solid	148.9	2.65E+06	66%	7341	1.26E-03	3.35E+03	2.72	3.60	0.20	2.03	0.005	0.018
241-AN-104	382.4	5.90E+06	95%	11925	2.32E-03	1.37E+04	2.74	2.72	0.22	2.76	0.005	0.017
AN-104 liquid	219.3	3.20E+06	100%	4306	2.55E-03	8.15E+03	2.74	2.72	0.22	2.76	0.005	0.017
AN-104 solid	163.0	2.70E+06	90%	7619	2.06E-03	5.57E+03	2.74	2.72	0.22	2.76	0.005	0.017
241-AN-105	408.9	6.34E+06	95%	12446	1.48E-03	9.36E+03	2.61	2.63	0.43	2.89	0.005	0.026
AN-105 liquid	231.3	3.42E+06	100%	4542	1.40E-03	4.78E+03	2.61	2.63	0.43	2.89	0.005	0.026
AN-105 solid	177.6	2.92E+06	88%	7904	1.57E-03	4.57E+03	2.61	2.63	0.43	2.89	0.005	0.026
241-AN-106	14.2	2.05E+05	80%	4696	6.77E-04	1.39E+02	1.06	0.38	0.37	0.27	0.005	0.012
AN-106 liquid	8.0	9.91E+04	100%	157	3.10E-04	3.07E+01	1.06	0.38	0.37	0.27	0.005	0.012
AN-106 solid	6.2	1.06E+05	62%	4539	1.02E-03	1.08E+02	1.06	0.38	0.37	0.27	0.005	0.012
241-AN-107	379.1	5.59E+06	95%	11861	2.10E-03	1.17E+04	3.84	1.43	3.01	0.02	0.005	0.117
AN-107 liquid	289.4	4.13E+06	100%	5682	1.98E-03	8.19E+03	3.84	1.43	3.01	0.02	0.005	0.117
AN-107 solid	89.7	1.46E+06	80%	6179	2.45E-03	3.56E+03	3.84	1.43	3.01	0.02	0.005	0.117
241-AP-101	404.9	5.36E+06	100%	12367	6.60E-04	3.54E+03	2.17	0.89	0.25	0.78	0.005	0.010
AP-101 liquid	404.9	5.36E+06	100%	12367	6.60E-04	3.54E+03	2.17	0.89	0.25	0.78	0.005	0.010
AP-101 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-AP-102	396.5	4.96E+06	100%	12203	8.96E-04	4.45E+03	1.23	0.78	0.27	0.96	0.005	0.011
AP-102 liquid	396.5	4.96E+06	100%	12203	8.96E-04	4.45E+03	1.23	0.78	0.27	0.96	0.005	0.011
AP-102 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AP-103	103.5	1.48E+06	100%	6450	9.69E-04	1.44E+03	1.81	1.98	0.31	0.54	0.005	0.010
AP-103 liquid	103.1	1.48E+06	100%	6443	9.69E-04	1.44E+03	1.81	1.98	0.31	0.54	0.005	0.010
AP-103 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AP-104	8.7	9.09E+04	100%	4589	1.88E-05	1.71E+00	0.04	0.02	0.01	0.00	0.139	0.140
AP-104 liquid	8.7	9.09E+04	100%	4589	1.88E-05	1.71E+00	0.04	0.02	0.01	0.00	0.139	0.140
AP-104 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AP-105	277.8	3.96E+06	96%	9872	7.05E-04	2.79E+03	4.57	2.77	0.15	1.92	0.005	0.008
AP-105 liquid	245.5	3.42E+06	100%	4820	5.38E-04	1.84E+03	4.57	2.77	0.15	1.92	0.005	0.008
AP-105 solid	32.3	5.32E+05	73%	5052	1.78E-03	9.46E+02	4.57	2.77	0.15	1.92	0.005	0.008
241-AP-106	33.8	3.91E+05	100%	5081	3.15E-04	1.23E+02	0.72	0.29	0.09	0.34	0.005	0.007
AP-106 liquid	33.8	3.91E+05	100%	5081	3.15E-04	1.23E+02	0.72	0.29	0.09	0.34	0.005	0.007
AP-106 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AP-107	354.4	4.17E+06	100%	11376	3.36E-04	1.40E+03	1.22	0.53	0.05	0.63	0.005	0.006
AP-107 liquid	354.4	4.17E+06	100%	11376	3.36E-04	1.40E+03	1.22	0.53	0.05	0.63	0.005	0.006
AP-107 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AP-108	134.0	1.59E+06	100%	7049	4.06E-04	6.47E+02	1.08	0.67	0.08	0.75	0.005	0.006
AP-108 liquid	134.0	1.59E+06	100%	7049	4.06E-04	6.47E+02	1.08	0.67	0.08	0.75	0.005	0.006
AP-108 solid	not exist	0.00E+00	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exit	not exist
241-AW-101	408.9	6.23E+06	97%	12446	1.65E-03	1.03E+04	2.53	2.15	0.34	2.29	0.005	0.022
AW-101 liquid	297.8	4.35E+06	100%	5846	1.69E-03	7.36E+03	2.53	2.15	0.34	2.29	0.005	0.022
AW-101 solid	111.1	1.89E+06	89%	6600	1.55E-03	2.92E+03	2.53	2.15	0.34	2.29	0.005	0.022

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-AW-102	29.0	3.90E+05	69%	4988	3.91E-03	1.53E+03	1.17	0.52	0.05	0.61	0.005	0.006
AW-102 liquid	14.5	1.71E+05	100%	285	3.70E-04	6.31E+01	1.17	0.52	0.05	0.61	0.005	0.006
AW-102 solid	14.5	2.20E+05	46%	4703	6.66E-03	1.46E+03	1.17	0.52	0.05	0.61	0.005	0.006
241-AW-103	185.2	2.32E+06	70%	8054	2.91E-04	6.75E+02	0.07	0.04	0.09	0.006	0.085	0.087
AW-103 liquid	58.8	6.26E+05	100%	1155	9.92E-05	6.20E+01	0.07	0.04	0.09	0.006	0.085	0.087
AW-103 solid	126.4	1.70E+06	59%	6899	3.61E-04	6.13E+02	0.07	0.04	0.09	0.006	0.085	0.087
241-AW-104	406.3	5.49E+06	92%	12396	4.61E-04	2.53E+03	1.18	0.97	0.31	0.94	0.005	0.012
AW-104 liquid	322.4	4.20E+06	100%	6331	6.02E-04	2.53E+03	1.18	0.97	0.31	0.94	0.005	0.012
AW-104 solid	83.9	1.29E+06	65%	6065	2.08E-06	2.67E+00	1.18	0.97	0.31	0.94	0.005	0.012
241-AW-105	155.8	1.96E+06	79%	7477	4.21E-04	8.28E+02	0.44	0.03	0.21	0.00	0.005	0.009
AW-105 liquid	54.1	5.75E+05	100%	1062	1.09E-05	6.29E+00	0.44	0.03	0.21	0.00	0.005	0.009
AW-105 solid	101.7	1.39E+06	71%	6414	5.91E-04	8.21E+02	0.44	0.03	0.21	0.00	0.005	0.009
241-AW-106	171.8	2.59E+06	97%	7790	1.08E-03	2.81E+03	1.90	1.52	0.25	0.59	0.005	0.016
AW-106 liquid	89.0	1.28E+06	100%	1747	1.07E-03	1.36E+03	1.90	1.52	0.25	0.59	0.005	0.016
AW-106 solid	82.8	1.32E+06	94%	6043	1.09E-03	1.44E+03	1.90	1.52	0.25	0.59	0.005	0.016
241-AY-101	55.9	7.18E+05	69%	5516	2.01E-02	1.44E+04	0.42	0.77	0.45	0.001	0.005	0.033
AY-101 liquid	16.7	1.88E+05	100%	328	4.89E-04	9.20E+01	0.42	0.77	0.45	0.001	0.005	0.027
AY-101 solid	39.2	5.30E+05	58%	5188	2.70E-02	1.43E+04	0.42	0.77	0.45	0.001	0.005	0.036
241-AY-102	225.9	2.78E+06	83%	8853	1.95E-02	5.42E+04	0.01	0.14	0.09	0.170	0.073	0.078
AY-102 liquid	149.2	1.70E+06	100%	2930	1.56E-04	2.65E+02	0.01	0.14	0.09	0.170	0.073	0.077
AY-102 solid	76.6	1.08E+06	57%	5922	4.99E-02	5.40E+04	0.01	0.14	0.09	0.170	0.073	0.081
241-AZ-101	306.8	3.89E+06	98%	10442	2.34E-02	9.12E+04	1.06	1.23	0.09	0.41	0.005	0.016
AZ-101 liquid	289.8	3.59E+06	100%	5689	6.33E-03	2.27E+04	1.06	1.23	0.09	0.41	0.005	0.016
AZ-101 solid	17.1	2.97E+05	76%	4753	2.30E-01	6.85E+04	1.06	1.23	0.09	0.41	0.005	0.018

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-AZ-102	338.1	4.03E+06	95%	11056	1.98E-02	7.99E+04	0.38	0.62	0.14	0.45	0.005	0.018
AZ-102 liquid	300.3	3.44E+06	100%	5896	4.51E-03	1.55E+04	0.38	0.62	0.14	0.45	0.005	0.017
AZ-102 solid	37.8	5.87E+05	66%	5159	1.10E-01	6.43E+04	0.38	0.62	0.14	0.45	0.005	0.031
241-SY-101	431.7	6.74E+06	87%	12895	1.58E-03	1.06E+04	2.83	2.33	0.71	2.11	0.005	0.078
SY-101 liquid	219.3	3.18E+06	100%	4306	1.48E-03	4.69E+03	2.83	2.33	0.71	2.11	0.005	0.078
SY-101 solid	212.4	3.57E+06	75%	8589	1.67E-03	5.94E+03	2.83	2.33	0.71	2.11	0.005	0.078
241-SY-102	222.2	2.82E+06	93%	8781	5.60E-04	1.58E+03	1.41	0.97	0.13	1.17	0.005	0.008
SY-102 liquid	190.3	2.34E+06	100%	3736	5.25E-04	1.23E+03	1.41	0.97	0.13	1.175	0.005	0.008
SY-102 solid	32.0	4.80E+05	59%	5045	7.30E-04	3.50E+02	1.41	0.97	0.13	1.17	0.005	0.008
241-SY-103	270.2	4.19E+06	86%	9722	1.14E-03	4.77E+03	2.89	3.11	0.63	2.82	0.005	0.032
SY-103 liquid	138.7	2.13E+06	100%	2724	1.41E-03	2.99E+03	2.89	3.11	0.63	2.82	0.005	0.032
SY-103 solid	131.4	2.07E+06	71%	6999	8.61E-04	1.78E+03	2.89	3.11	0.63	2.82	0.005	0.032
241-A-101	346.0	5.49E+06	84%	11212	1.34E-03	7.35E+03	2.19	2.98	0.24	3.19	0.005	0.032
A-101 liquid	184.5	2.69E+06	100%	8040	1.31E-03	3.53E+03	2.19	2.98	0.24	3.19	0.005	0.034
A-101 solid	161.6	2.79E+06	69%	3173	1.37E-03	3.82E+03	2.19	2.98	0.24	3.19	0.005	0.029
241-A-102	14.9	2.50E+05	65%	4710	5.63E-03	1.41E+03	3.34	2.29	0.68	2.29	0.005	0.023
A-102 liquid	1.5	2.12E+04	100%	29	1.37E-03	2.89E+01	3.34	2.29	0.68	2.29	0.005	0.023
A-102 solid	13.4	2.29E+05	62%	4682	6.02E-03	1.38E+03	3.34	2.29	0.68	2.29	0.005	0.023
241-A-103	134.7	1.83E+06	59%	7063	5.80E-02	1.06E+05	2.15	0.78	0.56	2.41	0.005	0.027
A-103 liquid	1.8	2.80E+04	100%	36	1.10E-03	3.07E+01	2.15	0.78	0.56	2.41	0.005	0.027
A-103 solid	132.9	1.80E+06	59%	7027	5.88E-02	1.06E+05	2.15	0.78	0.56	2.41	0.005	0.027
241-A-104	10.2	1.74E+05	59%	4618	1.15E-01	2.00E+04	1.28	0.78	0.26	0.42	0.005	0.060
A-104 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.060
A-104 solid	10.2	1.74E+05	59%	4618	1.15E-01	2.00E+04	1.28	0.78	0.26	0.42	0.005	0.060

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A-105 liquid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
A-105 solid	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	45.4	7.33E+05	59%	5309	7.10E-03	5.21E+03	1.28	0.78	0.26	0.42	0.005	0.027
A-106 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.027
A-106 solid	45.4	7.33E+05	59%	5309	7.10E-03	5.21E+03	1.28	0.78	0.26	0.42	0.005	0.027
241-AX-101	271.6	4.45E+06	87%	9751	1.33E-03	5.90E+03	2.40	3.52	0.24	3.63	0.005	0.020
AX-101 liquid	140.2	2.16E+06	100%	2752	1.31E-03	2.83E+03	2.40	3.52	0.24	3.63	0.005	0.020
AX-101 solid	131.4	2.29E+06	74%	6999	1.34E-03	3.07E+03	2.40	3.52	0.24	3.63	0.005	0.020
241-AX-102	10.9	1.65E+05	66%	4632	1.18E-02	1.94E+03	2.83	2.33	0.66	1.98	0.005	0.015
AX-102 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.015
AX-102 solid	10.9	1.65E+05	66%	4632	1.18E-02	1.94E+03	2.83	2.33	0.66	1.98	0.005	0.015
241-AX-103	40.7	6.88E+05	85%	5216	5.91E-03	4.07E+03	2.83	2.33	0.66	1.98	0.005	0.031
AX-103 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.031
AX-103 solid	40.7	6.88E+05	85%	5216	5.91E-03	4.07E+03	2.83	2.33	0.66	1.98	0.005	0.031
241-AX-104	2.9	5.45E+04	9%	4475	3.52E-01	1.92E+04	1.28	0.78	0.26	0.42	0.005	0.011
AX-104 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.011
AX-104 solid	2.9	5.45E+04	9%	4475	3.52E-01	1.92E+04	1.28	0.78	0.26	0.42	0.005	0.011
241-B-101	41.0	6.33E+05	59%	5224	1.02E-03	6.47E+02	2.83	2.33	0.66	1.98	0.005	0.031
B-101 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.031
B-101 solid	41.0	6.33E+05	59%	5224	1.02E-03	6.47E+02	2.83	2.33	0.66	1.98	0.005	0.031
241-B-102	11.6	2.09E+05	42%	4646	2.52E-04	5.28E+01	2.83	2.33	0.66	1.98	0.005	0.012
B-102 liquid	1.5	2.10E+04	100%	29	1.48E-03	3.11E+01	2.83	2.33	0.66	1.98	0.005	0.012
B-102 solid	10.2	1.88E+05	36%	4618	1.15E-04	2.17E+01	2.83	2.33	0.66	1.98	0.005	0.012

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-B-103	21.4	3.97E+05	88%	4839	7.81E-05	3.10E+01	2.83	2.33	0.66	1.98	0.005	0.012
B-103 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.012
B-103 solid	21.4	3.97E+05	88%	4839	7.81E-05	3.10E+01	2.83	2.33	0.66	1.98	0.005	0.012
241-B-104	134.7	1.71E+06	90%	7063	1.42E-02	2.42E+04	1.28	0.78	0.26	0.42	0.005	0.008
B-104 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
B-104 solid	134.4	1.71E+06	90%	7056	1.42E-02	2.42E+04	1.28	0.78	0.26	0.42	0.005	0.008
241-B-105	57.4	9.80E+05	43%	5544	2.78E-03	2.73E+03	2.83	2.33	0.66	1.98	0.005	0.012
B-105 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.012
B-105 solid	57.4	9.80E+05	43%	5544	2.78E-03	2.73E+03	2.83	2.33	0.66	1.98	0.005	0.012
241-B-106	42.5	6.46E+05	89%	5252	1.41E-02	9.10E+03	1.28	0.78	0.26	0.42	0.005	0.008
B-106 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
B-106 solid	42.1	6.41E+05	89%	5245	1.42E-02	9.10E+03	1.28	0.78	0.26	0.42	0.005	0.008
241-B-107	59.9	1.04E+06	63%	5594	5.47E-03	5.67E+03	3.34	2.29	0.68	2.29	0.005	0.012
B-107 liquid	0.4	5.30E+03	100%	7	1.37E-03	7.24E+00	3.34	2.29	0.68	2.29	0.005	0.012
B-107 solid	59.6	1.03E+06	63%	5587	5.49E-03	5.66E+03	3.34	2.29	0.68	2.29	0.005	0.012
241-B-108	34.1	5.70E+05	39%	5088	2.27E-04	1.29E+02	3.34	2.29	0.68	2.29	0.005	0.012
B-108 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.012
B-108 solid	34.1	5.70E+05	39%	5088	2.27E-04	1.29E+02	3.34	2.29	0.68	2.29	0.005	0.012
241-B-109	46.1	8.98E+05	72%	5323	4.96E-03	4.46E+03	3.34	2.29	0.68	2.29	0.005	0.013
B-109 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.013
B-109 solid	46.1	8.98E+05	72%	5323	4.96E-03	4.46E+03	3.34	2.29	0.68	2.29	0.005	0.013
241-B-110	89.3	1.27E+06	58%	6172	7.26E-04	9.19E+02	1.28	0.78	0.26	0.42	0.005	0.008
B-110 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
B-110 solid	89.0	1.26E+06	58%	6165	7.27E-04	9.17E+02	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_W (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-B-111	86.1	1.07E+06	55%	6108	2.40E-03	2.56E+03	1.28	0.78	0.26	0.42	0.005	0.009
B-111 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.009
B-111 solid	85.7	1.06E+06	55%	6100	2.41E-03	2.56E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-B-112	12.0	1.59E+05	62%	4653	1.48E-03	2.35E+02	2.76	0.76	0.06	0.10	0.005	0.006
B-112 liquid	1.1	1.44E+04	100%	21	1.48E-03	2.14E+01	2.76	0.76	0.06	0.10	0.005	0.006
B-112 solid	10.9	1.44E+05	59%	4632	1.48E-03	2.14E+02	2.76	0.76	0.06	0.10	0.005	0.006
241-B-201	148.0	1.37E+05	60%	1089	3.59E-05	4.91E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-201 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-201 solid	142.9	1.32E+05	59%	1062	1.69E-05	2.24E+00	1.28	0.78	0.26	0.42	0.005	0.007
241-B-202	137.8	1.33E+05	81%	1035	2.60E-05	3.45E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-202 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-202 solid	137.8	1.33E+05	81%	1035	2.60E-05	3.45E+00	1.28	0.78	0.26	0.42	0.005	0.007
241-B-203	260.2	2.30E+05	85%	1677	1.33E-05	3.05E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-203 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.007
B-203 solid	255.1	2.25E+05	85%	1650	1.69E-06	3.80E-01	1.28	0.78	0.26	0.42	0.005	0.007
241-B-204	255.1	2.25E+05	50%	1650	1.40E-02	3.14E+03	0.78	0.04	0.28	0.47	0.005	0.007
B-204 liquid	5.1	3.97E+03	100%	27	6.02E-04	2.39E+00	0.78	0.04	0.28	0.47	0.005	0.007
B-204 solid	250.0	2.21E+05	50%	1623	1.42E-02	3.13E+03	0.78	0.04	0.28	0.47	0.005	0.007
241-BX-101	15.6	2.80E+05	26%	4724	1.84E-03	5.16E+02	1.95	1.40	0.39	0.40	0.005	0.010
BX-101 liquid	0.4	4.86E+03	100%	7	4.13E-04	2.01E+00	1.95	1.40	0.39	0.40	0.005	0.010
BX-101 solid	15.3	2.75E+05	25%	4717	1.87E-03	5.14E+02	1.95	1.40	0.39	0.40	0.005	0.010
241-BX-102	34.9	2.75E+05	59%	5102	6.62E-04	1.82E+02	1.28	0.78	0.26	0.42	0.005	0.008
BX-102 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
BX-102 solid	34.9	2.75E+05	59%	5102	6.62E-04	1.82E+02	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-BX-103	25.8	4.40E+05	66%	4924	9.54E-04	4.20E+02	1.95	1.40	0.39	0.40	0.005	0.010
BX-103 liquid	3.3	4.37E+04	100%	64	4.13E-04	1.80E+01	1.95	1.40	0.39	0.40	0.005	0.010
BX-103 solid	22.5	3.97E+05	62%	4860	1.01E-03	4.02E+02	1.95	1.40	0.39	0.40	0.005	0.010
241-BX-104	35.9	6.43E+05	60%	5124	1.88E-03	1.21E+03	2.18	1.39	0.25	0.22	0.005	0.010
BX-104 liquid	1.1	1.46E+04	100%	21	6.20E-04	9.08E+00	2.18	1.39	0.25	0.22	0.005	0.010
BX-104 solid	34.9	6.29E+05	59%	5102	1.91E-03	1.20E+03	2.18	1.39	0.25	0.22	0.005	0.010
241-BX-105	18.5	3.19E+05	24%	4781	9.82E-04	3.13E+02	1.89	1.41	0.73	0.46	0.005	0.013
BX-105 liquid	1.8	2.44E+04	100%	36	6.00E-04	1.46E+01	1.89	1.41	0.73	0.46	0.005	0.013
BX-105 solid	16.7	2.94E+05	17%	4746	1.01E-03	2.98E+02	1.89	1.41	0.73	0.46	0.005	0.013
241-BX-106	13.8	2.43E+05	52%	4689	1.01E-03	2.47E+02	1.28	0.78	0.26	0.42	0.005	0.008
BX-106 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
BX-106 solid	13.8	2.43E+05	52%	4689	1.01E-03	2.47E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-107	125.3	1.88E+06	69%	6878	1.45E-04	2.73E+02	1.28	0.78	0.26	0.42	0.005	0.008
BX-107 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
BX-107 solid	124.9	1.88E+06	68%	6870	1.44E-04	2.70E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-108	9.4	1.44E+05	38%	4603	8.57E-04	1.24E+02	1.28	0.78	0.26	0.42	0.005	0.008
BX-108 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
BX-108solid	9.4	1.44E+05	38%	4603	8.57E-04	1.24E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-109	70.1	1.08E+06	71%	5794	1.29E-03	1.40E+03	1.28	0.78	0.26	0.42	0.005	0.008
BX-109 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
BX-109 solid	70.1	1.08E+06	71%	5794	1.29E-03	1.40E+03	1.28	0.78	0.26	0.42	0.005	0.008
241-BX-110	75.2	1.44E+06	74%	5894	5.20E-04	7.47E+02	12.04	0.78	0.68	0.35	0.005	0.013
BX-110 liquid	1.1	1.59E+04	100%	21	4.28E-04	6.81E+00	12.04	0.78	0.68	0.35	0.005	0.013
BX-110 solid	74.1	1.42E+06	74%	5872	5.21E-04	7.40E+02	12.04	0.78	0.68	0.35	0.005	0.013

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-BX-111	58.8	8.48E+05	10%	5573	4.74E-04	4.02E+02	2.83	2.33	0.66	1.98	0.005	0.012
BX-111 liquid	0.4	5.26E+03	100%	7	1.48E-03	7.77E+00	2.83	2.33	0.66	1.98	0.005	0.012
BX-111 solid	58.5	8.43E+05	9%	5566	4.68E-04	3.95E+02	2.83	2.33	0.66	1.98	0.005	0.012
241-BX-112	59.9	8.18E+05	83%	5594	2.87E-04	2.35E+02	1.59	0.77	0.25	0.00	0.005	0.008
BX-112 liquid	0.4	4.47E+03	100%	7	6.02E-04	2.69E+00	1.59	0.77	0.25	0.00	0.005	0.008
BX-112 solid	59.6	8.13E+05	83%	5587	2.86E-04	2.32E+02	1.59	0.77	0.25	0.00	0.005	0.008
241-BY-101	140.5	2.43E+06	30%	7177	1.16E-03	2.83E+03	2.83	2.33	0.66	1.98	0.005	0.015
BY-101 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.015
BY-101 solid	140.5	2.43E+06	30%	7177	1.16E-03	2.83E+03	2.83	2.33	0.66	1.98	0.005	0.015
241-BY-102	100.6	1.57E+06	31%	6393	5.70E-04	8.96E+02	2.82	1.73	0.13	3.53	0.005	0.007
BY-102 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.82	1.73	0.13	3.53	0.005	0.007
BY-102 solid	100.6	1.57E+06	31%	6393	5.70E-04	8.96E+02	2.82	1.73	0.13	3.53	0.005	0.007
241-BY-103	145.2	2.58E+06	41%	7270	6.08E-04	1.57E+03	2.83	2.33	0.66	1.98	0.005	0.015
BY-103 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.015
BY-103 solid	145.2	2.58E+06	41%	7270	6.08E-04	1.57E+03	2.83	2.33	0.66	1.98	0.005	0.015
241-BY-104	118.4	2.02E+06	32%	6742	4.68E-03	9.45E+03	3.34	2.29	0.68	2.29	0.005	0.032
BY-104 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.032
BY-104 solid	118.4	2.02E+06	32%	6742	4.68E-03	9.45E+03	3.34	2.29	0.68	2.29	0.005	0.032
241-BY-105	182.6	3.65E+06	33%	8004	6.65E-04	2.43E+03	3.21	1.50	0.17	2.72	0.005	0.010
BY-105 liquid	0.0	0.00E+00	100%	0	7.81E-04	0.00E+00	3.21	1.50	0.17	2.72	0.005	0.010
BY-105 solid	182.6	3.65E+06	33%	8004	6.65E-04	2.43E+03	3.21	1.50	0.17	2.72	0.005	0.010
241-BY-106	204.1	3.66E+06	43%	8425	1.67E-03	6.11E+03	2.83	2.33	0.66	1.98	0.005	0.031
BY-106 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.031
BY-106 solid	204.1	3.66E+06	43%	8425	1.67E-03	6.11E+03	2.83	2.33	0.66	1.98	0.005	0.031

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-BY-107	96.6	1.67E+06	54%	6314	9.82E-04	1.64E+03	3.01	3.62	0.24	5.14	0.005	0.011
BY-107 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	3.01	3.62	0.24	5.14	0.005	0.011
BY-107 solid	96.6	1.67E+06	54%	6314	9.82E-04	1.64E+03	3.01	3.62	0.24	5.14	0.005	0.011
241-BY-108	82.8	1.37E+06	53%	6043	6.92E-03	9.46E+03	3.34	2.29	0.68	2.29	0.005	0.025
BY-108 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.025
BY-108 solid	82.8	1.37E+06	53%	6043	6.92E-03	9.46E+03	3.34	2.29	0.68	2.29	0.005	0.025
241-BY-109	105.3	1.83E+06	32%	6485	7.82E-04	1.43E+03	2.83	2.33	0.66	1.98	0.005	0.013
BY-109 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.013
BY-109 solid	105.3	1.83E+06	32%	6485	7.82E-04	1.43E+03	2.83	2.33	0.66	1.98	0.005	0.013
241-BY-110	144.5	2.61E+06	24%	7255	1.17E-03	3.06E+03	2.83	2.33	0.66	1.98	0.005	0.027
BY-110 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.027
BY-110 solid	144.5	2.61E+06	24%	7255	1.17E-03	3.06E+03	2.83	2.33	0.66	1.98	0.005	0.027
241-BY-111	166.7	2.73E+06	8%	7690	1.02E-03	2.79E+03	2.83	2.33	0.66	1.98	0.005	0.017
BY-111 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.017
BY-111 solid	166.7	2.73E+06	8%	7690	1.02E-03	2.79E+03	2.83	2.33	0.66	1.98	0.005	0.017
241-BY-112	105.7	1.61E+06	12%	6493	1.02E-03	1.64E+03	2.83	2.33	0.66	1.98	0.005	0.019
BY-112 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.019
BY-112 solid	105.7	1.61E+06	12%	6493	1.02E-03	1.64E+03	2.83	2.33	0.66	1.98	0.005	0.019
241-C-101	32.0	5.14E+05	38%	5045	3.95E-03	2.03E+03	1.28	0.78	0.26	0.42	0.005	0.011
C-101 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.011
C-101 solid	32.0	5.14E+05	38%	5045	3.95E-03	2.03E+03	1.28	0.78	0.26	0.42	0.005	0.011
241-C-102	114.7	2.15E+06	38%	6671	1.42E-02	3.06E+04	1.28	0.78	0.26	0.42	0.005	0.010
C-102 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.010
C-102 solid	114.7	2.15E+06	38%	6671	1.42E-02	3.06E+04	1.28	0.78	0.26	0.42	0.005	0.010

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-C-103	71.9	9.24E+05	78%	5830	1.40E-02	1.29E+04	0.07	0.53	0.66	0.00	0.005	0.036
C-103 liquid	28.7	3.22E+05	100%	563	6.02E-04	1.94E+02	0.07	0.53	0.66	0.00	0.005	0.036
C-103 solid	43.2	6.01E+05	66%	5266	2.12E-02	1.28E+04	0.07	0.53	0.66	0.00	0.005	0.036
241-C-104	107.1	1.90E+06	65%	6521	2.47E-03	4.70E+03	1.28	0.78	0.26	0.42	0.005	0.013
C-104 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.013
C-104 solid	107.1	1.90E+06	65%	6521	2.47E-03	4.70E+03	1.28	0.78	0.26	0.42	0.005	0.013
241-C-105	47.6	7.69E+05	37%	5352	4.35E-03	3.35E+03	0.55	0.78	0.23	0.00	0.005	0.014
C-105 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	0.55	0.78	0.23	0.00	0.005	0.014
C-105 solid	47.6	7.69E+05	37%	5352	5.53E-03	4.25E+03	0.55	0.78	0.23	0.00	0.005	0.014
241-C-106	18.2	2.20E+05	87%	4774	1.10E-03	2.43E+02	0.01	0.14	0.09	0.17	0.073	0.073
C-106 liquid	15.3	1.73E+05	100%	299	1.56E-04	2.71E+01	0.01	0.14	0.09	0.17	0.073	0.073
C-106 solid	2.9	4.69E+04	38%	4475	4.60E-03	2.16E+02	0.01	0.14	0.09	0.17	0.073	0.073
241-C-107	93.3	1.36E+06	44%	6250	8.31E-03	1.13E+04	1.28	0.78	0.26	0.42	0.005	0.018
C-107 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.018
C-107 solid	93.3	1.36E+06	44%	6250	8.31E-03	1.13E+04	1.28	0.78	0.26	0.42	0.005	0.018
241-C-108	24.0	3.50E+05	58%	4888	1.41E-03	4.92E+02	1.28	0.78	0.26	0.42	0.005	0.009
C-108 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
C-108 solid	24.0	3.50E+05	58%	4888	1.41E-03	4.92E+02	1.28	0.78	0.26	0.42	0.005	0.009
241-C-109	24.0	3.06E+05	61%	4888	8.52E-03	2.61E+03	1.28	0.78	0.26	0.42	0.005	0.009
C-109 liquid	1.5	1.77E+04	100%	29	6.02E-04	1.07E+01	1.28	0.78	0.26	0.42	0.005	0.009
C-109 solid	22.5	2.89E+05	59%	4860	9.00E-03	2.60E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-C-110	64.6	9.76E+05	59%	5687	1.23E-04	1.20E+02	1.28	0.78	0.26	0.42	0.005	0.008
C-110 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
C-110 solid	64.3	9.72E+05	59%	5680	1.21E-04	1.17E+02	1.28	0.78	0.26	0.42	0.005	0.008

Author [illegible] Date 4-24-00 Checked by E. [illegible] Date 4-24-00

Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-C-111	20.7	2.80E+05	32%	4824	2.80E-02	7.86E+03	1.28	0.78	0.26	0.42	0.005	0.009
C-111 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
C-111 solid	20.7	2.80E+05	32%	4824	2.80E-02	7.86E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-C-112	37.8	6.50E+05	59%	5159	1.47E-02	9.56E+03	1.28	0.78	0.26	0.42	0.005	0.010
C-112 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.010
C-112 solid	37.8	6.50E+05	59%	5159	1.47E-02	9.56E+03	1.28	0.78	0.26	0.42	0.005	0.010
241-C-201	10.2	1.01E+04	59%	368	9.62E-05	9.69E-01	1.28	0.78	0.26	0.42	0.005	0.007
C-201 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
C-201 solid	10.2	1.01E+04	59%	368	9.62E-05	9.69E-01	1.28	0.78	0.26	0.42	0.005	0.007
241-C-202	5.1	5.68E+03	8%	341	1.72E-02	9.79E+01	1.28	0.78	0.26	0.42	0.005	0.007
C-202 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
C-202 solid	5.1	5.68E+03	8%	341	1.72E-02	9.79E+01	1.28	0.78	0.26	0.42	0.005	0.007
241-C-203	25.5	2.20E+04	52%	448	1.37E-02	3.01E+02	1.28	0.78	0.26	0.42	0.005	0.007
C-203 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
C-203 solid	25.5	2.20E+04	52%	448	1.37E-02	3.01E+02	1.28	0.78	0.26	0.42	0.005	0.007
241-C-204	15.3	1.32E+04	59%	394	1.08E-04	1.42E+00	1.28	0.78	0.26	0.42	0.005	0.008
C-204 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
C-204 solid	15.3	1.32E+04	59%	394	1.08E-04	1.42E+00	1.28	0.78	0.26	0.42	0.005	0.008
241-S-101	155.0	2.65E+06	64%	7462	1.75E-03	4.65E+03	2.92	2.04	0.70	1.80	0.005	0.039
S-101 liquid	4.4	6.18E+04	100%	86	1.37E-03	8.43E+01	2.92	2.04	0.70	1.80	0.005	0.039
S-101 solid	150.7	2.59E+06	63%	7377	1.76E-03	4.57E+03	2.92	2.04	0.70	1.80	0.005	0.039
241-S-102	186.6	3.24E+06	54%	8083	1.58E-03	5.12E+03	2.83	2.33	0.66	1.98	0.005	0.030
S-102 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.030
S-102 solid	186.6	3.24E+06	54%	8083	1.58E-03	5.12E+03	2.83	2.33	0.66	1.98	0.005	0.030

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-S-103	83.9	1.39E+06	64%	6065	1.02E-03	1.42E+03	2.83	2.33	0.66	1.98	0.005	0.018
S-103 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.018
S-103 solid	83.9	1.39E+06	64%	6065	1.02E-03	1.42E+03	2.83	2.33	0.66	1.98	0.005	0.018
241-S-104	106.8	1.82E+06	67%	6514	2.29E-03	4.18E+03	1.28	0.78	0.26	0.42	0.005	0.014
S-104 liquid	0.4	4.43E+03	100%	7	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.014
S-104 solid	106.4	1.82E+06	67%	6507	2.29E-03	4.17E+03	1.28	0.78	0.26	0.42	0.005	0.014
241-S-105	165.6	2.81E+06	18%	7669	1.07E-03	3.01E+03	2.83	2.33	0.66	1.98	0.005	0.015
S-105 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.015
S-105 solid	165.6	2.81E+06	18%	7669	1.07E-03	3.01E+03	2.83	2.33	0.66	1.98	0.005	0.015
241-S-106	154.7	2.78E+06	59%	7455	6.54E-04	1.82E+03	2.83	2.33	0.66	1.98	0.005	0.016
S-106 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.016
S-106 solid	154.7	2.78E+06	59%	7455	6.54E-04	1.82E+03	2.83	2.33	0.66	1.98	0.005	0.016
241-S-107	136.5	2.04E+06	51%	7099	1.49E-03	3.04E+03	1.28	0.78	0.26	0.42	0.005	0.014
S-107 liquid	5.1	6.20E+04	100%	100	6.02E-04	3.73E+01	1.28	0.78	0.26	0.42	0.005	0.014
S-107 solid	131.4	1.97E+06	50%	6999	1.52E-03	3.01E+03	1.28	0.78	0.26	0.42	0.005	0.014
241-S-108	163.4	2.81E+06	4%	7626	7.87E-04	2.21E+03	2.83	2.33	0.66	1.98	0.005	0.017
S-108 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.017
S-108 solid	163.4	2.81E+06	4%	7626	7.87E-04	2.21E+03	2.83	2.33	0.66	1.98	0.005	0.017
241-S-109	184.1	2.51E+06	18%	8033	1.34E-03	3.37E+03	2.83	2.33	0.66	1.98	0.005	0.018
S-109 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.018
S-109 solid	184.1	2.51E+06	18%	8033	1.34E-03	3.37E+03	2.83	2.33	0.66	1.98	0.005	0.018
241-S-110	141.6	2.51E+06	32%	7198	1.55E-03	3.88E+03	3.50	1.87	0.46	2.16	0.005	0.025
S-110 liquid	0.0	0.00E+00	100%	0	1.32E-03	0.00E+00	3.50	1.87	0.46	2.16	0.005	0.025
S-110 solid	141.6	2.51E+06	32%	7198	1.55E-03	3.88E+03	3.50	1.87	0.46	2.16	0.005	0.025

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-S-111	196.1	3.24E+06	64%	8268	2.16E-03	7.00E+03	3.06	1.40	0.10	1.83	0.005	0.007
S-111 liquid	40.3	5.84E+05	100%	791	9.08E-04	5.30E+02	3.06	1.40	0.10	1.83	0.005	0.007
S-111 solid	155.8	2.65E+06	56%	7477	2.44E-03	6.47E+03	3.06	1.40	0.10	1.83	0.005	0.007
241-S-112	189.9	3.23E+06	63%	8147	1.34E-03	4.32E+03	2.83	2.33	0.66	1.98	0.005	0.018
S-112 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.018
S-112 solid	189.9	3.23E+06	63%	8147	1.34E-03	4.32E+03	2.83	2.33	0.66	1.98	0.005	0.018
241-SX-101	162.7	3.23E+06	64%	7612	1.42E-03	4.60E+03	1.69	1.70	0.02	5.04	0.005	0.007
SX-101 liquid	0.0	0.00E+00	100%	0	1.53E-04	0.00E+00	1.69	1.70	0.02	5.04	0.005	0.007
SX-101 solid	162.7	3.23E+06	64%	7612	1.42E-03	4.60E+03	1.69	1.70	0.02	5.04	0.005	0.007
241-SX-102	186.6	3.22E+06	86%	8083	1.56E-03	5.03E+03	2.55	3.28	0.10	3.14	0.005	0.014
SX-102 liquid	48.7	7.36E+05	100%	955	1.59E-03	1.17E+03	2.55	3.28	0.10	3.14	0.005	0.014
SX-102 solid	138.0	2.49E+06	81%	7127	1.55E-03	3.86E+03	2.55	3.28	0.10	3.14	0.005	0.014
241-SX-103	230.2	4.26E+06	66%	8938	2.32E-03	9.87E+03	2.56	3.45	0.18	3.00	0.005	0.027
SX-103 liquid	0.0	0.00E+00	100%	0	1.53E-03	0.00E+00	2.56	3.45	0.18	3.00	0.005	0.027
SX-103 solid	230.2	4.26E+06	66%	8938	2.32E-03	9.87E+03	2.56	3.45	0.18	3.00	0.005	0.027
241-SX-104	169.6	2.92E+06	70%	7747	1.69E-03	4.95E+03	2.83	2.33	0.66	1.98	0.005	0.042
SX-104 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.042
SX-104 solid	169.6	2.92E+06	70%	7747	1.69E-03	4.95E+03	2.83	2.33	0.66	1.98	0.005	0.042
241-SX-105	231.3	3.96E+06	82%	8959	1.43E-03	5.66E+03	2.66	3.11	0.22	3.00	0.005	0.034
SX-105 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	2.66	3.11	0.22	3.00	0.005	0.034
SX-105 solid	231.3	3.96E+06	82%	8959	1.43E-03	5.66E+03	2.66	3.11	0.22	3.00	0.005	0.034
241-SX-106	153.6	2.51E+06	91%	7434	9.86E-04	2.47E+03	3.39	2.87	0.29	1.82	0.005	0.014
SX-106 liquid	36.3	5.38E+05	100%	713	1.40E-03	7.52E+02	3.39	2.87	0.29	1.82	0.005	0.014
SX-106 solid	117.3	1.97E+06	88%	6721	8.74E-04	1.72E+03	3.39	2.87	0.29	1.82	0.005	0.014

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-SX-107	37.8	5.75E+05	59%	5159	1.42E-02	8.16E+03	1.28	0.78	0.26	0.42	0.005	0.040
SX-107 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.040
SX-107 solid	37.8	5.75E+05	59%	5159	1.42E-02	8.16E+03	1.28	0.78	0.26	0.42	0.005	0.040
241-SX-108	31.6	4.81E+05	2%	5038	1.42E-02	6.83E+03	1.28	0.78	0.26	0.42	0.005	0.053
SX-108 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.053
SX-108 solid	31.6	4.81E+05	2%	5038	1.42E-02	6.83E+03	1.28	0.78	0.26	0.42	0.005	0.053
241-SX-109	90.8	1.55E+06	37%	6200	4.01E-03	6.21E+03	2.83	2.33	0.66	1.98	0.005	0.058
SX-109 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.058
SX-109 solid	90.8	1.55E+06	37%	6200	4.01E-03	6.21E+03	2.83	2.33	0.66	1.98	0.005	0.058
241-SX-110	22.5	4.15E+05	59%	4860	2.30E-03	9.54E+02	1.28	0.78	0.26	0.42	0.005	0.036
SX-110 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.036
SX-110 solid	22.5	4.15E+05	59%	4860	2.30E-03	9.54E+02	1.28	0.78	0.26	0.42	0.005	0.036
241-SX-111	44.3	8.17E+05	59%	5288	2.30E-03	1.88E+03	1.28	0.78	0.26	0.42	0.005	0.066
SX-111 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.066
SX-111 solid	44.3	8.17E+05	59%	5288	2.30E-03	1.88E+03	1.28	0.78	0.26	0.42	0.005	0.066
241-SX-112	39.2	7.24E+05	59%	5188	2.30E-03	1.66E+03	1.28	0.78	0.26	0.42	0.005	0.029
SX-112 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.029
SX-112 solid	39.2	7.24E+05	59%	5188	2.30E-03	1.66E+03	1.28	0.78	0.26	0.42	0.005	0.029
241-SX-113	11.3	2.08E+05	64%	4639	2.30E-03	4.77E+02	1.28	0.78	0.26	0.42	0.005	0.009
SX-113 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
SX-113 solid	11.3	2.08E+05	64%	4639	2.30E-03	4.77E+02	1.28	0.78	0.26	0.42	0.005	0.009
241-SX-114	65.7	8.12E+05	59%	5708	1.42E-02	1.15E+04	1.28	0.78	0.26	0.42	0.005	0.046
SX-114 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.046
SX-114 solid	65.7	8.12E+05	59%	5708	1.42E-02	1.15E+04	1.28	0.78	0.26	0.42	0.005	0.046

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-SX-115	4.4	7.86E+04	59%	4503	3.35E-02	2.63E+03	1.28	0.78	0.26	0.42	0.005	0.009
SX-115 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
SX-115 solid	4.4	7.86E+04	59%	4503	3.35E-02	2.63E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-T-101	37.0	6.01E+05	64%	5145	4.13E-03	2.48E+03	3.34	2.29	0.68	2.29	0.005	0.013
T-101 liquid	0.4	5.30E+03	100%	7	1.37E-03	7.24E+00	3.34	2.29	0.68	2.29	0.005	0.013
T-101 solid	36.7	5.96E+05	64%	5138	4.16E-03	2.48E+03	3.34	2.29	0.68	2.29	0.005	0.013
241-T-102	11.6	1.85E+05	71%	4646	1.30E-03	2.40E+02	1.76	0.50	0.04	0.43	0.005	0.005
T-102 liquid	4.7	5.61E+04	100%	93	2.77E-04	1.55E+01	1.76	0.50	0.04	0.43	0.005	0.005
T-102 solid	6.9	1.29E+05	59%	4553	1.74E-03	2.24E+02	1.76	0.50	0.04	0.43	0.005	0.005
241-T-103	9.8	1.45E+05	66%	4610	1.25E-02	1.82E+03	1.28	0.78	0.26	0.42	0.005	0.007
T-103 liquid	1.5	1.77E+04	100%	29	6.02E-04	1.07E+01	1.28	0.78	0.26	0.42	0.005	0.007
T-103 solid	8.4	1.27E+05	61%	4582	1.42E-02	1.80E+03	1.28	0.78	0.26	0.42	0.005	0.007
241-T-104	118.4	1.57E+06	77%	6742	2.20E-05	3.44E+01	1.28	0.78	0.26	0.42	0.005	0.008
T-104 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-104 solid	118.4	1.57E+06	77%	6742	2.20E-05	3.44E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-105	35.6	5.38E+05	68%	5117	2.03E-03	1.09E+03	0.60	1.18	0.25	0.03	0.005	0.008
T-105 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	0.60	1.18	0.25	0.03	0.005	0.008
T-105 solid	35.6	5.38E+05	68%	5117	2.03E-03	1.09E+03	0.60	1.18	0.25	0.03	0.005	0.008
241-T-106	7.6	1.16E+05	28%	4568	2.89E-04	3.36E+01	1.28	0.78	0.26	0.42	0.005	0.008
T-106 liquid	0.7	8.86E+03	100%	14	6.02E-04	5.33E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-106 solid	6.9	1.08E+05	23%	4553	2.63E-04	2.83E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-107	62.8	9.89E+05	50%	5651	7.67E-04	7.58E+02	1.28	0.78	0.26	0.42	0.005	0.008
T-107 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-107 solid	62.8	9.89E+05	50%	5651	7.67E-04	7.58E+02	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-T-108	16.0	2.63E+05	68%	4732	3.80E-03	1.00E+03	3.34	2.29	0.68	2.29	0.005	0.012
T-108 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.012
T-108 solid	16.0	2.63E+05	68%	4732	3.80E-03	1.00E+03	3.34	2.29	0.68	2.29	0.005	0.012
241-T-109	21.1	3.40E+05	82%	4831	1.02E-03	3.48E+02	2.83	2.33	0.66	1.98	0.005	0.012
T-109 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.012
T-109 solid	21.1	3.40E+05	82%	4831	1.02E-03	3.48E+02	2.83	2.33	0.66	1.98	0.005	0.012
241-T-110	140.5	1.85E+06	87%	7177	4.65E-04	8.58E+02	1.28	0.78	0.26	0.42	0.005	0.008
T-110 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-110 solid	140.5	1.85E+06	87%	7177	4.65E-04	8.58E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-T-111	161.9	2.16E+06	81%	7598	3.53E-05	7.62E+01	1.28	0.78	0.26	0.42	0.005	0.008
T-111 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-111 solid	161.9	2.16E+06	81%	7598	3.53E-05	7.62E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-112	24.3	3.20E+05	91%	4896	1.77E-04	5.68E+01	0.38	0.84	0.27	0.00	0.005	0.008
T-112 liquid	2.5	2.91E+04	100%	50	6.02E-04	1.75E+01	0.38	0.84	0.27	0.00	0.005	0.008
T-112 solid	21.8	2.91E+05	90%	4846	1.35E-04	3.92E+01	0.38	0.84	0.27	0.00	0.005	0.008
241-T-201	148.0	1.39E+05	76%	1089	2.04E-05	2.83E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-201 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-201 solid	142.9	1.35E+05	76%	1062	1.26E-06	1.69E-01	1.28	0.78	0.26	0.42	0.005	0.008
241-T-202	107.1	9.86E+04	101%	875	1.62E-07	1.60E-02	1.28	0.78	0.26	0.42	0.005	0.007
T-202 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
T-202 solid	107.1	9.86E+04	101%	875	1.62E-07	1.60E-02	1.28	0.78	0.26	0.42	0.005	0.007
241-T-203	178.6	1.63E+05	89%	1249	1.11E-07	1.81E-02	1.28	0.78	0.26	0.42	0.005	0.008
T-203 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-203 solid	178.6	1.63E+05	89%	1249	1.11E-07	1.81E-02	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-T-204	193.9	1.74E+05	101%	1329	7.31E-08	1.27E-02	1.28	0.78	0.26	0.42	0.005	0.008
T-204 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
T-204 solid	193.9	1.74E+05	101%	1329	7.31E-08	1.27E-02	1.28	0.78	0.26	0.42	0.005	0.008
241-TX-101	31.6	5.73E+05	60%	5038	1.22E-02	7.00E+03	1.28	0.78	0.26	0.42	0.005	0.009
TX-101 liquid	1.1	1.33E+04	100%	21	6.02E-04	8.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
TX-101 solid	30.5	5.60E+05	59%	5017	1.25E-02	7.00E+03	1.28	0.78	0.26	0.42	0.005	0.009
241-TX-102	78.8	1.40E+06	22%	5965	8.01E-04	1.12E+03	2.83	2.33	0.66	1.98	0.005	0.017
TX-102 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.017
TX-102 solid	78.8	1.40E+06	22%	5965	8.01E-04	1.12E+03	2.83	2.33	0.66	1.98	0.005	0.017
241-TX-103	57.0	1.01E+06	29%	5537	1.02E-03	1.03E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-103 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-103 solid	57.0	1.01E+06	29%	5537	1.02E-03	1.03E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TX-104	23.6	4.23E+05	89%	4881	3.73E-03	1.58E+03	5.73	2.05	0.09	0.22	0.005	0.006
TX-104 liquid	1.8	2.74E+04	100%	36	1.37E-03	3.75E+01	5.73	2.05	0.09	0.22	0.005	0.006
TX-104 solid	21.8	3.96E+05	88%	4846	3.89E-03	1.54E+03	5.73	2.05	0.09	0.22	0.005	0.006
241-TX-105	221.1	3.92E+06	7%	8760	8.01E-04	3.14E+03	2.83	2.33	0.66	1.98	0.005	0.025
TX-105 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.025
TX-105 solid	221.1	3.92E+06	7%	8760	8.01E-04	3.14E+03	2.83	2.33	0.66	1.98	0.005	0.025
241-TX-106	123.8	2.19E+06	29%	6849	8.01E-04	1.76E+03	2.83	2.33	0.66	1.98	0.005	0.016
TX-106 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.016
TX-106 solid	123.8	2.19E+06	29%	6849	8.01E-04	1.76E+03	2.83	2.33	0.66	1.98	0.005	0.016
241-TX-107	13.1	2.33E+05	45%	4675	3.12E-03	7.25E+02	2.83	2.33	0.66	1.98	0.005	0.013
TX-107 liquid	0.4	5.26E+03	100%	7	1.48E-03	7.77E+00	2.83	2.33	0.66	1.98	0.005	0.013
TX-107 solid	12.7	2.27E+05	44%	4667	3.16E-03	7.17E+02	2.83	2.33	0.66	1.98	0.005	0.013

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-TX-108	48.7	8.58E+05	16%	5373	1.19E-03	1.02E+03	2.83	2.33	0.66	1.98	0.005	0.012
TX-108 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.012
TX-108 solid	48.7	8.58E+05	16%	5373	1.19E-03	1.02E+03	2.83	2.33	0.66	1.98	0.005	0.012
241-TX-109	139.4	2.04E+06	50%	7156	3.92E-04	7.99E+02	1.28	0.78	0.26	0.42	0.005	0.011
TX-109 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.011
TX-109 solid	139.4	2.04E+06	50%	7156	3.92E-04	7.99E+02	1.28	0.78	0.26	0.42	0.005	0.011
241-TX-110	167.8	2.93E+06	10%	7712	1.45E-03	4.24E+03	2.83	2.33	0.66	1.98	0.005	0.018
TX-110 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.018
TX-110 solid	167.8	2.93E+06	10%	7712	1.45E-03	4.24E+03	2.83	2.33	0.66	1.98	0.005	0.018
241-TX-111	134.4	2.33E+06	11%	7056	1.74E-03	4.07E+03	2.83	2.33	0.66	1.98	0.005	0.016
TX-111 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.016
TX-111 solid	134.4	2.33E+06	11%	7056	1.74E-03	4.07E+03	2.83	2.33	0.66	1.98	0.005	0.016
241-TX-112	235.7	4.18E+06	15%	9045	7.82E-04	3.27E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-112 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-112 solid	235.7	4.18E+06	15%	9045	7.82E-04	3.27E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TX-113	220.4	3.70E+06	11%	8746	2.87E-03	1.06E+04	3.34	2.29	0.68	2.29	0.005	0.014
TX-113 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.014
TX-113 solid	220.4	3.70E+06	11%	8746	2.87E-03	1.06E+04	3.34	2.29	0.68	2.29	0.005	0.014
241-TX-114	194.3	3.45E+06	9%	8232	8.04E-04	2.77E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-114 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-114 solid	194.3	3.45E+06	9%	8232	8.04E-04	2.77E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TX-115	206.2	3.66E+06	8%	8468	1.02E-03	3.73E+03	2.83	2.33	0.66	1.98	0.005	0.013
TX-115 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.013
TX-115 solid	206.2	3.66E+06	8%	8468	1.02E-03	3.73E+03	2.83	2.33	0.66	1.98	0.005	0.013

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-TX-116	229.1	4.04E+06	12%	8917	1.46E-03	5.90E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-116 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-116 solid	229.1	4.04E+06	12%	8917	1.46E-03	5.90E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TX-117	227.3	4.05E+06	6%	8881	1.09E-03	4.41E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-117 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-117 solid	227.3	4.05E+06	6%	8881	1.09E-03	4.41E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TX-118	108.9	1.93E+06	27%	6557	1.96E-03	3.79E+03	2.83	2.33	0.66	1.98	0.005	0.014
TX-118 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.014
TX-118 solid	108.9	1.93E+06	27%	6557	1.96E-03	3.79E+03	2.83	2.33	0.66	1.98	0.005	0.014
241-TY-101	42.8	7.34E+05	14%	5259	4.59E-04	3.37E+02	3.34	2.29	0.68	2.29	0.005	0.012
TY-101 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.012
TY-101 solid	42.8	7.34E+05	14%	5259	4.59E-04	3.37E+02	3.34	2.29	0.68	2.29	0.005	0.012
241-TY-102	23.2	4.17E+05	63%	4874	1.02E-03	4.26E+02	2.83	2.33	0.66	1.98	0.005	0.011
TY-102 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.011
TY-102 solid	23.2	4.17E+05	63%	4874	1.02E-03	4.26E+02	2.83	2.33	0.66	1.98	0.005	0.011
241-TY-103	58.8	1.04E+06	48%	5573	6.76E-04	7.04E+02	3.65	0.31	0.16	0.40	0.005	0.007
TY-103 liquid	0.0	0.00E+00	100%	0	9.24E-05	0.00E+00	3.65	0.31	0.16	0.40	0.005	0.007
TY-103 solid	58.8	1.04E+06	48%	5573	6.76E-04	7.04E+02	3.65	0.31	0.16	0.40	0.005	0.007
241-TY-104	16.7	2.51E+05	71%	4746	1.35E-02	3.38E+03	1.28	0.78	0.26	0.42	0.005	0.008
TY-104 liquid	1.1	1.33E+04	100%	21	6.02E-04	8.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
TY-104 solid	15.6	2.38E+05	69%	4724	1.42E-02	3.37E+03	1.28	0.78	0.26	0.42	0.005	0.008
241-TY-105	83.9	1.34E+06	44%	6065	1.29E-03	1.73E+03	1.28	0.78	0.26	0.42	0.005	0.009
TY-105 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
TY-105 solid	83.9	1.34E+06	44%	6065	1.29E-03	1.73E+03	1.28	0.78	0.26	0.42	0.005	0.009

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-TY-106	7.6	1.09E+05	46%	4568	8.32E-04	9.06E+01	1.28	0.78	0.26	0.42	0.005	0.007
TY-106 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.007
TY-106 solid	7.6	1.09E+05	46%	4568	8.32E-04	9.06E+01	1.28	0.78	0.26	0.42	0.005	0.007
241-U-101	9.1	1.35E+05	45%	4596	1.29E-02	1.73E+03	1.28	0.78	0.26	0.42	0.005	0.008
U-101 liquid	1.1	1.33E+04	100%	21	6.02E-04	8.00E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-101 solid	8.0	1.22E+05	39%	4575	1.42E-02	1.73E+03	1.28	0.78	0.26	0.42	0.005	0.008
241-U-102	136.2	2.38E+06	76%	7091	1.22E-03	2.89E+03	3.94	2.26	1.09	1.30	0.005	0.027
U-102 liquid	6.5	9.40E+04	100%	128	1.28E-03	1.20E+02	3.94	2.26	1.09	1.30	0.005	0.027
U-102 solid	129.6	2.28E+06	75%	6963	1.21E-03	2.77E+03	3.94	2.26	1.09	1.30	0.005	0.027
241-U-103	169.9	2.94E+06	80%	7755	1.15E-03	3.38E+03	3.18	3.02	0.87	2.30	0.005	0.023
U-103 liquid	4.7	6.94E+04	100%	93	1.90E-03	1.32E+02	3.18	3.02	0.87	2.30	0.005	0.023
U-103 solid	165.2	2.87E+06	79%	7662	1.13E-03	3.25E+03	3.18	3.02	0.87	2.30	0.005	0.023
241-U-104	44.3	7.61E+05	64%	5288	6.12E-03	4.66E+03	3.34	2.29	0.68	2.29	0.005	0.019
U-104 liquid	0.0	0.00E+00	100%	0	1.37E-03	0.00E+00	3.34	2.29	0.68	2.29	0.005	0.019
U-104 solid	44.3	7.61E+05	64%	5288	6.12E-03	4.66E+03	3.34	2.29	0.68	2.29	0.005	0.019
241-U-105	151.8	2.57E+06	50%	7398	1.46E-03	3.75E+03	2.92	2.35	1.12	2.04	0.005	0.030
U-105 liquid	13.4	2.04E+05	100%	264	2.95E-03	6.03E+02	2.92	2.35	1.12	2.04	0.005	0.030
U-105 solid	138.3	2.37E+06	46%	7134	1.33E-03	3.15E+03	2.92	2.35	1.12	2.04	0.005	0.030
241-U-106	82.1	1.37E+06	84%	6029	1.35E-03	1.85E+03	3.76	2.02	3.27	0.84	0.005	0.064
U-106 liquid	5.4	7.67E+04	100%	107	1.48E-03	1.13E+02	3.76	2.02	3.27	0.84	0.005	0.064
U-106 solid	76.6	1.29E+06	83%	5922	1.34E-03	1.73E+03	3.76	2.02	3.27	0.84	0.005	0.064
241-U-107	148.1	2.58E+06	58%	7327	4.61E-04	1.19E+03	3.66	2.41	0.27	1.87	0.005	0.009
U-107 liquid	12.0	1.76E+05	100%	235	1.27E-03	2.25E+02	3.66	2.41	0.27	1.87	0.005	0.009
U-107 solid	136.2	2.41E+06	55%	7091	4.01E-04	9.66E+02	3.66	2.41	0.27	1.87	0.005	0.009

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{wt}$ (wt%) TOC in Liquid	$[Al]_{wt}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-U-108	169.9	3.04E+06	73%	7755	1.41E-03	4.29E+03	2.92	2.83	0.52	2.37	0.005	0.015
U-108 liquid	8.7	1.26E+05	100%	171	1.52E-03	1.92E+02	2.92	2.83	0.52	2.37	0.005	0.015
U-108 solid	161.2	2.91E+06	71%	7583	1.41E-03	4.10E+03	2.92	2.83	0.52	2.37	0.005	0.015
241-U-109	168.8	2.93E+06	53%	7733	6.98E-04	2.05E+03	2.98	2.78	0.44	1.99	0.005	0.013
U-109 liquid	6.9	1.06E+05	100%	135	1.32E-03	1.40E+02	2.98	2.78	0.44	1.99	0.005	0.013
U-109 solid	161.9	2.82E+06	52%	7598	6.75E-04	1.91E+03	2.98	2.78	0.44	1.99	0.005	0.013
241-U-110	67.5	1.03E+06	45%	5744	1.42E-02	1.46E+04	1.28	0.78	0.26	0.42	0.005	0.009
U-110 liquid	0.0	0.00E+00	100%	0	6.02E-04	0.00E+00	1.28	0.78	0.26	0.42	0.005	0.009
U-110 solid	67.5	1.03E+06	45%	5744	1.42E-02	1.46E+04	1.28	0.78	0.26	0.42	0.005	0.009
241-U-111	119.5	2.03E+06	63%	6764	1.57E-03	3.19E+03	2.83	2.33	0.66	1.98	0.005	0.016
U-111 liquid	0.0	0.00E+00	100%	0	1.48E-03	0.00E+00	2.83	2.33	0.66	1.98	0.005	0.016
U-111 solid	119.5	2.03E+06	63%	6764	1.57E-03	3.19E+03	2.83	2.33	0.66	1.98	0.005	0.016
241-U-112	17.8	3.02E+05	38%	4767	1.75E-03	5.28E+02	1.28	0.78	0.26	0.42	0.005	0.008
U-112 liquid	1.5	1.77E+04	100%	29	6.02E-04	1.07E+01	1.28	0.78	0.26	0.42	0.005	0.008
U-112 solid	16.3	2.84E+05	34%	4739	1.82E-03	5.18E+02	1.28	0.78	0.26	0.42	0.005	0.008
241-U-201	25.5	2.89E+04	48%	448	1.36E-03	3.95E+01	1.28	0.78	0.26	0.42	0.005	0.008
U-201 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-201 solid	20.4	2.45E+04	38%	421	1.50E-03	3.68E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-U-202	25.5	2.89E+04	49%	448	1.36E-03	3.95E+01	1.28	0.78	0.26	0.42	0.005	0.008
U-202 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-202 solid	20.4	2.45E+04	40%	421	1.50E-03	3.68E+01	1.28	0.78	0.26	0.42	0.005	0.008
241-U-203	15.3	1.67E+04	69%	394	1.26E-03	2.11E+01	1.28	0.78	0.26	0.42	0.005	0.008
U-203 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-203 solid	10.2	1.22E+04	57%	368	1.50E-03	1.84E+01	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-2 Derived Data for Hydrogen Generation Rates Model Calculations for 177 Tanks (23 Sheets)

Tank Name	D_w (inch) Waste Level	M_L (kg) Total Mass	[Liquid] (wt%)	A_{wet} (ft^2) Wetted Area	H_L (Watt/kg) Heat Load per kg	H_L (Watt) Tank Heat Load	$[NO_3]_M$ (mole/L) NO_3 in Liquid	$[NO_2]_M$ (mole/L) NO_2 in Liquid	$[TOC]_{\%}$ (wt%) TOC in Liquid	$[Al]_{\%}$ (wt%) Aluminum in Liquid	G_{H2O} (H_2/100eV) G values for water	G_{TOT} (H_2/100eV) Total G values
241-U-204	15.3	1.43E+04	52%	394	1.94E-04	2.79E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-204 liquid	5.1	4.43E+03	100%	27	6.02E-04	2.67E+00	1.28	0.78	0.26	0.42	0.005	0.008
U-204 solid	10.2	9.92E+03	30%	368	1.23E-05	1.22E-01	1.28	0.78	0.26	0.42	0.005	0.008

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-AN-101	2.14E-07	1.17E-08	7.56E-07	9.82E-07	3.03E-09	1.66E-10	1.07E-08	1.39E-08
AN-101 liquid	2.16E-08	1.23E-08	1.63E-07	1.97E-07	2.91E-10	1.66E-10	2.19E-09	2.65E-09
AN-101 solid	6.74E-07	9.80E-09	2.57E-06	3.25E-06	1.14E-08	1.66E-10	4.34E-08	5.50E-08
241-AN-102	1.18E-06	1.54E-06	2.12E-07	2.94E-06	1.94E-08	2.53E-08	3.48E-09	4.82E-08
AN-102 liquid	1.15E-06	1.56E-06	1.34E-07	2.85E-06	1.88E-08	2.55E-08	2.19E-09	4.66E-08
AN-102 solid	1.40E-06	1.32E-06	1.01E-06	3.73E-06	2.44E-08	2.28E-08	1.75E-08	6.47E-08
241-AN-103	2.79E-07	4.17E-07	1.97E-07	8.94E-07	5.11E-09	7.65E-09	3.61E-09	1.64E-08
AN-103 liquid	4.44E-07	4.94E-07	1.27E-07	1.07E-06	7.66E-09	8.53E-09	2.19E-09	1.84E-08
AN-103 solid	1.31E-07	3.28E-07	2.79E-07	7.38E-07	2.60E-09	6.48E-09	5.51E-09	1.46E-08
241-AN-104	3.43E-07	4.73E-07	2.03E-07	1.02E-06	5.89E-09	8.11E-09	3.49E-09	1.75E-08
AN-104 liquid	3.94E-07	4.96E-07	1.35E-07	1.03E-06	6.39E-09	8.04E-09	2.19E-09	1.66E-08
AN-104 solid	2.87E-07	4.46E-07	2.84E-07	1.02E-06	5.28E-09	8.22E-09	5.22E-09	1.87E-08
241-AN-105	3.27E-07	7.35E-07	1.97E-07	1.26E-06	5.64E-09	1.27E-08	3.40E-09	2.17E-08
AN-105 liquid	3.28E-07	7.78E-07	1.34E-07	1.24E-06	5.39E-09	1.28E-08	2.19E-09	2.04E-08
AN-105 solid	3.24E-07	6.85E-07	2.73E-07	1.28E-06	5.92E-09	1.25E-08	4.98E-09	2.34E-08
241-AN-106	5.75E-08	2.87E-08	2.31E-06	2.40E-06	9.23E-10	4.60E-10	3.71E-08	3.84E-08
AN-106 liquid	3.28E-08	3.57E-08	1.59E-07	2.28E-07	4.52E-10	4.92E-10	2.19E-09	3.14E-09
AN-106 solid	6.68E-08	2.20E-08	4.33E-06	4.42E-06	1.27E-09	4.18E-10	8.22E-08	8.39E-08
241-AN-107	2.10E-06	4.14E-07	2.14E-07	2.73E-06	3.43E-08	6.78E-09	3.50E-09	4.46E-08
AN-107 liquid	2.08E-06	4.36E-07	1.38E-07	2.66E-06	3.30E-08	6.92E-09	2.19E-09	4.22E-08
AN-107 solid	2.07E-06	3.50E-07	4.27E-07	2.84E-06	3.72E-08	6.31E-09	7.70E-09	5.13E-08
241-AP-101	6.02E-08	4.57E-08	2.32E-07	3.38E-07	8.85E-10	6.73E-10	3.41E-09	4.97E-09
AP-101 liquid	6.02E-08	4.57E-08	2.32E-07	3.38E-07	8.85E-10	6.73E-10	3.41E-09	4.97E-09
AP-101 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-AP-102	8.74E-08	5.97E-08	2.48E-07	3.95E-07	1.21E-09	8.29E-10	3.44E-09	5.48E-09
AP-102 liquid	8.74E-08	5.97E-08	2.48E-07	3.95E-07	1.21E-09	8.29E-10	3.44E-09	5.48E-09
AP-102 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AP-103	8.76E-08	3.12E-08	4.38E-07	5.56E-07	1.39E-09	4.96E-10	6.97E-09	8.86E-09
AP-103 liquid	8.76E-08	3.12E-08	4.37E-07	5.56E-07	1.40E-09	4.98E-10	6.98E-09	8.88E-09
AP-103 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AP-104	2.35E-08	1.58E-10	5.08E-06	5.10E-06	2.72E-10	1.83E-12	5.88E-08	5.91E-08
AP-104 liquid	2.35E-08	1.58E-10	5.08E-06	5.10E-06	2.72E-10	1.83E-12	5.88E-08	5.91E-08
AP-104 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AP-105	4.95E-08	3.92E-08	2.51E-07	3.40E-07	7.82E-10	6.19E-10	3.97E-09	5.37E-09
AP-105 liquid	3.92E-08	4.07E-08	1.42E-07	2.22E-07	6.07E-10	6.30E-10	2.19E-09	3.43E-09
AP-105 solid	9.42E-08	2.96E-08	9.55E-07	1.08E-06	1.72E-09	5.41E-10	1.75E-08	1.97E-08
241-AP-106	1.87E-08	9.44E-09	1.31E-06	1.34E-06	2.41E-10	1.21E-10	1.68E-08	1.72E-08
AP-106 liquid	1.87E-08	9.44E-09	1.31E-06	1.34E-06	2.41E-10	1.21E-10	1.68E-08	1.72E-08
AP-106 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AP-107	1.74E-08	4.64E-09	2.74E-07	2.96E-07	2.27E-10	6.07E-11	3.59E-09	3.88E-09
AP-107 liquid	1.74E-08	4.64E-09	2.74E-07	2.96E-07	2.27E-10	6.07E-11	3.59E-09	3.88E-09
AP-107 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AP-108	2.34E-08	1.05E-08	4.46E-07	4.80E-07	3.09E-10	1.39E-10	5.88E-09	6.33E-09
AP-108 liquid	2.34E-08	1.05E-08	4.46E-07	4.80E-07	3.09E-10	1.39E-10	5.88E-09	6.33E-09
AP-108 solid	not exist	not exist	not exist	not exit	not exist	not exist	not exist	not exit
241-AW-101	3.10E-07	5.40E-07	2.01E-07	1.05E-06	5.25E-09	9.13E-09	3.40E-09	1.78E-08
AW-101 liquid	3.30E-07	5.59E-07	1.35E-07	1.02E-06	5.35E-09	9.06E-09	2.19E-09	1.66E-08
AW-101 solid	2.67E-07	4.95E-07	3.52E-07	1.11E-06	5.04E-09	9.34E-09	6.64E-09	2.10E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-AW-102	1.49E-07	6.92E-09	1.29E-06	1.44E-06	2.22E-09	1.03E-10	1.92E-08	2.15E-08
AW-102 liquid	2.03E-08	9.98E-09	1.68E-07	1.99E-07	2.65E-10	1.30E-10	2.19E-09	2.59E-09
AW-102 solid	1.67E-07	4.55E-09	2.16E-06	2.33E-06	2.80E-09	7.64E-11	3.62E-08	3.91E-08
241-AW-103	1.58E-07	1.43E-09	3.49E-07	5.09E-07	2.21E-09	1.99E-11	4.86E-09	7.09E-09
AW-103 liquid	7.71E-08	2.04E-09	1.86E-07	2.65E-07	9.10E-10	2.41E-11	2.19E-09	3.13E-09
AW-103 solid	1.66E-07	1.20E-09	4.09E-07	5.76E-07	2.47E-09	1.80E-11	6.10E-09	8.59E-09
241-AW-104	4.65E-08	7.38E-08	2.27E-07	3.48E-07	6.97E-10	1.11E-09	3.41E-09	5.21E-09
AW-104 liquid	6.61E-08	8.03E-08	1.52E-07	2.98E-07	9.56E-10	1.16E-09	2.19E-09	4.31E-09
AW-104 solid	1.48E-10	5.22E-08	4.75E-07	5.27E-07	2.52E-12	8.89E-10	8.08E-09	8.97E-09
241-AW-105	2.58E-08	2.66E-09	3.83E-07	4.12E-07	3.62E-10	3.73E-11	5.36E-09	5.76E-09
AW-105 liquid	8.44E-10	3.36E-09	1.86E-07	1.90E-07	9.96E-12	3.96E-11	2.19E-09	2.24E-09
AW-105 solid	3.24E-08	2.38E-09	4.65E-07	5.00E-07	4.91E-10	3.61E-11	7.05E-09	7.58E-09
241-AW-106	1.48E-07	1.78E-07	3.02E-07	6.28E-07	2.49E-09	2.98E-09	5.07E-09	1.05E-08
AW-106 liquid	1.51E-07	1.83E-07	1.38E-07	4.72E-07	2.41E-09	2.92E-09	2.19E-09	7.52E-09
AW-106 solid	1.45E-07	1.72E-07	4.61E-07	7.79E-07	2.57E-09	3.04E-09	8.16E-09	1.38E-08
241-AY-101	4.10E-06	3.86E-08	7.73E-07	4.91E-06	5.84E-08	5.50E-10	1.10E-08	7.00E-08
AY-101 liquid	1.17E-07	3.34E-08	1.76E-07	3.26E-07	1.47E-09	4.18E-10	2.19E-09	4.08E-09
AY-101 solid	5.05E-06	3.99E-08	9.85E-07	6.08E-06	7.58E-08	5.99E-10	1.48E-08	9.12E-08
241-AY-102	1.13E-05	6.00E-08	3.21E-07	1.17E-05	1.54E-07	8.18E-10	4.38E-09	1.60E-07
AY-102 liquid	1.07E-07	4.37E-08	1.74E-07	3.25E-07	1.35E-09	5.51E-10	2.19E-09	4.10E-09
AY-102 solid	2.06E-05	1.04E-07	5.51E-07	2.12E-05	3.23E-07	1.63E-09	8.64E-09	3.33E-07
241-AZ-101	3.28E-06	4.67E-07	2.70E-07	4.02E-06	4.62E-08	6.57E-09	3.80E-09	5.65E-08
AZ-101 liquid	8.95E-07	4.66E-07	1.59E-07	1.52E-06	1.23E-08	6.42E-09	2.19E-09	2.09E-08
AZ-101 solid	2.78E-05	4.92E-07	1.61E-06	2.99E-05	5.38E-07	9.50E-09	3.11E-08	5.79E-07

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-AZ-102	3.05E-06	4.21E-07	2.76E-07	3.75E-06	4.04E-08	5.58E-09	3.65E-09	4.96E-08
AZ-102 liquid	6.85E-07	3.70E-07	1.72E-07	1.23E-06	8.72E-09	4.71E-09	2.19E-09	1.56E-08
AZ-102 solid	2.02E-05	1.18E-06	8.85E-07	2.23E-05	3.49E-07	2.04E-08	1.53E-08	3.85E-07
241-SY-101	9.61E-07	4.37E-06	1.92E-07	5.53E-06	1.67E-08	7.58E-08	3.34E-09	9.58E-08
SY-101 liquid	1.04E-06	5.04E-06	1.36E-07	6.21E-06	1.67E-08	8.11E-08	2.19E-09	9.99E-08
SY-101 solid	8.77E-07	3.78E-06	2.42E-07	4.90E-06	1.63E-08	7.04E-08	4.52E-09	9.13E-08
241-SY-102	3.82E-08	3.85E-08	3.13E-07	3.90E-07	5.38E-10	5.43E-10	4.42E-09	5.50E-09
SY-102 liquid	3.85E-08	4.14E-08	1.61E-07	2.41E-07	5.26E-10	5.66E-10	2.19E-09	3.29E-09
SY-102 solid	3.15E-08	2.44E-08	1.06E-06	1.11E-06	5.25E-10	4.06E-10	1.76E-08	1.86E-08
241-SY-103	2.77E-07	7.16E-07	2.33E-07	1.23E-06	4.78E-09	1.23E-08	4.02E-09	2.12E-08
SY-103 liquid	4.00E-07	8.34E-07	1.29E-07	1.36E-06	6.80E-09	1.42E-08	2.19E-09	2.32E-08
SY-103 solid	1.74E-07	5.95E-07	3.40E-07	1.11E-06	3.05E-09	1.04E-08	5.95E-09	1.94E-08
241-A-101	3.19E-07	3.45E-06	4.12E-07	4.18E-06	5.62E-09	6.07E-08	7.25E-09	7.36E-08
A-101 liquid	4.05E-07	5.02E-06	6.02E-07	6.03E-06	6.56E-09	9.64E-08	1.16E-08	1.15E-07
A-101 solid	2.42E-07	2.23E-06	2.29E-07	2.70E-06	4.64E-09	4.28E-08	4.39E-09	5.18E-08
241-A-102	7.70E-07	3.79E-07	3.79E-06	4.94E-06	1.44E-08	7.08E-09	7.08E-08	9.22E-08
A-102 liquid	2.85E-07	5.80E-07	2.71E-07	1.14E-06	4.62E-09	1.10E-08	5.13E-09	2.07E-08
A-102 solid	7.83E-07	3.61E-07	4.12E-06	5.27E-06	1.48E-08	6.83E-09	7.80E-08	9.96E-08
241-A-103	8.29E-06	6.17E-07	7.77E-07	9.68E-06	1.25E-07	9.31E-09	1.17E-08	1.46E-07
A-103 liquid	2.65E-07	1.04E-06	2.57E-07	1.56E-06	4.53E-09	1.57E-08	3.87E-09	2.41E-08
A-103 solid	8.33E-06	6.10E-07	7.85E-07	9.72E-06	1.25E-07	9.19E-09	1.18E-08	1.47E-07
241-A-104	3.64E-05	4.34E-06	5.35E-06	4.61E-05	6.91E-07	8.25E-08	1.02E-07	8.75E-07
A-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
A-104 solid	3.64E-05	4.34E-06	5.35E-06	4.61E-05	6.91E-07	8.25E-08	1.02E-07	8.75E-07

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA
A-105 liquid	NA	NA	NA	NA	NA	NA	NA	NA
A-105 solid	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	1.01E-06	6.78E-07	1.46E-06	3.14E-06	1.80E-08	1.22E-08	2.62E-08	5.64E-08
A-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
A-106 solid	1.01E-06	6.78E-07	1.46E-06	3.14E-06	1.80E-08	1.22E-08	2.62E-08	5.64E-08
241-AX-101	2.11E-07	1.27E-06	4.42E-07	1.92E-06	3.83E-09	2.30E-08	8.03E-09	3.49E-08
AX-101 liquid	2.41E-07	1.46E-06	2.57E-07	1.96E-06	4.11E-09	2.83E-08	4.98E-09	3.74E-08
AX-101 solid	1.82E-07	1.08E-06	6.16E-07	1.88E-06	3.52E-09	2.10E-08	1.19E-08	3.64E-08
241-AX-102	1.09E-06	1.21E-07	5.67E-06	6.88E-06	1.82E-08	2.04E-09	9.51E-08	1.15E-07
AX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-102 solid	1.09E-06	1.21E-07	5.67E-06	6.88E-06	1.82E-08	2.04E-09	9.51E-08	1.15E-07
241-AX-103	1.38E-06	9.58E-07	1.53E-06	3.87E-06	2.60E-08	1.80E-08	2.87E-08	7.27E-08
AX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-103 solid	1.38E-06	9.58E-07	1.53E-06	3.87E-06	2.60E-08	1.80E-08	2.87E-08	7.27E-08
241-AX-104	3.41E-06	9.06E-09	1.65E-05	2.00E-05	7.09E-08	1.89E-10	3.45E-07	4.16E-07
AX-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-104 solid	3.41E-06	9.06E-09	1.65E-05	2.00E-05	7.09E-08	1.89E-10	3.45E-07	4.16E-07
241-B-101	1.65E-07	6.55E-07	1.66E-06	2.48E-06	2.83E-09	1.12E-08	2.85E-08	4.25E-08
B-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-101 solid	1.65E-07	6.55E-07	1.66E-06	2.48E-06	2.83E-09	1.12E-08	2.85E-08	4.25E-08
241-B-102	1.18E-08	3.78E-08	4.47E-06	4.52E-06	2.35E-10	7.57E-10	8.95E-08	9.05E-08
B-102 liquid	1.63E-07	8.98E-08	2.73E-07	5.26E-07	2.63E-09	1.85E-09	5.62E-09	1.01E-08
B-102 solid	4.55E-09	3.20E-08	4.94E-06	4.98E-06	9.36E-11	6.58E-10	1.02E-07	1.02E-07

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-B-103	7.38E-09	7.15E-08	2.46E-06	2.54E-06	1.52E-10	1.47E-09	5.05E-08	5.22E-08
B-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-103 solid	7.38E-09	7.15E-08	2.46E-06	2.54E-06	1.52E-10	1.47E-09	5.05E-08	5.22E-08
241-B-104	9.42E-07	2.21E-08	8.31E-07	1.80E-06	1.33E-08	3.12E-10	1.17E-08	2.53E-08
B-104 liquid	4.45E-08	2.45E-08	3.24E-07	3.93E-07	6.02E-10	3.46E-10	4.58E-09	5.53E-09
B-104 solid	9.44E-07	2.21E-08	8.33E-07	1.80E-06	1.33E-08	3.12E-10	1.18E-08	2.54E-08
241-B-105	1.34E-07	3.96E-08	1.14E-06	1.31E-06	2.53E-09	7.50E-10	2.16E-08	2.49E-08
B-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-105 solid	1.34E-07	3.96E-08	1.14E-06	1.31E-06	2.53E-09	7.50E-10	2.16E-08	2.49E-08
241-B-106	8.72E-07	1.56E-08	1.64E-06	2.53E-06	1.47E-08	2.63E-10	2.77E-08	4.26E-08
B-106 liquid	4.18E-08	1.75E-08	3.24E-07	3.84E-07	5.66E-10	2.96E-10	5.48E-09	6.34E-09
B-106 solid	8.77E-07	1.56E-08	1.65E-06	2.54E-06	1.48E-08	2.64E-10	2.79E-08	4.30E-08
241-B-107	3.58E-07	4.73E-08	1.09E-06	1.49E-06	6.88E-09	9.09E-10	2.09E-08	2.87E-08
B-107 liquid	1.43E-07	7.55E-08	2.71E-07	4.89E-07	2.31E-09	1.45E-09	5.22E-09	8.98E-09
B-107 solid	3.58E-07	4.72E-08	1.09E-06	1.50E-06	6.89E-09	9.07E-10	2.10E-08	2.88E-08
241-B-108	9.60E-09	3.35E-08	1.80E-06	1.84E-06	1.78E-10	6.20E-10	3.34E-08	3.42E-08
B-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-108 solid	9.60E-09	3.35E-08	1.80E-06	1.84E-06	1.78E-10	6.20E-10	3.34E-08	3.42E-08
241-B-109	4.17E-07	7.92E-08	1.20E-06	1.69E-06	9.01E-09	1.71E-09	2.58E-08	3.66E-08
B-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-109 solid	4.17E-07	7.92E-08	1.20E-06	1.69E-06	9.01E-09	1.71E-09	2.58E-08	3.66E-08
241-B-110	3.22E-08	1.65E-08	9.83E-07	1.03E-06	5.07E-10	2.60E-10	1.55E-08	1.62E-08
B-110 liquid	4.57E-08	2.83E-08	3.24E-07	3.99E-07	6.19E-10	4.46E-10	5.11E-09	6.17E-09
B-110 solid	3.22E-08	1.65E-08	9.85E-07	1.03E-06	5.06E-10	2.60E-10	1.55E-08	1.63E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-B-111	1.03E-07	1.81E-08	1.15E-06	1.27E-06	1.42E-09	2.49E-10	1.59E-08	1.76E-08
B-111 liquid	4.72E-08	3.30E-08	3.24E-07	4.05E-07	6.40E-10	4.55E-10	4.47E-09	5.56E-09
B-111 solid	1.03E-07	1.80E-08	1.16E-06	1.28E-06	1.42E-09	2.48E-10	1.59E-08	1.76E-08
241-B-112	4.72E-08	1.62E-09	5.91E-06	5.96E-06	6.93E-10	2.37E-11	8.69E-08	8.76E-08
B-112 liquid	7.56E-08	2.59E-09	2.99E-07	3.77E-07	1.11E-09	3.80E-11	4.39E-09	5.54E-09
B-112 solid	4.43E-08	1.52E-09	6.47E-06	6.52E-06	6.52E-10	2.23E-11	9.51E-08	9.58E-08
241-B-201	1.37E-09	6.07E-09	1.60E-06	1.61E-06	1.97E-11	8.76E-11	2.31E-08	2.32E-08
B-201 liquid	3.82E-08	1.01E-08	1.22E-06	1.26E-06	5.18E-10	1.46E-10	1.76E-08	1.83E-08
B-201 solid	6.31E-10	5.93E-09	1.62E-06	1.62E-06	9.14E-12	8.58E-11	2.34E-08	2.35E-08
241-B-202	1.42E-09	1.16E-08	1.57E-06	1.58E-06	2.13E-11	1.75E-10	2.36E-08	2.38E-08
B-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-202 solid	1.42E-09	1.16E-08	1.57E-06	1.58E-06	2.13E-11	1.75E-10	2.36E-08	2.38E-08
241-B-203	6.99E-10	7.10E-09	1.47E-06	1.48E-06	9.63E-12	9.77E-11	2.03E-08	2.04E-08
B-203 liquid	3.72E-08	8.32E-09	1.22E-06	1.26E-06	5.04E-10	1.15E-10	1.67E-08	1.74E-08
B-203 solid	8.88E-11	7.07E-09	1.48E-06	1.48E-06	1.22E-12	9.74E-11	2.03E-08	2.04E-08
241-B-204	4.62E-07	5.95E-09	1.48E-06	1.95E-06	6.35E-09	8.17E-11	2.03E-08	2.68E-08
B-204 liquid	3.95E-08	1.18E-08	1.35E-06	1.41E-06	4.80E-10	1.63E-10	1.87E-08	1.93E-08
B-204 solid	4.62E-07	5.84E-09	1.48E-06	1.95E-06	6.36E-09	8.05E-11	2.04E-08	2.69E-08
241-BX-101	4.33E-08	9.92E-09	3.40E-06	3.46E-06	8.63E-10	1.98E-10	6.77E-08	6.88E-08
BX-101 liquid	3.71E-08	3.79E-08	2.96E-07	3.71E-07	5.50E-10	7.58E-10	5.92E-09	7.23E-09
BX-101 solid	4.18E-08	9.43E-09	3.46E-06	3.51E-06	8.36E-10	1.89E-10	6.92E-08	7.02E-08
241-BX-102	2.75E-08	1.16E-08	3.75E-06	3.78E-06	2.41E-10	1.02E-10	3.28E-08	3.31E-08
BX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-102 solid	2.75E-08	1.16E-08	3.75E-06	3.78E-06	2.41E-10	1.02E-10	3.28E-08	3.31E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-BX-103	5.51E-08	2.23E-08	2.25E-06	2.33E-06	1.04E-09	4.23E-10	4.27E-08	4.42E-08
BX-103 liquid	3.60E-08	3.37E-08	2.96E-07	3.66E-07	5.35E-10	6.60E-10	5.79E-09	6.98E-09
BX-103 solid	5.52E-08	2.10E-08	2.47E-06	2.55E-06	1.08E-09	4.12E-10	4.83E-08	4.98E-08
241-BX-104	1.05E-07	3.33E-08	1.61E-06	1.74E-06	2.09E-09	6.62E-10	3.19E-08	3.47E-08
BX-104 liquid	5.82E-08	5.59E-08	2.94E-07	4.08E-07	8.69E-10	1.12E-09	5.89E-09	7.88E-09
BX-104 solid	1.05E-07	3.28E-08	1.64E-06	1.77E-06	2.11E-09	6.57E-10	3.28E-08	3.55E-08
241-BX-105	2.79E-08	1.40E-08	3.02E-06	3.07E-06	5.32E-10	2.67E-10	5.78E-08	5.86E-08
BX-105 liquid	7.20E-08	5.91E-08	2.94E-07	4.25E-07	1.07E-09	1.16E-09	5.76E-09	7.99E-09
BX-105 solid	2.10E-08	1.02E-08	3.25E-06	3.28E-06	4.12E-10	2.00E-10	6.36E-08	6.42E-08
241-BX-106	3.71E-08	1.02E-08	3.89E-06	3.93E-06	7.25E-10	1.99E-10	7.60E-08	7.70E-08
BX-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-106 solid	3.71E-08	1.02E-08	3.89E-06	3.93E-06	7.25E-10	1.99E-10	7.60E-08	7.70E-08
241-BX-107	7.13E-09	1.43E-08	7.38E-07	7.59E-07	1.19E-10	2.39E-10	1.23E-08	1.26E-08
BX-107 liquid	4.31E-08	2.09E-08	3.24E-07	3.88E-07	5.84E-10	3.48E-10	5.41E-09	6.34E-09
BX-107 solid	7.07E-09	1.43E-08	7.39E-07	7.60E-07	1.18E-10	2.38E-10	1.23E-08	1.27E-08
241-BX-108	2.27E-08	6.88E-09	6.44E-06	6.47E-06	3.84E-10	1.17E-10	1.09E-07	1.10E-07
BX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-108solid	2.27E-08	6.88E-09	6.44E-06	6.47E-06	3.84E-10	1.17E-10	1.09E-07	1.10E-07
241-BX-109	6.85E-08	1.88E-08	1.08E-06	1.17E-06	1.17E-09	3.22E-10	1.85E-08	2.00E-08
BX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-109 solid	6.85E-08	1.88E-08	1.08E-06	1.17E-06	1.17E-09	3.22E-10	1.85E-08	2.00E-08
241-BX-110	4.40E-08	3.56E-08	8.27E-07	9.07E-07	9.33E-10	7.55E-10	1.75E-08	1.92E-08
BX-110 liquid	4.87E-08	4.79E-08	2.71E-07	3.68E-07	7.90E-10	1.02E-09	5.77E-09	7.58E-09
BX-110 solid	4.39E-08	3.54E-08	8.33E-07	9.13E-07	9.34E-10	7.54E-10	1.77E-08	1.94E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-BX-111	5.16E-09	8.77E-09	1.32E-06	1.34E-06	8.26E-11	1.40E-10	2.12E-08	2.14E-08
BX-111 liquid	1.63E-07	8.91E-08	2.73E-07	5.25E-07	2.62E-09	1.43E-09	4.37E-09	8.42E-09
BX-111 solid	4.80E-09	8.27E-09	1.33E-06	1.34E-06	7.68E-11	1.32E-10	2.13E-08	2.15E-08
241-BX-112	1.66E-08	2.28E-09	1.38E-06	1.40E-06	2.51E-10	3.46E-11	2.09E-08	2.12E-08
BX-112 liquid	4.17E-08	2.74E-09	3.22E-07	3.66E-07	5.70E-10	4.16E-11	4.88E-09	5.49E-09
BX-112 solid	1.64E-08	2.28E-09	1.38E-06	1.40E-06	2.49E-10	3.45E-11	2.10E-08	2.13E-08
241-BY-101	4.69E-08	4.94E-08	5.95E-07	6.91E-07	9.01E-10	9.48E-10	1.14E-08	1.33E-08
BY-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-101 solid	4.69E-08	4.94E-08	5.95E-07	6.91E-07	9.01E-10	9.48E-10	1.14E-08	1.33E-08
241-BY-102	1.06E-08	1.06E-08	8.19E-07	8.40E-07	1.85E-10	1.83E-10	1.42E-08	1.46E-08
BY-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-102 solid	1.06E-08	1.06E-08	8.19E-07	8.40E-07	1.85E-10	1.83E-10	1.42E-08	1.46E-08
241-BY-103	3.35E-08	7.00E-08	5.67E-07	6.71E-07	6.62E-10	1.38E-09	1.12E-08	1.32E-08
BY-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-103 solid	3.35E-08	7.00E-08	5.67E-07	6.71E-07	6.62E-10	1.38E-09	1.12E-08	1.32E-08
241-BY-104	4.39E-07	4.22E-07	6.73E-07	1.53E-06	8.30E-09	7.98E-09	1.27E-08	2.90E-08
BY-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-104 solid	4.39E-07	4.22E-07	6.73E-07	1.53E-06	8.30E-09	7.98E-09	1.27E-08	2.90E-08
241-BY-105	2.04E-08	7.32E-08	4.42E-07	5.36E-07	4.53E-10	1.62E-09	9.81E-09	1.19E-08
BY-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-105 solid	2.04E-08	7.32E-08	4.42E-07	5.36E-07	4.53E-10	1.62E-09	9.81E-09	1.19E-08
241-BY-106	1.99E-07	4.83E-07	4.64E-07	1.15E-06	3.96E-09	9.63E-09	9.24E-09	2.28E-08
BY-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-106 solid	1.99E-07	4.83E-07	4.64E-07	1.15E-06	3.96E-09	9.63E-09	9.24E-09	2.28E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-BY-107	5.05E-08	1.18E-07	7.62E-07	9.31E-07	9.68E-10	2.27E-09	1.46E-08	1.79E-08
BY-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-107 solid	5.05E-08	1.18E-07	7.62E-07	9.31E-07	9.68E-10	2.27E-09	1.46E-08	1.79E-08
241-BY-108	8.31E-07	3.81E-07	8.91E-07	2.10E-06	1.52E-08	6.99E-09	1.63E-08	3.86E-08
BY-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-108 solid	8.31E-07	3.81E-07	8.91E-07	2.10E-06	1.52E-08	6.99E-09	1.63E-08	3.86E-08
241-BY-109	2.78E-08	2.98E-08	7.16E-07	7.74E-07	5.35E-10	5.73E-10	1.38E-08	1.49E-08
BY-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-109 solid	2.78E-08	2.98E-08	7.16E-07	7.74E-07	5.35E-10	5.73E-10	1.38E-08	1.49E-08
241-BY-110	6.63E-08	1.88E-07	5.61E-07	8.16E-07	1.33E-09	3.78E-09	1.12E-08	1.63E-08
BY-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-110 solid	6.63E-08	1.88E-07	5.61E-07	8.16E-07	1.33E-09	3.78E-09	1.12E-08	1.63E-08
241-BY-111	1.24E-08	1.92E-08	5.68E-07	6.00E-07	2.26E-10	3.48E-10	1.03E-08	1.09E-08
BY-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-111 solid	1.24E-08	1.92E-08	5.68E-07	6.00E-07	2.26E-10	3.48E-10	1.03E-08	1.09E-08
241-BY-112	2.06E-08	3.90E-08	8.14E-07	8.73E-07	3.48E-10	6.59E-10	1.37E-08	1.48E-08
BY-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-112 solid	2.06E-08	3.90E-08	8.14E-07	8.73E-07	3.48E-10	6.59E-10	1.37E-08	1.48E-08
241-C-101	1.54E-07	3.63E-08	1.98E-06	2.17E-06	2.75E-09	6.48E-10	3.53E-08	3.87E-08
C-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-101 solid	1.54E-07	3.63E-08	1.98E-06	2.17E-06	2.75E-09	6.48E-10	3.53E-08	3.87E-08
241-C-102	4.63E-07	1.83E-08	6.24E-07	1.11E-06	9.65E-09	3.81E-10	1.30E-08	2.30E-08
C-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-102 solid	4.63E-07	1.83E-08	6.24E-07	1.11E-06	9.65E-09	3.81E-10	1.30E-08	2.30E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-C-103	3.55E-06	6.41E-08	1.27E-06	4.88E-06	5.06E-08	9.15E-10	1.81E-08	6.97E-08
C-103 liquid	1.96E-07	8.23E-08	3.52E-07	6.30E-07	2.44E-09	1.27E-09	5.44E-09	9.15E-09
C-103 solid	4.55E-06	5.43E-08	1.77E-06	6.37E-06	7.03E-08	8.40E-10	2.73E-08	9.84E-08
241-C-104	1.81E-07	8.78E-08	6.91E-07	9.60E-07	3.56E-09	1.73E-09	1.36E-08	1.89E-08
C-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-104 solid	1.81E-07	8.78E-08	6.91E-07	9.60E-07	3.56E-09	1.73E-09	1.36E-08	1.89E-08
241-C-105	1.98E-07	5.68E-09	1.40E-06	1.61E-06	3.30E-09	9.47E-11	2.34E-08	2.68E-08
C-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-105 solid	2.52E-07	5.68E-09	1.40E-06	1.66E-06	4.51E-09	1.02E-10	2.52E-08	2.98E-08
241-C-106	6.29E-07	2.99E-09	4.37E-06	5.00E-06	8.48E-09	4.03E-11	5.88E-08	6.74E-08
C-106 liquid	1.03E-07	3.44E-09	3.48E-07	4.54E-07	1.30E-09	6.18E-11	6.25E-09	7.61E-09
C-106 solid	1.15E-06	1.31E-09	1.92E-05	2.04E-05	2.07E-08	2.36E-11	3.45E-07	3.65E-07
241-C-107	5.95E-07	1.78E-07	9.24E-07	1.70E-06	9.64E-09	2.89E-09	1.50E-08	2.75E-08
C-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-107 solid	5.95E-07	1.78E-07	9.24E-07	1.70E-06	9.64E-09	2.89E-09	1.50E-08	2.75E-08
241-C-108	6.55E-08	2.17E-08	2.82E-06	2.90E-06	1.06E-09	3.52E-10	4.56E-08	4.71E-08
C-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-108 solid	6.55E-08	2.17E-08	2.82E-06	2.90E-06	1.06E-09	3.52E-10	4.56E-08	4.71E-08
241-C-109	4.27E-07	2.47E-08	3.22E-06	3.67E-06	6.06E-09	3.50E-10	4.56E-08	5.21E-08
C-109 liquid	4.94E-08	4.04E-08	3.24E-07	4.14E-07	6.69E-10	5.76E-10	4.62E-09	5.86E-09
C-109 solid	4.33E-07	2.37E-08	3.39E-06	3.85E-06	6.17E-09	3.38E-10	4.83E-08	5.48E-08
241-C-110	5.25E-09	1.29E-08	1.17E-06	1.19E-06	8.80E-11	2.17E-10	1.97E-08	2.00E-08
C-110 liquid	4.35E-08	2.18E-08	3.24E-07	3.90E-07	5.89E-10	3.67E-10	5.45E-09	6.40E-09
C-110 solid	5.14E-09	1.29E-08	1.18E-06	1.20E-06	8.63E-11	2.16E-10	1.98E-08	2.01E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-C-111	7.10E-07	1.05E-08	3.47E-06	4.19E-06	1.07E-08	1.58E-10	5.22E-08	6.30E-08
C-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-111 solid	7.10E-07	1.05E-08	3.47E-06	4.19E-06	1.07E-08	1.58E-10	5.22E-08	6.30E-08
241-C-112	7.44E-07	2.93E-08	1.60E-06	2.37E-06	1.42E-08	5.60E-10	3.06E-08	4.53E-08
C-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-112 solid	7.44E-07	2.93E-08	1.60E-06	2.37E-06	1.42E-08	5.60E-10	3.06E-08	4.53E-08
241-C-201	3.79E-09	8.48E-09	7.36E-06	7.37E-06	5.83E-11	1.30E-10	1.13E-07	1.13E-07
C-201 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-201 solid	3.79E-09	8.48E-09	7.36E-06	7.37E-06	5.83E-11	1.30E-10	1.13E-07	1.13E-07
241-C-202	9.07E-08	1.08E-09	1.21E-05	1.22E-05	1.57E-09	1.87E-11	2.10E-07	2.12E-07
C-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-202 solid	9.07E-08	1.08E-09	1.21E-05	1.22E-05	1.57E-09	1.87E-11	2.10E-07	2.12E-07
241-C-203	4.70E-07	6.70E-09	4.11E-06	4.59E-06	6.30E-09	9.00E-11	5.52E-08	6.16E-08
C-203 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-203 solid	4.70E-07	6.70E-09	4.11E-06	4.59E-06	6.30E-09	9.00E-11	5.52E-08	6.16E-08
241-C-204	4.39E-09	1.01E-08	6.03E-06	6.05E-06	5.89E-11	1.35E-10	8.10E-08	8.12E-08
C-204 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-204 solid	4.39E-09	1.01E-08	6.03E-06	6.05E-06	5.89E-11	1.35E-10	8.10E-08	8.12E-08
241-S-101	3.86E-07	1.11E-06	5.67E-07	2.06E-06	7.34E-09	2.11E-08	1.08E-08	3.92E-08
S-101 liquid	4.73E-07	1.74E-06	2.79E-07	2.49E-06	7.44E-09	3.32E-08	5.33E-09	4.60E-08
S-101 solid	3.83E-07	1.09E-06	5.74E-07	2.05E-06	7.31E-09	2.09E-08	1.10E-08	3.91E-08
241-S-102	2.28E-07	5.66E-07	5.02E-07	1.30E-06	4.40E-09	1.09E-08	9.69E-09	2.50E-08
S-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-102 solid	2.28E-07	5.66E-07	5.02E-07	1.30E-06	4.40E-09	1.09E-08	9.69E-09	2.50E-08

Author [illegible] Date 4-24-00 Checked by S. Bai[illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-S-103	1.07E-07	1.90E-07	8.77E-07	1.17E-06	1.98E-09	3.51E-09	1.62E-08	2.17E-08
S-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-103 solid	1.07E-07	1.90E-07	8.77E-07	1.17E-06	1.98E-09	3.51E-09	1.62E-08	2.17E-08
241-S-104	1.91E-07	1.26E-07	7.20E-07	1.04E-06	3.63E-09	2.39E-09	1.37E-08	1.97E-08
S-104 liquid	*7.50E-08*	1.88E-07	3.24E-07	5.88E-07	1.02E-09	3.57E-09	6.16E-09	1.07E-08
S-104 solid	1.92E-07	1.26E-07	7.21E-07	1.04E-06	3.64E-09	2.39E-09	1.37E-08	1.97E-08
241-S-105	2.53E-08	2.95E-08	5.50E-07	6.05E-07	4.77E-10	5.56E-10	1.04E-08	1.14E-08
S-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-105 solid	2.53E-08	2.95E-08	5.50E-07	6.05E-07	4.77E-10	5.56E-10	1.04E-08	1.14E-08
241-S-106	5.50E-08	1.18E-07	5.41E-07	7.14E-07	1.10E-09	2.34E-09	1.08E-08	1.42E-08
S-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-106 solid	5.50E-08	1.18E-07	5.41E-07	7.14E-07	1.10E-09	2.34E-09	1.08E-08	1.42E-08
241-S-107	9.81E-08	1.05E-07	7.03E-07	9.05E-07	1.62E-09	1.73E-09	1.16E-08	1.50E-08
S-107 liquid	7.70E-08	2.04E-07	3.24E-07	6.06E-07	1.04E-09	3.40E-09	5.41E-09	9.86E-09
S-107 solid	9.70E-08	1.02E-07	7.15E-07	9.13E-07	1.62E-09	1.69E-09	1.19E-08	1.52E-08
241-S-108	4.36E-09	9.18E-09	5.47E-07	5.60E-07	8.33E-11	1.75E-10	1.04E-08	1.07E-08
S-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-108 solid	4.36E-09	9.18E-09	5.47E-07	5.60E-07	8.33E-11	1.75E-10	1.04E-08	1.07E-08
241-S-109	3.95E-08	5.16E-08	6.45E-07	7.36E-07	5.98E-10	7.82E-10	9.76E-09	1.11E-08
S-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-109 solid	3.95E-08	5.16E-08	6.45E-07	7.36E-07	5.98E-10	7.82E-10	9.76E-09	1.11E-08
241-S-110	1.10E-07	3.24E-07	5.79E-07	1.01E-06	2.16E-09	6.36E-09	1.14E-08	1.99E-08
S-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-110 solid	1.10E-07	3.24E-07	5.79E-07	1.01E-06	2.16E-09	6.36E-09	1.14E-08	1.99E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-S-111	8.79E-08	3.01E-08	5.15E-07	6.33E-07	1.61E-09	5.52E-10	9.44E-09	1.16E-08
S-111 liquid	5.76E-08	4.70E-08	2.73E-07	3.78E-07	9.26E-10	8.88E-10	5.16E-09	6.98E-09
S-111 solid	8.69E-08	2.64E-08	5.68E-07	6.81E-07	1.64E-09	4.99E-10	1.07E-08	1.29E-08
241-S-112	1.34E-07	1.70E-07	5.09E-07	8.13E-07	2.52E-09	3.21E-09	9.60E-09	1.53E-08
S-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-112 solid	1.34E-07	1.70E-07	5.09E-07	8.13E-07	2.52E-09	3.21E-09	9.60E-09	1.53E-08
241-SX-101	5.42E-08	1.29E-07	4.75E-07	6.58E-07	1.19E-09	2.84E-09	1.05E-08	1.45E-08
SX-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-101 solid	5.42E-08	1.29E-07	4.75E-07	6.58E-07	1.19E-09	2.84E-09	1.05E-08	1.45E-08
241-SX-102	1.69E-07	9.41E-07	5.05E-07	1.62E-06	3.25E-09	1.80E-08	9.69E-09	3.10E-08
SX-102 liquid	2.00E-07	1.08E-06	2.62E-07	1.54E-06	3.36E-09	2.16E-08	5.24E-09	3.02E-08
SX-102 solid	1.60E-07	8.93E-07	5.77E-07	1.63E-06	3.20E-09	1.79E-08	1.16E-08	3.27E-08
241-SX-103	3.67E-07	2.36E-06	4.23E-07	3.15E-06	7.54E-09	4.85E-08	8.69E-09	6.47E-08
SX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-103 solid	3.67E-07	2.36E-06	4.23E-07	3.15E-06	7.54E-09	4.85E-08	8.69E-09	6.47E-08
241-SX-104	4.44E-07	1.62E-06	5.34E-07	2.60E-06	8.50E-09	3.10E-08	1.02E-08	4.98E-08
SX-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-104 solid	4.44E-07	1.62E-06	5.34E-07	2.60E-06	8.50E-09	3.10E-08	1.02E-08	4.98E-08
241-SX-105	3.57E-07	4.19E-06	4.56E-07	5.00E-06	6.79E-09	7.97E-08	8.67E-09	9.51E-08
SX-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-105 solid	3.57E-07	4.19E-06	4.56E-07	5.00E-06	6.79E-09	7.97E-08	8.67E-09	9.51E-08
241-SX-106	1.16E-07	3.11E-07	5.98E-07	1.03E-06	2.11E-09	5.63E-09	1.08E-08	1.86E-08
SX-106 liquid	1.82E-07	3.42E-07	2.67E-07	7.91E-07	2.98E-09	6.37E-09	4.98E-09	1.43E-08
SX-106 solid	1.00E-07	3.02E-07	6.88E-07	1.09E-06	1.87E-09	5.63E-09	1.28E-08	2.03E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-SX-107	3.02E-06	1.78E-06	1.81E-06	6.61E-06	5.10E-08	3.01E-08	3.06E-08	1.12E-07
SX-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-107 solid	3.02E-06	1.78E-06	1.81E-06	6.61E-06	5.10E-08	3.01E-08	3.06E-08	1.12E-07
241-SX-108	1.66E-07	1.39E-07	2.11E-06	2.42E-06	2.81E-09	2.35E-09	3.57E-08	4.09E-08
SX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-108 solid	1.66E-07	1.39E-07	2.11E-06	2.42E-06	2.81E-09	2.35E-09	3.57E-08	4.09E-08
241-SX-109	7.63E-07	1.77E-06	8.07E-07	3.34E-06	1.45E-08	3.35E-08	1.53E-08	6.32E-08
SX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-109 solid	7.63E-07	1.77E-06	8.07E-07	3.34E-06	1.45E-08	3.35E-08	1.53E-08	6.32E-08
241-SX-110	4.34E-07	1.36E-06	2.36E-06	4.15E-06	8.90E-09	2.78E-08	4.83E-08	8.50E-08
SX-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-110 solid	4.34E-07	1.36E-06	2.36E-06	4.15E-06	8.90E-09	2.78E-08	4.83E-08	8.50E-08
241-SX-111	7.95E-07	5.30E-06	1.30E-06	7.40E-06	1.63E-08	1.09E-07	2.67E-08	1.52E-07
SX-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-111 solid	7.95E-07	5.30E-06	1.30E-06	7.40E-06	1.63E-08	1.09E-07	2.67E-08	1.52E-07
241-SX-112	3.51E-07	8.15E-07	1.45E-06	2.61E-06	7.18E-09	1.67E-08	2.96E-08	5.35E-08
SX-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-112 solid	3.51E-07	8.15E-07	1.45E-06	2.61E-06	7.18E-09	1.67E-08	2.96E-08	5.35E-08
241-SX-113	1.24E-07	2.92E-08	4.50E-06	4.66E-06	2.55E-09	5.98E-10	9.22E-08	9.54E-08
SX-113 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-113 solid	1.24E-07	2.92E-08	4.50E-06	4.66E-06	2.55E-09	5.98E-10	9.22E-08	9.54E-08
241-SX-114	3.44E-06	2.40E-06	1.42E-06	7.25E-06	4.72E-08	3.29E-08	1.94E-08	9.95E-08
SX-114 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-114 solid	3.44E-06	2.40E-06	1.42E-06	7.25E-06	4.72E-08	3.29E-08	1.94E-08	9.95E-08

Author [illegible] Date 4-24-00 Checked by E. [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-SX-115	1.66E-06	2.68E-08	1.16E-05	1.32E-05	3.32E-08	5.38E-10	2.31E-07	2.65E-07
SX-115 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-115 solid	1.66E-06	2.68E-08	1.16E-05	1.32E-05	3.32E-08	5.38E-10	2.31E-07	2.65E-07
241-T-101	3.08E-07	6.98E-08	1.73E-06	2.10E-06	5.54E-09	1.26E-09	3.11E-08	3.79E-08
T-101 liquid	1.59E-07	1.09E-07	2.71E-07	5.39E-07	2.58E-09	1.97E-09	4.89E-09	9.43E-09
T-101 solid	3.08E-07	6.94E-08	1.74E-06	2.12E-06	5.56E-09	1.25E-09	3.14E-08	3.82E-08
241-T-102	4.50E-08	1.99E-09	5.07E-06	5.11E-06	7.94E-10	3.52E-11	8.95E-08	9.03E-08
T-102 liquid	1.34E-08	2.80E-09	3.33E-07	3.49E-07	1.77E-10	5.79E-11	6.90E-09	7.13E-09
T-102 solid	4.97E-08	1.64E-09	7.13E-06	7.18E-06	1.03E-09	3.40E-11	1.48E-07	1.49E-07
241-T-103	5.54E-07	9.24E-09	6.42E-06	6.98E-06	9.08E-09	1.52E-10	1.05E-07	1.14E-07
T-103 liquid	4.02E-08	1.40E-08	3.24E-07	3.79E-07	5.44E-10	2.36E-10	5.48E-09	6.26E-09
T-103 solid	5.83E-07	8.59E-09	7.27E-06	7.86E-06	9.84E-09	1.45E-10	1.23E-07	1.33E-07
241-T-104	1.15E-09	1.26E-08	8.66E-07	8.80E-07	1.70E-11	1.85E-10	1.27E-08	1.29E-08
T-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-104 solid	1.15E-09	1.26E-08	8.66E-07	8.80E-07	1.70E-11	1.85E-10	1.27E-08	1.29E-08
241-T-105	9.31E-08	3.63E-09	1.92E-06	2.01E-06	1.56E-09	6.10E-11	3.22E-08	3.38E-08
T-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-105 solid	9.31E-08	3.63E-09	1.92E-06	2.01E-06	1.56E-09	6.10E-11	3.22E-08	3.38E-08
241-T-106	5.53E-09	4.13E-09	7.91E-06	7.92E-06	9.37E-11	7.00E-11	1.34E-07	1.34E-07
T-106 liquid	4.04E-08	1.45E-08	3.24E-07	3.79E-07	5.48E-10	2.51E-10	5.61E-09	6.41E-09
T-106 solid	4.00E-09	3.28E-09	8.54E-06	8.54E-06	6.91E-11	5.67E-11	1.48E-07	1.48E-07
241-T-107	2.64E-08	8.40E-09	1.15E-06	1.19E-06	4.61E-10	1.47E-10	2.01E-08	2.07E-08
T-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-107 solid	2.64E-08	8.40E-09	1.15E-06	1.19E-06	4.61E-10	1.47E-10	2.01E-08	2.07E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-T-108	2.71E-07	5.23E-08	3.63E-06	3.95E-06	4.95E-09	9.55E-10	6.63E-08	7.22E-08
T-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-108 solid	2.71E-07	5.23E-08	3.63E-06	3.95E-06	4.95E-09	9.55E-10	6.63E-08	7.22E-08
241-T-109	8.68E-08	5.81E-08	2.86E-06	3.01E-06	1.56E-09	1.04E-09	5.13E-08	5.39E-08
T-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-109 solid	8.68E-08	5.81E-08	2.86E-06	3.01E-06	1.56E-09	1.04E-09	5.13E-08	5.39E-08
241-T-110	2.74E-08	1.33E-08	7.84E-07	8.24E-07	4.00E-10	1.94E-10	1.14E-08	1.20E-08
T-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-110 solid	2.74E-08	1.33E-08	7.84E-07	8.24E-07	4.00E-10	1.94E-10	1.14E-08	1.20E-08
241-T-111	1.94E-09	1.25E-08	7.09E-07	7.23E-07	2.87E-11	1.85E-10	1.05E-08	1.07E-08
T-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-111 solid	1.94E-09	1.25E-08	7.09E-07	7.23E-07	2.87E-11	1.85E-10	1.05E-08	1.07E-08
241-T-112	1.12E-08	1.28E-09	3.08E-06	3.10E-06	1.63E-10	1.86E-11	4.50E-08	4.52E-08
T-112 liquid	4.17E-08	1.40E-09	3.45E-07	3.88E-07	5.31E-10	2.08E-11	5.11E-09	5.66E-09
T-112 solid	8.42E-09	1.26E-09	3.36E-06	3.37E-06	1.25E-10	1.87E-11	4.98E-08	4.99E-08
241-T-201	1.06E-09	1.16E-08	1.58E-06	1.59E-06	1.55E-11	1.71E-10	2.31E-08	2.33E-08
T-201 liquid	4.08E-08	1.52E-08	1.22E-06	1.27E-06	5.52E-10	2.24E-10	1.79E-08	1.86E-08
T-201 solid	6.44E-11	1.15E-08	1.59E-06	1.60E-06	9.47E-13	1.69E-10	2.34E-08	2.35E-08
241-T-202	1.10E-11	1.46E-08	1.79E-06	1.80E-06	1.58E-13	2.09E-10	2.57E-08	2.59E-08
T-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-202 solid	1.10E-11	1.46E-08	1.79E-06	1.80E-06	1.58E-13	2.09E-10	2.57E-08	2.59E-08
241-T-203	6.78E-12	1.43E-08	1.55E-06	1.56E-06	9.65E-14	2.03E-10	2.20E-08	2.22E-08
T-203 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-203 solid	6.78E-12	1.43E-08	1.55E-06	1.56E-06	9.65E-14	2.03E-10	2.20E-08	2.22E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-T-204	5.10E-12	1.73E-08	1.54E-06	1.56E-06	7.14E-14	2.42E-10	2.16E-08	2.18E-08
T-204 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-204 solid	5.10E-12	1.73E-08	1.54E-06	1.56E-06	7.14E-14	2.42E-10	2.16E-08	2.18E-08
241-TX-101	6.12E-07	2.69E-08	1.77E-06	2.41E-06	1.23E-08	5.41E-10	3.57E-08	4.86E-08
TX-101 liquid	5.06E-08	4.50E-08	3.24E-07	4.20E-07	6.85E-10	9.19E-10	6.62E-09	8.22E-09
TX-101 solid	6.16E-07	2.64E-08	1.81E-06	2.45E-06	1.26E-08	5.39E-10	3.68E-08	4.99E-08
241-TX-102	2.66E-08	5.39E-08	8.61E-07	9.41E-07	5.24E-10	1.06E-09	1.69E-08	1.85E-08
TX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-102 solid	2.66E-08	5.39E-08	8.61E-07	9.41E-07	5.24E-10	1.06E-09	1.69E-08	1.85E-08
241-TX-103	3.71E-08	3.84E-08	1.10E-06	1.18E-06	7.31E-10	7.56E-10	2.17E-08	2.32E-08
TX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-103 solid	3.71E-08	3.84E-08	1.10E-06	1.18E-06	7.31E-10	7.56E-10	2.17E-08	2.32E-08
241-TX-104	1.80E-07	5.17E-09	2.32E-06	2.51E-06	3.59E-09	1.03E-10	4.63E-08	5.00E-08
TX-104 liquid	7.45E-08	5.84E-09	2.62E-07	3.42E-07	1.25E-09	1.18E-10	5.28E-09	6.65E-09
TX-104 solid	1.86E-07	5.13E-09	2.47E-06	2.66E-06	3.76E-09	1.03E-10	4.98E-08	5.36E-08
241-TX-105	1.20E-08	4.39E-08	4.51E-07	5.06E-07	2.35E-10	8.65E-10	8.86E-09	9.96E-09
TX-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-105 solid	1.20E-08	4.39E-08	4.51E-07	5.06E-07	2.35E-10	8.65E-10	8.86E-09	9.96E-09
241-TX-106	3.39E-08	6.32E-08	6.29E-07	7.26E-07	6.67E-10	1.24E-09	1.24E-08	1.43E-08
TX-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-106 solid	3.39E-08	6.32E-08	6.29E-07	7.26E-07	6.67E-10	1.24E-09	1.24E-08	1.43E-08
241-TX-107	1.69E-07	5.32E-08	4.05E-06	4.27E-06	3.33E-09	1.05E-09	8.08E-08	8.44E-08
TX-107 liquid	1.78E-07	1.19E-07	2.73E-07	5.70E-07	2.86E-09	2.36E-09	5.42E-09	1.06E-08
TX-107 solid	1.66E-07	5.17E-08	4.14E-06	4.36E-06	3.29E-09	1.03E-09	8.22E-08	8.65E-08

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-TX-108	1.97E-08	1.22E-08	1.26E-06	1.29E-06	3.86E-10	2.39E-10	2.47E-08	2.53E-08
TX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-108 solid	1.97E-08	1.22E-08	1.26E-06	1.29E-06	3.86E-10	2.39E-10	2.47E-08	2.53E-08
241-TX-109	1.93E-08	4.27E-08	7.09E-07	7.71E-07	3.13E-10	6.91E-10	1.15E-08	1.25E-08
TX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-109 solid	1.93E-08	4.27E-08	7.09E-07	7.71E-07	3.13E-10	6.91E-10	1.15E-08	1.25E-08
241-TX-110	2.23E-08	2.72E-08	5.30E-07	5.80E-07	4.33E-10	5.28E-10	1.03E-08	1.12E-08
TX-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-110 solid	2.23E-08	2.72E-08	5.30E-07	5.80E-07	4.33E-10	5.28E-10	1.03E-08	1.12E-08
241-TX-111	2.60E-08	2.06E-08	6.10E-07	6.56E-07	5.02E-10	3.97E-10	1.18E-08	1.27E-08
TX-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-111 solid	2.60E-08	2.06E-08	6.10E-07	6.56E-07	5.02E-10	3.97E-10	1.18E-08	1.27E-08
241-TX-112	1.41E-08	1.88E-08	4.36E-07	4.69E-07	2.78E-10	3.70E-10	8.59E-09	9.24E-09
TX-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-112 solid	1.41E-08	1.88E-08	4.36E-07	4.69E-07	2.78E-10	3.70E-10	8.59E-09	9.24E-09
241-TX-113	4.22E-08	1.72E-08	4.77E-07	5.36E-07	7.85E-10	3.20E-10	8.88E-09	9.98E-09
TX-113 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-113 solid	4.22E-08	1.72E-08	4.77E-07	5.36E-07	7.85E-10	3.20E-10	8.88E-09	9.98E-09
241-TX-114	9.35E-09	1.20E-08	4.81E-07	5.03E-07	1.84E-10	2.37E-10	9.48E-09	9.90E-09
TX-114 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-114 solid	9.35E-09	1.20E-08	4.81E-07	5.03E-07	1.84E-10	2.37E-10	9.48E-09	9.90E-09
241-TX-115	1.05E-08	1.01E-08	4.67E-07	4.87E-07	2.06E-10	1.98E-10	9.19E-09	9.59E-09
TX-115 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-115 solid	1.05E-08	1.01E-08	4.67E-07	4.87E-07	2.06E-10	1.98E-10	9.19E-09	9.59E-09

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-TX-116	2.21E-08	1.59E-08	4.45E-07	4.83E-07	4.33E-10	3.11E-10	8.71E-09	9.45E-09
TX-116 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-116 solid	2.21E-08	1.59E-08	4.45E-07	4.83E-07	4.33E-10	3.11E-10	8.71E-09	9.45E-09
241-TX-117	8.39E-09	8.10E-09	4.42E-07	4.58E-07	1.66E-10	1.60E-10	8.74E-09	9.07E-09
TX-117 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-117 solid	8.39E-09	8.10E-09	4.42E-07	4.58E-07	1.66E-10	1.60E-10	8.74E-09	9.07E-09
241-TX-118	6.95E-08	4.10E-08	6.83E-07	7.94E-07	1.37E-09	8.07E-10	1.35E-08	1.56E-08
TX-118 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-118 solid	6.95E-08	4.10E-08	6.83E-07	7.94E-07	1.37E-09	8.07E-10	1.35E-08	1.56E-08
241-TY-101	7.26E-09	1.34E-08	1.44E-06	1.46E-06	1.38E-10	2.56E-10	2.75E-08	2.79E-08
TY-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-101 solid	7.26E-09	1.34E-08	1.44E-06	1.46E-06	1.38E-10	2.56E-10	2.75E-08	2.79E-08
241-TY-102	6.55E-08	4.27E-08	2.36E-06	2.47E-06	1.30E-09	8.51E-10	4.69E-08	4.91E-08
TY-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-102 solid	6.55E-08	4.27E-08	2.36E-06	2.47E-06	1.30E-09	8.51E-10	4.69E-08	4.91E-08
241-TY-103	2.04E-08	6.94E-09	1.08E-06	1.10E-06	4.02E-10	1.37E-10	2.12E-08	2.17E-08
TY-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-103 solid	2.04E-08	6.94E-09	1.08E-06	1.10E-06	4.02E-10	1.37E-10	2.12E-08	2.17E-08
241-TY-104	6.54E-07	1.15E-08	3.81E-06	4.48E-06	1.09E-08	1.92E-10	6.36E-08	7.47E-08
TY-104 liquid	4.12E-08	1.63E-08	3.24E-07	3.82E-07	5.58E-10	2.75E-10	5.45E-09	6.32E-09
TY-104 solid	6.73E-07	1.13E-08	4.01E-06	4.69E-06	1.14E-08	1.90E-10	6.77E-08	7.93E-08
241-TY-105	4.69E-08	1.84E-08	9.14E-07	9.79E-07	8.30E-10	3.26E-10	1.62E-08	1.73E-08
TY-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-105 solid	4.69E-08	1.84E-08	9.14E-07	9.79E-07	8.30E-10	3.26E-10	1.62E-08	1.73E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-TY-106	2.59E-08	6.63E-09	8.45E-06	8.49E-06	4.10E-10	1.05E-10	1.34E-07	1.35E-07
TY-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-106 solid	2.59E-08	6.63E-09	8.45E-06	8.49E-06	4.10E-10	1.05E-10	1.34E-07	1.35E-07
241-U-101	4.17E-07	9.65E-09	6.87E-06	7.30E-06	6.88E-09	1.59E-10	1.13E-07	1.20E-07
U-101 liquid	4.33E-08	2.14E-08	3.24E-07	3.89E-07	5.86E-10	3.62E-10	5.48E-09	6.43E-09
U-101 solid	3.99E-07	8.37E-09	7.58E-06	7.99E-06	6.75E-09	1.41E-10	1.28E-07	1.35E-07
241-U-102	2.21E-07	3.08E-07	6.01E-07	1.13E-06	4.29E-09	5.98E-09	1.17E-08	2.19E-08
U-102 liquid	3.07E-07	4.07E-07	2.75E-07	9.89E-07	4.90E-09	7.97E-09	5.38E-09	1.83E-08
U-102 solid	2.18E-07	3.04E-07	6.14E-07	1.14E-06	4.26E-09	5.96E-09	1.20E-08	2.22E-08
241-U-103	1.89E-07	3.50E-07	5.32E-07	1.07E-06	3.62E-09	6.72E-09	1.02E-08	2.06E-08
U-103 liquid	3.92E-07	4.40E-07	2.69E-07	1.10E-06	6.40E-09	8.47E-09	5.19E-09	2.01E-08
U-103 solid	1.85E-07	3.48E-07	5.39E-07	1.07E-06	3.56E-09	6.70E-09	1.04E-08	2.06E-08
241-U-104	6.57E-07	2.10E-07	1.40E-06	2.27E-06	1.25E-08	4.00E-09	2.67E-08	4.32E-08
U-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-104 solid	6.57E-07	2.10E-07	1.40E-06	2.27E-06	1.25E-08	4.00E-09	2.67E-08	4.32E-08
241-U-105	2.01E-07	3.28E-07	5.80E-07	1.11E-06	3.78E-09	6.18E-09	1.09E-08	2.09E-08
U-105 liquid	8.05E-07	6.50E-07	2.60E-07	1.72E-06	1.36E-08	1.24E-08	4.94E-09	3.09E-08
U-105 solid	1.68E-07	3.01E-07	6.07E-07	1.08E-06	3.19E-09	5.71E-09	1.15E-08	2.04E-08
241-U-106	6.43E-07	6.91E-07	8.87E-07	2.22E-06	1.19E-08	1.28E-08	1.64E-08	4.12E-08
U-106 liquid	8.42E-07	8.27E-07	2.81E-07	1.95E-06	1.32E-08	1.55E-08	5.27E-09	3.39E-08
U-106 solid	6.32E-07	6.83E-07	9.23E-07	2.24E-06	1.18E-08	1.28E-08	1.73E-08	4.20E-08
241-U-107	2.25E-08	4.54E-08	5.71E-07	6.39E-07	4.36E-10	8.79E-10	1.11E-08	1.24E-08
U-107 liquid	1.08E-07	7.85E-08	2.69E-07	4.56E-07	1.76E-09	1.54E-09	5.29E-09	8.59E-09
U-107 solid	1.86E-08	4.29E-08	5.93E-07	6.55E-07	3.65E-10	8.43E-10	1.17E-08	1.29E-08

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-U-108	1.42E-07	1.84E-07	5.14E-07	8.41E-07	2.82E-09	3.66E-09	1.02E-08	1.67E-08
U-108 liquid	2.10E-07	2.54E-07	2.73E-07	7.37E-07	3.38E-09	5.09E-09	5.48E-09	1.40E-08
U-108 solid	1.39E-07	1.81E-07	5.25E-07	8.45E-07	2.79E-09	3.63E-09	1.05E-08	1.70E-08
241-U-109	4.37E-08	8.71E-08	5.32E-07	6.63E-07	8.41E-10	1.68E-09	1.02E-08	1.28E-08
U-109 liquid	1.55E-07	1.63E-07	2.58E-07	5.76E-07	2.64E-09	3.16E-09	5.00E-09	1.08E-08
U-109 solid	4.08E-08	8.43E-08	5.42E-07	6.67E-07	7.91E-10	1.63E-09	1.05E-08	1.29E-08
241-U-110	5.26E-07	1.84E-08	1.13E-06	1.67E-06	8.89E-09	3.10E-10	1.90E-08	2.82E-08
U-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-110 solid	5.26E-07	1.84E-08	1.13E-06	1.67E-06	8.89E-09	3.10E-10	1.90E-08	2.82E-08
241-U-111	1.43E-07	1.31E-07	6.70E-07	9.44E-07	2.70E-09	2.48E-09	1.27E-08	1.78E-08
U-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-111 solid	1.43E-07	1.31E-07	6.70E-07	9.44E-07	2.70E-09	2.48E-09	1.27E-08	1.78E-08
241-U-112	4.73E-08	7.36E-09	3.18E-06	3.24E-06	8.90E-10	1.39E-10	6.00E-08	6.10E-08
U-112 liquid	4.25E-08	1.92E-08	3.24E-07	3.86E-07	5.75E-10	3.71E-10	6.26E-09	7.21E-09
U-112 solid	4.43E-08	6.62E-09	3.36E-06	3.41E-06	8.54E-10	1.28E-10	6.49E-08	6.59E-08
241-U-201	4.46E-08	7.59E-09	3.12E-06	3.17E-06	7.88E-10	1.34E-10	5.52E-08	5.61E-08
U-201 liquid	4.10E-08	1.58E-08	1.22E-06	1.27E-06	5.56E-10	2.97E-10	2.27E-08	2.36E-08
U-201 solid	3.94E-08	6.10E-09	3.47E-06	3.51E-06	7.38E-10	1.14E-10	6.49E-08	6.57E-08
241-U-202	4.61E-08	7.90E-09	3.12E-06	3.18E-06	8.15E-10	1.40E-10	5.52E-08	5.61E-08
U-202 liquid	4.11E-08	1.60E-08	1.22E-06	1.27E-06	5.57E-10	2.99E-10	2.27E-08	2.36E-08
U-202 solid	4.14E-08	6.44E-09	3.47E-06	3.51E-06	7.75E-10	1.21E-10	6.49E-08	6.58E-08
241-U-203	5.86E-08	1.02E-08	4.77E-06	4.84E-06	9.96E-10	1.74E-10	8.10E-08	8.22E-08
U-203 liquid	4.06E-08	1.49E-08	1.22E-06	1.27E-06	5.50E-10	2.78E-10	2.27E-08	2.36E-08
U-203 solid	5.83E-08	8.55E-09	6.05E-06	6.12E-06	1.09E-09	1.60E-10	1.13E-07	1.15E-07

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Table A-3 Calculated Hydrogen Generation Rates as Mole Per Unit Waste Weight and Volume In Tank Waste Layer for 177 Tanks (23 Sheets)

Tank Name	RC_{rad} (mole/kg-d) HGR form Radiolysis	RC_{therm} (mole/kg-d) HGR from Thermolysis	RC_{corr} (mole/kg-d) HGR from Corrosion	RC_{tot} (mole/kg-d) Total HGR From Model	RC_{rad} (mole/m^3-s) HGR form Radiolysis	RC_{therm} (mole/m^3-s) HGR from Thermolysis	RC_{corr} (mole/m^3-s) HGR from Corrosion	RC_{tot} (mole/m^3-s) Total HGR From Model
241-U-204	6.77E-09	7.60E-09	5.54E-06	5.55E-06	9.90E-11	1.11E-10	8.10E-08	8.12E-08
U-204 liquid	4.05E-08	1.47E-08	1.22E-06	1.27E-06	5.49E-10	2.23E-10	1.84E-08	1.92E-08
U-204 solid	2.51E-10	4.44E-09	7.47E-06	7.48E-06	3.80E-12	6.73E-11	1.13E-07	1.13E-07

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-AN-101	7.86E-05	5.07E-06	3.26E-04	19.2%	1.2%	79.6%	4.09E-04	17
AN-101 liquid	7.03E-06	4.02E-06	5.31E-05	11.0%	6.3%	82.8%	6.41E-05	3
AN-101 solid	7.16E-05	1.05E-06	2.73E-04	20.7%	0.3%	79.0%	3.45E-04	14
241-AN-102	4.05E-03	5.33E-03	7.29E-04	40.0%	52.7%	7.2%	1.01E-02	414
AN-102 liquid	3.62E-03	4.93E-03	4.22E-04	40.4%	54.9%	4.7%	8.97E-03	368
AN-102 solid	4.29E-04	4.04E-04	3.08E-04	37.6%	35.4%	27.0%	1.14E-03	47
241-AN-103	1.04E-03	1.45E-03	6.82E-04	32.7%	45.8%	21.5%	3.17E-03	130
AN-103 liquid	8.27E-04	9.25E-04	2.37E-04	41.6%	46.5%	11.9%	1.99E-03	82
AN-103 solid	2.10E-04	5.26E-04	4.45E-04	17.8%	44.5%	37.7%	1.18E-03	48
241-AN-104	1.23E-03	1.70E-03	7.26E-04	33.7%	46.4%	19.9%	3.66E-03	150
AN-104 liquid	7.64E-04	9.66E-04	2.62E-04	38.4%	48.5%	13.2%	1.99E-03	82
AN-104 solid	4.70E-04	7.34E-04	4.64E-04	28.2%	44.0%	27.8%	1.67E-03	68
241-AN-105	1.25E-03	2.82E-03	7.54E-04	25.8%	58.5%	15.6%	4.82E-03	198
AN-105 liquid	6.76E-04	1.61E-03	2.75E-04	26.4%	62.9%	10.7%	2.56E-03	105
AN-105 solid	5.70E-04	1.21E-03	4.79E-04	25.2%	53.6%	21.2%	2.26E-03	93
241-AN-106	5.99E-06	3.43E-06	2.75E-04	2.1%	1.2%	96.7%	2.84E-04	12
AN-106 liquid	1.89E-06	2.07E-06	9.19E-06	14.4%	15.7%	69.9%	1.31E-05	1
AN-106 solid	4.10E-06	1.36E-06	2.66E-04	1.5%	0.5%	98.0%	2.71E-04	11
241-AN-107	6.96E-03	1.39E-03	7.15E-04	76.8%	15.4%	7.9%	9.07E-03	372
AN-107 liquid	5.16E-03	1.09E-03	3.43E-04	78.3%	16.5%	5.2%	6.59E-03	270
AN-107 solid	1.80E-03	3.07E-04	3.73E-04	72.6%	12.4%	15.0%	2.48E-03	102
241-AP-101	1.89E-04	1.44E-04	7.28E-04	17.8%	13.6%	68.6%	1.06E-03	43
AP-101 liquid	1.89E-04	1.44E-04	7.28E-04	17.8%	13.6%	68.6%	1.06E-03	43
AP-101 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-AP-102	2.54E-04	1.74E-04	7.20E-04	22.1%	15.2%	62.7%	1.15E-03	47
AP-102 liquid	2.54E-04	1.74E-04	7.20E-04	22.1%	15.2%	62.7%	1.15E-03	47
AP-102 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AP-103	7.51E-05	2.68E-05	3.75E-04	15.8%	5.6%	78.6%	4.77E-04	20
AP-103 liquid	7.51E-05	2.68E-05	3.75E-04	15.8%	5.6%	78.6%	4.77E-04	20
AP-103 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AP-104	1.23E-06	8.32E-09	2.67E-04	0.5%	0.0%	99.5%	2.68E-04	11
AP-104 liquid	1.23E-06	8.32E-09	2.67E-04	0.5%	0.0%	99.5%	2.68E-04	11
AP-104 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AP-105	1.08E-04	9.11E-05	5.81E-04	13.8%	11.7%	74.5%	7.80E-04	32
AP-105 liquid	7.85E-05	8.19E-05	2.84E-04	17.7%	18.4%	63.9%	4.44E-04	18
AP-105 solid	2.93E-05	9.26E-06	2.98E-04	8.7%	2.8%	88.5%	3.36E-04	14
241-AP-106	4.25E-06	2.15E-06	2.97E-04	1.4%	0.7%	97.9%	3.04E-04	12
AP-106 liquid	4.25E-06	2.15E-06	2.97E-04	1.4%	0.7%	97.9%	3.04E-04	12
AP-106 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AP-107	4.18E-05	1.12E-05	6.59E-04	5.9%	1.6%	92.6%	7.12E-04	29
AP-107 liquid	4.18E-05	1.12E-05	6.59E-04	5.9%	1.6%	92.6%	7.12E-04	29
AP-107 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AP-108	2.16E-05	9.77E-06	4.11E-04	4.9%	2.2%	92.9%	4.43E-04	18
AP-108 liquid	2.16E-05	9.77E-06	4.11E-04	4.9%	2.2%	92.9%	4.43E-04	18
AP-108 solid	not exit	not exist	not exist	not exist	not exist	not exist	not exist	not exist
241-AW-101	1.16E-03	2.02E-03	7.50E-04	29.5%	51.4%	19.1%	3.93E-03	161
AW-101 liquid	8.59E-04	1.46E-03	3.52E-04	32.1%	54.7%	13.2%	2.67E-03	109
AW-101 solid	3.02E-04	5.62E-04	3.98E-04	23.9%	44.6%	31.5%	1.26E-03	52

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-AW-102	2.35E-05	1.59E-06	2.93E-04	7.4%	0.5%	92.1%	3.18E-04	13
AW-102 liquid	2.03E-06	9.99E-07	1.68E-05	10.2%	5.0%	84.7%	1.98E-05	1
AW-102 solid	2.14E-05	5.87E-07	2.77E-04	7.2%	0.2%	92.6%	2.99E-04	12
241-AW-103	1.92E-04	1.94E-06	4.71E-04	28.8%	0.3%	70.9%	6.65E-04	27
AW-103 liquid	*2.80E-05*	7.45E-07	*6.75E-05*	29.1%	0.8%	70.1%	9.63E-05	4
AW-103 solid	1.64E-04	1.19E-06	4.03E-04	28.8%	0.2%	71.0%	5.68E-04	23
241-AW-104	1.62E-04	2.38E-04	7.30E-04	14.4%	21.0%	64.6%	1.13E-03	46
AW-104 liquid	1.62E-04	1.98E-04	3.73E-04	22.1%	27.0%	50.8%	7.33E-04	30
AW-104 solid	1.12E-07	3.95E-05	3.57E-04	0.0%	10.0%	90.0%	3.97E-04	16
241-AW-105	2.63E-05	3.04E-06	4.35E-04	5.7%	0.7%	93.7%	4.65E-04	19
AW-105 liquid	2.81E-07	1.12E-06	6.18E-05	0.4%	1.8%	97.8%	6.33E-05	3
AW-105 solid	2.60E-05	1.92E-06	3.73E-04	6.5%	0.5%	93.0%	4.01E-04	16
241-AW-106	2.31E-04	2.77E-04	4.70E-04	23.6%	28.4%	48.1%	9.78E-04	40
AW-106 liquid	1.16E-04	1.41E-04	1.05E-04	32.0%	38.9%	29.1%	3.62E-04	15
AW-106 solid	1.15E-04	1.37E-04	3.64E-04	18.7%	22.2%	59.2%	6.16E-04	25
241-AY-101	1.62E-03	1.658E-05	3.34E-04	82.3%	0.8%	16.9%	1.97E-03	81
AY-101 liquid	1.33E-05	3.80E-06	1.98E-05	35.9%	10.3%	53.8%	3.69E-05	2
AY-101 solid	1.61E-03	1.28E-05	3.14E-04	83.1%	0.7%	16.2%	1.94E-03	79
241-AY-102	1.34E-02	1.117E-04	5.32E-04	95.4%	0.8%	3.8%	1.40E-02	575
AY-102 liquid	1.08E-04	4.44E-05	1.76E-04	32.9%	13.5%	53.5%	3.29E-04	13
AY-102 solid	1.33E-02	6.73E-05	3.56E-04	96.9%	0.5%	2.6%	1.37E-02	562
241-AZ-101	7.04E-03	1.121E-03	6.44E-04	80.0%	12.7%	7.3%	8.80E-03	361
AZ-101 liquid	1.97E-03	1.03E-03	3.51E-04	58.8%	30.7%	10.5%	3.35E-03	137
AZ-101 solid	5.07E-03	8.99E-05	2.93E-04	93.0%	1.6%	5.4%	5.45E-03	223

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-AZ-102	8.72E-03	1.210E-03	6.82E-04	82.2%	11.4%	6.4%	1.06E-02	435
AZ-102 liquid	1.44E-03	7.84E-04	3.64E-04	55.7%	30.2%	14.0%	2.59E-03	106
AZ-102 solid	7.28E-03	4.26E-04	3.18E-04	90.7%	5.3%	4.0%	8.02E-03	329
241-SY-101	3.82E-03	1.76E-02	7.71E-04	17.2%	79.3%	3.5%	2.22E-02	909
SY-101 liquid	1.96E-03	9.56E-03	2.58E-04	16.6%	81.2%	2.2%	1.18E-02	483
SY-101 solid	1.86E-03	8.05E-03	5.14E-04	17.8%	77.2%	4.9%	1.04E-02	427
241-SY-102	6.20E-05	6.440E-05	5.21E-04	9.6%	9.9%	80.5%	6.48E-04	27
SY-102 liquid	5.31E-05	5.75E-05	2.22E-04	16.0%	17.3%	66.7%	3.32E-04	14
SY-102 solid	8.91E-06	6.93E-06	2.99E-04	2.8%	2.2%	95.0%	3.15E-04	13
241-SY-103	7.28E-04	1.82E-03	5.89E-04	23.2%	58.0%	18.8%	3.13E-03	128
SY-103 liquid	5.11E-04	1.07E-03	1.65E-04	29.2%	61.3%	9.4%	1.75E-03	72
SY-103 solid	2.17E-04	7.44E-04	4.24E-04	15.7%	53.7%	30.6%	1.38E-03	57
241-A-101	1.09E-03	1.23E-02	1.40E-03	7.4%	83.1%	9.5%	1.48E-02	605
A-101 liquid	6.74E-04	8.40E-03	1.00E-03	6.7%	83.4%	9.9%	1.01E-02	413
A-101 solid	4.17E-04	3.87E-03	3.95E-04	8.9%	82.6%	8.4%	4.68E-03	192
241-A-102	1.13E-04	5.82E-05	5.79E-04	15.1%	7.8%	77.2%	7.50E-04	31
A-102 liquid	3.69E-06	7.53E-06	3.51E-06	25.0%	51.1%	23.8%	1.47E-05	1
A-102 solid	1.09E-04	5.06E-05	5.75E-04	14.9%	6.9%	78.2%	7.36E-04	30
241-A-103	9.10E-03	6.87E-04	8.62E-04	85.5%	6.5%	8.1%	1.07E-02	436
A-103 liquid	4.49E-06	1.77E-05	4.35E-06	16.9%	66.7%	16.4%	2.66E-05	1
A-103 solid	9.10E-03	6.70E-04	8.58E-04	85.6%	6.3%	8.1%	1.06E-02	435
241-A-104	3.89E-03	4.67E-04	5.72E-04	78.9%	9.5%	11.6%	4.93E-03	202
A-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
A-104 solid	3.89E-03	4.67E-04	5.72E-04	78.9%	9.5%	11.6%	4.93E-03	202

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA
A-105 liquid	NA	NA	NA	NA	NA	NA	NA	NA
A-105 solid	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	4.62E-04	3.13E-04	6.70E-04	32.0%	21.7%	46.4%	1.45E-03	59
A-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
A-106 solid	4.62E-04	3.13E-04	6.70E-04	32.0%	21.7%	46.4%	1.45E-03	59
241-AX-101	5.66E-04	3.41E-03	8.53E-04	11.7%	70.6%	17.7%	4.83E-03	198
AX-101 liquid	3.14E-04	1.90E-03	4.28E-07	14.1%	85.8%	0.0%	2.22E-03	91
AX-101 solid	2.52E-04	1.51E-03	8.53E-04	9.7%	57.7%	32.7%	2.61E-03	107
241-AX-102	1.06E-04	1.19E-05	5.55E-04	15.8%	1.8%	82.4%	6.73E-04	28
AX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-102 solid	1.06E-04	1.19E-05	5.55E-04	15.8%	1.8%	82.4%	6.73E-04	28
241-AX-103	5.82E-04	4.05E-04	6.42E-04	35.7%	24.8%	39.4%	1.63E-03	67
AX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-103 solid	5.82E-04	4.05E-04	6.42E-04	35.7%	24.8%	39.4%	1.63E-03	67
241-AX-104	1.13E-04	3.02E-07	5.48E-04	17.1%	0.0%	82.9%	6.61E-04	27
AX-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
AX-104 solid	1.13E-04	3.02E-07	5.48E-04	17.1%	0.0%	82.9%	6.61E-04	27
241-B-101	6.40E-05	2.55E-04	6.43E-04	6.6%	26.5%	66.9%	9.62E-04	39
B-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-101 solid	6.40E-05	2.55E-04	6.43E-04	6.6%	26.5%	66.9%	9.62E-04	39
241-B-102	2.51E-06	4.63E-06	5.43E-04	0.5%	0.8%	98.7%	5.50E-04	23
B-102 liquid	2.01E-06	1.10E-06	4.54E-09	64.5%	35.4%	0.1%	3.11E-06	0
B-102 solid	5.00E-07	3.53E-06	5.43E-04	0.1%	0.6%	99.3%	5.47E-04	22

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-B-103	1.70E-06	1.66E-05	5.67E-04	0.3%	2.8%	96.9%	5.85E-04	24
B-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-103 solid	1.70E-06	1.66E-05	5.67E-04	0.3%	2.8%	96.9%	5.85E-04	24
241-B-104	9.45E-04	2.23E-05	8.33E-04	52.5%	1.2%	46.3%	1.80E-03	74
B-104 liquid	1.15E-07	6.37E-08	1.36E-09	63.9%	35.3%	0.8%	1.80E-07	0
B-104 solid	9.45E-04	2.22E-05	8.33E-04	52.5%	1.2%	46.3%	1.80E-03	74
241-B-105	7.63E-05	2.27E-05	6.51E-04	10.2%	3.0%	86.8%	7.50E-04	31
B-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-105 solid	7.63E-05	2.27E-05	6.51E-04	10.2%	3.0%	86.8%	7.50E-04	31
241-B-106	3.28E-04	5.92E-06	6.17E-04	34.5%	0.6%	64.9%	9.52E-04	39
B-106 liquid	1.08E-07	4.53E-08	1.35E-09	69.8%	29.3%	0.9%	1.55E-07	0
B-106 solid	3.28E-04	5.87E-06	6.17E-04	34.5%	0.6%	64.9%	9.52E-04	39
241-B-107	2.14E-04	2.84E-05	6.50E-04	24.0%	3.2%	72.9%	8.92E-04	37
B-107 liquid	4.36E-07	2.31E-07	1.12E-09	65.3%	34.5%	0.2%	6.68E-07	0
B-107 solid	2.13E-04	2.82E-05	6.50E-04	23.9%	3.2%	72.9%	8.91E-04	37
241-B-108	3.17E-06	1.11E-05	5.96E-04	0.5%	1.8%	97.7%	6.10E-04	25
B-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-108 solid	3.17E-06	1.11E-05	5.96E-04	0.5%	1.8%	97.7%	6.10E-04	25
241-B-109	2.19E-04	4.18E-05	6.27E-04	24.6%	4.7%	70.6%	8.88E-04	36
B-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-109 solid	2.19E-04	4.18E-05	6.27E-04	24.6%	4.7%	70.6%	8.88E-04	36
241-B-110	2.41E-05	1.24E-05	7.36E-04	3.1%	1.6%	95.3%	7.72E-04	32
B-110 liquid	1.20E-07	7.42E-08	1.37E-09	61.3%	38.0%	0.7%	1.96E-07	0
B-110 solid	2.40E-05	1.24E-05	7.36E-04	3.1%	1.6%	95.3%	7.72E-04	32

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-B-111	6.48E-05	1.15E-05	7.25E-04	8.1%	1.4%	90.5%	8.02E-04	33
B-111 liquid	1.23E-07	8.63E-08	1.36E-09	58.5%	40.9%	0.6%	2.11E-07	0
B-111 solid	6.47E-05	1.14E-05	7.25E-04	8.1%	1.4%	90.5%	8.02E-04	33
241-B-112	4.37E-06	1.50E-07	5.45E-04	0.8%	0.0%	99.2%	5.49E-04	22
B-112 liquid	6.36E-07	2.18E-08	3.73E-09	96.1%	3.3%	0.6%	6.61E-07	0
B-112 solid	3.73E-06	1.28E-07	5.45E-04	0.7%	0.0%	99.3%	5.48E-04	22
241-B-201	1.45E-07	4.79E-07	1.23E-04	0.1%	0.4%	99.5%	1.24E-04	5
B-201 liquid	9.72E-08	2.57E-08	1.87E-08	68.7%	18.2%	13.2%	1.42E-07	0
B-201 solid	4.80E-08	4.53E-07	1.23E-04	0.0%	0.4%	99.6%	1.23E-04	5
241-B-202	1.09E-07	8.97E-07	1.21E-04	0.1%	0.7%	99.2%	1.22E-04	5
B-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
B-202 solid	1.09E-07	8.97E-07	1.21E-04	0.1%	0.7%	99.2%	1.22E-04	5
241-B-203	1.05E-07	9.35E-07	1.90E-04	0.1%	0.5%	99.5%	1.91E-04	8
B-203 liquid	9.41E-08	2.10E-08	1.85E-08	70.4%	15.7%	13.9%	1.34E-07	0
B-203 solid	1.14E-08	9.14E-07	1.90E-04	0.0%	0.5%	99.5%	1.91E-04	8
241-B-204	5.86E-05	7.71E-07	1.88E-04	23.7%	0.3%	76.0%	2.47E-04	10
B-204 liquid	9.03E-08	2.70E-08	2.08E-08	65.4%	19.5%	15.1%	1.38E-07	0
B-204 solid	5.85E-05	7.45E-07	1.88E-04	23.7%	0.3%	76.0%	2.47E-04	10
241-BX-101	6.85E-06	1.64E-06	5.59E-04	1.2%	0.3%	98.5%	5.67E-04	23
BX-101 liquid	1.06E-07	1.08E-07	1.24E-09	49.2%	50.3%	0.6%	2.15E-07	0
BX-101 solid	6.75E-06	1.53E-06	5.59E-04	1.2%	0.3%	98.5%	5.67E-04	23
241-BX-102	4.41E-06	1.87E-06	5.99E-04	0.7%	0.3%	99.0%	6.06E-04	25
BX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-102 solid	4.41E-06	1.87E-06	5.99E-04	0.7%	0.3%	99.0%	6.06E-04	25

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-BX-103	1.37E-05	5.77E-06	5.73E-04	2.3%	1.0%	96.7%	5.93E-04	24
BX-103 liquid	9.22E-07	8.63E-07	1.11E-08	51.3%	48.1%	0.6%	1.80E-06	0
BX-103 solid	1.28E-05	4.91E-06	5.73E-04	2.2%	0.8%	97.0%	5.91E-04	24
241-BX-104	4.00E-05	1.28E-05	6.13E-04	6.0%	1.9%	92.1%	6.66E-04	27
BX-104 liquid	5.08E-07	4.88E-07	3.75E-09	50.8%	48.8%	0.4%	1.00E-06	0
BX-104 solid	3.94E-05	1.24E-05	6.13E-04	5.9%	1.9%	92.2%	6.65E-04	27
241-BX-105	4.64E-06	2.61E-06	5.58E-04	0.8%	0.5%	98.7%	5.66E-04	23
BX-105 liquid	1.03E-06	8.42E-07	6.12E-09	54.7%	44.9%	0.3%	1.87E-06	0
BX-105 solid	3.61E-06	1.76E-06	5.58E-04	0.6%	0.3%	99.0%	5.64E-04	23
241-BX-106	5.26E-06	1.45E-06	5.52E-04	0.9%	0.3%	98.8%	5.58E-04	23
BX-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-106 solid	5.26E-06	1.45E-06	5.52E-04	0.9%	0.3%	98.8%	5.58E-04	23
241-BX-107	7.85E-06	1.58E-05	8.09E-04	0.9%	1.9%	97.2%	8.32E-04	34
BX-107 liquid	1.12E-07	5.40E-08	1.35E-09	66.8%	32.4%	0.8%	1.67E-07	0
BX-107 solid	7.74E-06	1.57E-05	8.09E-04	0.9%	1.9%	97.2%	8.32E-04	34
241-BX-108	1.90E-06	5.80E-07	5.41E-04	0.4%	0.1%	99.5%	5.43E-04	22
BX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-108solid	1.90E-06	5.80E-07	5.41E-04	0.4%	0.1%	99.5%	5.43E-04	22
241-BX-109	4.34E-05	1.20E-05	6.84E-04	5.9%	1.6%	92.5%	7.40E-04	30
BX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BX-109 solid	4.34E-05	1.20E-05	6.84E-04	5.9%	1.6%	92.5%	7.40E-04	30
241-BX-110	3.68E-05	3.00E-05	6.91E-04	4.9%	4.0%	91.2%	7.58E-04	31
BX-110 liquid	4.52E-07	4.45E-07	3.39E-09	50.2%	49.4%	0.4%	9.01E-07	0
BX-110 solid	3.64E-05	2.95E-05	6.91E-04	4.8%	3.9%	91.3%	7.57E-04	31

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-BX-111	2.85E-06	4.35E-06	6.53E-04	0.4%	0.7%	98.9%	6.60E-04	27
BX-111 liquid	4.99E-07	2.73E-07	1.13E-09	64.6%	35.3%	0.1%	7.73E-07	0
BX-111 solid	2.35E-06	4.08E-06	6.53E-04	0.4%	0.6%	99.0%	6.59E-04	27
241-BX-112	7.89E-06	1.09E-06	6.55E-04	1.2%	0.2%	98.6%	6.64E-04	27
BX-112 liquid	1.08E-07	7.13E-09	1.33E-09	92.8%	6.1%	1.1%	1.17E-07	0
BX-112 solid	7.78E-06	1.08E-06	6.55E-04	1.2%	0.2%	98.7%	6.64E-04	27
241-BY-101	6.71E-05	7.10E-05	8.51E-04	6.8%	7.2%	86.0%	9.89E-04	41
BY-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-101 solid	6.71E-05	7.10E-05	8.51E-04	6.8%	7.2%	86.0%	9.89E-04	41
241-BY-102	9.90E-06	9.88E-06	7.62E-04	1.3%	1.3%	97.5%	7.82E-04	32
BY-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-102 solid	9.90E-06	9.88E-06	7.62E-04	1.3%	1.3%	97.5%	7.82E-04	32
241-BY-103	5.11E-05	1.07E-04	8.63E-04	5.0%	10.5%	84.5%	1.02E-03	42
BY-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-103 solid	5.11E-05	1.07E-04	8.63E-04	5.0%	10.5%	84.5%	1.02E-03	42
241-BY-104	5.28E-04	5.10E-04	8.11E-04	28.6%	27.6%	43.8%	1.85E-03	76
BY-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-104 solid	5.28E-04	5.10E-04	8.11E-04	28.6%	27.6%	43.8%	1.85E-03	76
241-BY-105	4.43E-05	1.60E-04	9.61E-04	3.8%	13.7%	82.5%	1.16E-03	48
BY-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-105 solid	4.43E-05	1.60E-04	9.61E-04	3.8%	13.7%	82.5%	1.16E-03	48
241-BY-106	4.35E-04	1.06E-03	1.01E-03	17.3%	42.3%	40.4%	2.51E-03	103
BY-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-106 solid	4.35E-04	1.06E-03	1.01E-03	17.3%	42.3%	40.4%	2.51E-03	103

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-BY-107	5.01E-05	1.18E-04	7.57E-04	5.4%	12.7%	81.8%	9.25E-04	38
BY-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-107 solid	5.01E-05	1.18E-04	7.57E-04	5.4%	12.7%	81.8%	9.25E-04	38
241-BY-108	6.83E-04	3.15E-04	7.32E-04	39.5%	18.2%	42.3%	1.73E-03	71
BY-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-108 solid	6.83E-04	3.15E-04	7.32E-04	39.5%	18.2%	42.3%	1.73E-03	71
241-BY-109	2.95E-05	3.18E-05	7.60E-04	3.6%	3.9%	92.5%	8.21E-04	34
BY-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-109 solid	2.95E-05	3.18E-05	7.60E-04	3.6%	3.9%	92.5%	8.21E-04	34
241-BY-110	1.03E-04	2.93E-04	8.68E-04	8.1%	23.2%	68.7%	1.26E-03	52
BY-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-110 solid	1.03E-04	2.93E-04	8.68E-04	8.1%	23.2%	68.7%	1.26E-03	52
241-BY-111	2.00E-05	3.10E-05	9.13E-04	2.1%	3.2%	94.7%	9.64E-04	40
BY-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-111 solid	2.00E-05	3.10E-05	9.13E-04	2.1%	3.2%	94.7%	9.64E-04	40
241-BY-112	1.96E-05	3.72E-05	7.73E-04	2.4%	4.5%	93.2%	8.30E-04	34
BY-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
BY-112 solid	1.96E-05	3.72E-05	7.73E-04	2.4%	4.5%	93.2%	8.30E-04	34
241-C-101	4.80E-05	1.14E-05	6.18E-04	7.1%	1.7%	91.2%	6.77E-04	28
C-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-101 solid	4.80E-05	1.14E-05	6.18E-04	7.1%	1.7%	91.2%	6.77E-04	28
241-C-102	5.93E-04	2.35E-05	7.99E-04	41.9%	1.7%	56.5%	1.41E-03	58
C-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-102 solid	5.93E-04	2.35E-05	7.99E-04	41.9%	1.7%	56.5%	1.41E-03	58

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-C-103	1.74E-03	3.69E-05	6.60E-04	71.4%	1.5%	27.1%	2.44E-03	100
C-103 liquid	3.92E-05	1.65E-05	1.23E-07	70.2%	29.6%	0.2%	5.58E-05	2
C-103 solid	1.70E-03	2.04E-05	6.60E-04	71.4%	0.9%	27.7%	2.38E-03	98
241-C-104	2.08E-04	1.02E-04	7.97E-04	18.8%	9.2%	72.0%	1.11E-03	45
C-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-104 solid	2.08E-04	1.02E-04	7.97E-04	18.8%	9.2%	72.0%	1.11E-03	45
241-C-105	1.18E-04	2.67E-06	6.57E-04	15.1%	0.3%	84.5%	7.77E-04	32
C-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-105 solid	1.18E-04	2.67E-06	6.57E-04	15.1%	0.3%	84.5%	7.77E-04	32
241-C-106	4.11E-05	3.76E-07	5.16E-04	7.4%	0.1%	92.6%	5.57E-04	23
C-106 liquid	1.02E-05	3.41E-07	5.96E-08	96.2%	3.2%	0.6%	1.06E-05	0
C-106 solid	3.09E-05	3.54E-08	5.15E-04	5.7%	0.0%	94.3%	5.46E-04	22
241-C-107	5.12E-04	1.54E-04	7.96E-04	35.0%	10.5%	54.4%	1.46E-03	60
C-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-107 solid	5.12E-04	1.54E-04	7.96E-04	35.0%	10.5%	54.4%	1.46E-03	60
241-C-108	1.36E-05	4.52E-06	5.84E-04	2.3%	0.8%	97.0%	6.02E-04	25
C-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-108 solid	1.36E-05	4.52E-06	5.84E-04	2.3%	0.8%	97.0%	6.02E-04	25
241-C-109	7.49E-05	4.51E-06	5.82E-04	11.3%	0.7%	88.0%	6.61E-04	27
C-109 liquid	5.20E-07	4.26E-07	5.50E-09	54.7%	44.8%	0.6%	9.51E-07	0
C-109 solid	7.43E-05	4.09E-06	5.82E-04	11.3%	0.6%	88.1%	6.61E-04	27
241-C-110	3.04E-06	7.42E-06	6.71E-04	0.4%	1.1%	98.5%	6.81E-04	28
C-110 liquid	1.13E-07	5.67E-08	1.35E-09	66.0%	33.2%	0.8%	1.71E-07	0
C-110 solid	2.93E-06	7.37E-06	6.71E-04	0.4%	1.1%	98.5%	6.81E-04	28

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-C-111	1.18E-04	1.75E-06	5.75E-04	16.9%	0.3%	82.8%	6.95E-04	28
C-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-111 solid	1.18E-04	1.75E-06	5.75E-04	16.9%	0.3%	82.8%	6.95E-04	28
241-C-112	2.88E-04	1.14E-05	6.21E-04	31.3%	1.2%	67.4%	9.21E-04	38
C-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-112 solid	2.88E-04	1.14E-05	6.21E-04	31.3%	1.2%	67.4%	9.21E-04	38
241-C-201	2.21E-08	4.96E-08	4.29E-05	0.1%	0.1%	99.8%	4.30E-05	2
C-201 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-201 solid	2.21E-08	4.96E-08	4.29E-05	0.1%	0.1%	99.8%	4.30E-05	2
241-C-202	2.98E-07	3.56E-09	3.97E-05	0.7%	0.0%	99.2%	4.00E-05	2
C-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-202 solid	2.98E-07	3.56E-09	3.97E-05	0.7%	0.0%	99.2%	4.00E-05	2
241-C-203	5.95E-06	8.54E-08	5.21E-05	10.2%	0.1%	89.6%	5.82E-05	2
C-203 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-203 solid	5.95E-06	8.54E-08	5.21E-05	10.2%	0.1%	89.6%	5.82E-05	2
241-C-204	3.34E-08	7.70E-08	4.59E-05	0.1%	0.2%	99.8%	4.60E-05	2
C-204 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
C-204 solid	3.34E-08	7.70E-08	4.59E-05	0.1%	0.2%	99.8%	4.60E-05	2
241-S-101	6.22E-04	1.80E-03	9.05E-04	18.7%	54.1%	27.2%	3.32E-03	136
S-101 liquid	1.78E-05	6.54E-05	1.45E-08	21.4%	78.6%	0.0%	8.32E-05	3
S-101 solid	6.04E-04	1.73E-03	9.05E-04	18.6%	53.4%	27.9%	3.24E-03	133
241-S-102	4.45E-04	1.11E-03	9.80E-04	17.6%	43.8%	38.7%	2.53E-03	104
S-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-102 solid	4.45E-04	1.11E-03	9.80E-04	17.6%	43.8%	38.7%	2.53E-03	104

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-S-103	8.87E-05	1.58E-04	7.25E-04	9.1%	16.3%	74.6%	9.72E-04	40
S-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-103 solid	8.87E-05	1.58E-04	7.25E-04	9.1%	16.3%	74.6%	9.72E-04	40
241-S-104	2.11E-04	1.40E-04	7.95E-04	18.4%	12.2%	69.3%	1.15E-03	47
S-104 liquid	2.01E-07	5.05E-07	1.40E-09	28.5%	71.3%	0.2%	7.08E-07	0
S-104 solid	2.11E-04	1.39E-04	7.95E-04	18.4%	12.2%	69.4%	1.15E-03	47
241-S-105	4.18E-05	4.90E-05	9.09E-04	4.2%	4.9%	90.9%	1.00E-03	41
S-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-105 solid	4.18E-05	4.90E-05	9.09E-04	4.2%	4.9%	90.9%	1.00E-03	41
241-S-106	8.97E-05	1.93E-04	8.83E-04	7.7%	16.5%	75.8%	1.17E-03	48
S-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-106 solid	8.97E-05	1.93E-04	8.83E-04	7.7%	16.5%	75.8%	1.17E-03	48
241-S-107	1.18E-04	1.29E-04	8.48E-04	10.8%	11.8%	77.5%	1.09E-03	45
S-107 liquid	2.87E-06	7.60E-06	1.95E-08	27.3%	72.5%	0.2%	1.05E-05	0
S-107 solid	1.15E-04	1.21E-04	8.48E-04	10.6%	11.2%	78.2%	1.08E-03	44
241-S-108	7.23E-06	1.53E-05	9.06E-04	0.8%	1.6%	97.6%	9.29E-04	38
S-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-108 solid	7.23E-06	1.53E-05	9.06E-04	0.8%	1.6%	97.6%	9.29E-04	38
241-S-109	5.83E-05	7.66E-05	9.52E-04	5.4%	7.0%	87.6%	1.09E-03	45
S-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-109 solid	5.83E-05	7.66E-05	9.52E-04	5.4%	7.0%	87.6%	1.09E-03	45
241-S-110	1.65E-04	4.87E-04	8.67E-04	10.8%	32.1%	57.1%	1.52E-03	62
S-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-110 solid	1.65E-04	4.87E-04	8.67E-04	10.8%	32.1%	57.1%	1.52E-03	62

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-S-111	1.57E-04	5.80E-05	8.94E-04	14.1%	5.2%	80.6%	1.11E-03	45
S-111 liquid	1.99E-05	1.63E-05	1.28E-07	54.9%	44.8%	0.4%	3.63E-05	1
S-111 solid	1.37E-04	4.17E-05	8.94E-04	12.8%	3.9%	83.4%	1.07E-03	44
241-S-112	2.54E-04	3.25E-04	9.67E-04	16.4%	21.0%	62.6%	1.55E-03	63
S-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
S-112 solid	2.54E-04	3.25E-04	9.67E-04	16.4%	21.0%	62.6%	1.55E-03	63
241-SX-101	1.09E-04	2.61E-04	9.56E-04	8.2%	19.7%	72.1%	1.33E-03	54
SX-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-101 solid	1.09E-04	2.61E-04	9.56E-04	8.2%	19.7%	72.1%	1.33E-03	54
241-SX-102	3.34E-04	1.86E-03	8.80E-04	10.9%	60.4%	28.7%	3.07E-03	126
SX-102 liquid	9.03E-05	4.86E-04	1.53E-07	15.7%	84.3%	0.0%	5.77E-04	24
SX-102 solid	2.44E-04	1.37E-03	8.80E-04	9.8%	54.9%	35.3%	2.49E-03	102
241-SX-103	9.52E-04	6.15E-03	1.10E-03	11.6%	75.0%	13.4%	8.19E-03	336
SX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-103 solid	9.52E-04	6.15E-03	1.10E-03	11.6%	75.0%	13.4%	8.19E-03	336
241-SX-104	7.84E-04	2.88E-03	9.43E-04	17.0%	62.5%	20.5%	4.60E-03	189
SX-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-104 solid	7.84E-04	2.88E-03	9.43E-04	17.0%	62.5%	20.5%	4.60E-03	189
241-SX-105	8.70E-04	1.03E-02	1.11E-03	7.1%	83.8%	9.1%	1.22E-02	501
SX-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-105 solid	8.70E-04	1.03E-02	1.11E-03	7.1%	83.8%	9.1%	1.22E-02	501
241-SX-106	1.77E-04	4.68E-04	8.11E-04	12.1%	32.1%	55.7%	1.46E-03	60
SX-106 liquid	5.84E-05	1.10E-04	1.14E-07	34.7%	65.3%	0.1%	1.69E-04	7
SX-106 solid	1.18E-04	3.58E-04	8.11E-04	9.2%	27.8%	63.0%	1.29E-03	53

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-SX-107	1.11E-03	6.56E-04	6.63E-04	45.6%	27.1%	27.3%	2.42E-03	99
SX-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-107 solid	1.11E-03	6.56E-04	6.63E-04	45.6%	27.1%	27.3%	2.42E-03	99
241-SX-108	5.22E-05	4.39E-05	6.63E-04	6.9%	5.8%	87.3%	7.59E-04	31
SX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-108 solid	5.22E-05	4.39E-05	6.63E-04	6.9%	5.8%	87.3%	7.59E-04	31
241-SX-109	7.60E-04	1.77E-03	8.04E-04	22.8%	53.1%	24.1%	3.33E-03	137
SX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-109 solid	7.60E-04	1.77E-03	8.04E-04	22.8%	53.1%	24.1%	3.33E-03	137
241-SX-110	1.17E-04	3.66E-04	6.33E-04	10.4%	32.8%	56.7%	1.12E-03	46
SX-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-110 solid	1.17E-04	3.66E-04	6.33E-04	10.4%	32.8%	56.7%	1.12E-03	46
241-SX-111	4.22E-04	2.83E-03	6.92E-04	10.7%	71.7%	17.6%	3.94E-03	161
SX-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-111 solid	4.22E-04	2.83E-03	6.92E-04	10.7%	71.7%	17.6%	3.94E-03	161
241-SX-112	1.63E-04	3.80E-04	6.70E-04	13.4%	31.3%	55.3%	1.21E-03	50
SX-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-112 solid	1.63E-04	3.80E-04	6.70E-04	13.4%	31.3%	55.3%	1.21E-03	50
241-SX-113	1.54E-05	3.64E-06	5.59E-04	2.7%	0.6%	96.7%	5.78E-04	24
SX-113 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-113 solid	1.54E-05	3.64E-06	5.59E-04	2.7%	0.6%	96.7%	5.78E-04	24
241-SX-114	1.82E-03	1.27E-03	7.50E-04	47.3%	33.2%	19.5%	3.84E-03	157
SX-114 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-114 solid	1.82E-03	1.27E-03	7.50E-04	47.3%	33.2%	19.5%	3.84E-03	157

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-SX-115	7.78E-05	1.27E-06	5.42E-04	12.5%	0.2%	87.3%	6.21E-04	25
SX-115 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
SX-115 solid	7.78E-05	1.27E-06	5.42E-04	12.5%	0.2%	87.3%	6.21E-04	25
241-T-101	1.07E-04	2.45E-05	6.03E-04	14.6%	3.3%	82.1%	7.35E-04	30
T-101 liquid	4.90E-07	3.37E-07	1.13E-09	59.2%	40.6%	0.1%	8.28E-07	0
T-101 solid	1.07E-04	2.42E-05	6.03E-04	14.6%	3.3%	82.1%	7.34E-04	30
241-T-102	4.17E-06	2.15E-07	5.35E-04	0.8%	0.0%	99.2%	5.40E-04	22
T-102 liquid	4.40E-07	9.15E-08	1.80E-08	80.1%	16.6%	3.3%	5.49E-07	0
T-102 solid	3.73E-06	1.24E-07	5.35E-04	0.7%	0.0%	99.3%	5.39E-04	22
241-T-103	4.32E-05	7.77E-07	5.34E-04	7.5%	0.1%	92.4%	5.78E-04	24
T-103 liquid	4.11E-07	1.43E-07	5.35E-09	73.5%	25.6%	1.0%	5.60E-07	0
T-103 solid	4.28E-05	6.34E-07	5.34E-04	7.4%	0.1%	92.5%	5.77E-04	24
241-T-104	1.05E-06	1.15E-05	7.87E-04	0.1%	1.4%	98.4%	7.99E-04	33
T-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-104 solid	1.05E-06	1.15E-05	7.87E-04	0.1%	1.4%	98.4%	7.99E-04	33
241-T-105	2.90E-05	1.14E-06	5.97E-04	4.6%	0.2%	95.2%	6.27E-04	26
T-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-105 solid	2.90E-05	1.14E-06	5.97E-04	4.6%	0.2%	95.2%	6.27E-04	26
241-T-106	4.55E-07	2.79E-07	5.31E-04	0.1%	0.1%	99.9%	5.31E-04	22
T-106 liquid	2.07E-07	7.43E-08	2.67E-09	72.9%	26.2%	0.9%	2.84E-07	0
T-106 solid	2.48E-07	2.05E-07	5.31E-04	0.0%	0.0%	99.9%	5.31E-04	22
241-T-107	1.51E-05	4.84E-06	6.61E-04	2.2%	0.7%	97.1%	6.81E-04	28
T-107 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-107 solid	1.51E-05	4.84E-06	6.61E-04	2.2%	0.7%	97.1%	6.81E-04	28

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-T-108	4.12E-05	7.99E-06	5.52E-04	6.9%	1.3%	91.8%	6.01E-04	25
T-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-108 solid	4.12E-05	7.99E-06	5.52E-04	6.9%	1.3%	91.8%	6.01E-04	25
241-T-109	1.71E-05	1.15E-05	5.63E-04	2.9%	1.9%	95.2%	5.92E-04	24
T-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-109 solid	1.71E-05	1.15E-05	5.63E-04	2.9%	1.9%	95.2%	5.92E-04	24
241-T-110	2.93E-05	1.43E-05	8.37E-04	3.3%	1.6%	95.1%	8.80E-04	36
T-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-110 solid	2.93E-05	1.43E-05	8.37E-04	3.3%	1.6%	95.1%	8.80E-04	36
241-T-111	2.42E-06	1.57E-05	8.85E-04	0.3%	1.7%	98.0%	9.04E-04	37
T-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-111 solid	2.42E-06	1.57E-05	8.85E-04	0.3%	1.7%	98.0%	9.04E-04	37
241-T-112	2.12E-06	2.37E-07	5.66E-04	0.4%	0.0%	99.6%	5.68E-04	23
T-112 liquid	7.03E-07	2.36E-08	9.97E-09	95.4%	3.2%	1.4%	7.37E-07	0
T-112 solid	1.42E-06	2.14E-07	5.66E-04	0.2%	0.0%	99.7%	5.67E-04	23
241-T-201	1.09E-07	9.38E-07	1.24E-04	0.1%	0.8%	99.2%	1.25E-04	5
T-201 liquid	1.04E-07	3.89E-08	1.87E-08	64.4%	24.0%	11.6%	1.62E-07	0
T-201 solid	5.01E-09	8.99E-07	1.24E-04	0.0%	0.7%	99.3%	1.24E-04	5
241-T-202	6.28E-10	8.35E-07	1.02E-04	0.0%	0.8%	99.2%	1.03E-04	4
T-202 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-202 solid	6.28E-10	8.35E-07	1.02E-04	0.0%	0.8%	99.2%	1.03E-04	4
241-T-203	6.36E-10	1.35E-06	1.45E-04	0.0%	0.9%	99.1%	1.46E-04	6
T-203 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-203 solid	6.36E-10	1.35E-06	1.45E-04	0.0%	0.9%	99.1%	1.46E-04	6

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-T-204	5.15E-10	1.76E-06	1.55E-04	0.0%	1.1%	98.9%	1.57E-04	6
T-204 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
T-204 solid	5.15E-10	1.76E-06	1.55E-04	0.0%	1.1%	98.9%	1.57E-04	6
241-TX-101	2.05E-04	9.19E-06	6.00E-04	25.2%	1.1%	73.7%	8.15E-04	33
TX-101 liquid	3.99E-07	3.55E-07	4.12E-09	52.6%	46.8%	0.5%	7.59E-07	0
TX-101 solid	2.05E-04	8.83E-06	6.00E-04	25.2%	1.1%	73.7%	8.14E-04	33
241-TX-102	2.21E-05	4.49E-05	7.14E-04	2.8%	5.7%	91.4%	7.81E-04	32
TX-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-102 solid	2.21E-05	4.49E-05	7.14E-04	2.8%	5.7%	91.4%	7.81E-04	32
241-TX-103	2.20E-05	2.29E-05	6.54E-04	3.1%	3.3%	93.6%	6.99E-04	29
TX-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-103 solid	2.20E-05	2.29E-05	6.54E-04	3.1%	3.3%	93.6%	6.99E-04	29
241-TX-104	4.43E-05	1.28E-06	5.70E-04	7.2%	0.2%	92.6%	6.16E-04	25
TX-104 liquid	1.19E-06	9.36E-08	5.45E-09	92.3%	7.2%	0.4%	1.29E-06	0
TX-104 solid	4.31E-05	1.19E-06	5.70E-04	7.0%	0.2%	92.8%	6.14E-04	25
241-TX-105	2.78E-05	1.03E-04	1.05E-03	2.4%	8.7%	88.9%	1.18E-03	48
TX-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-105 solid	2.78E-05	1.03E-04	1.05E-03	2.4%	8.7%	88.9%	1.18E-03	48
241-TX-106	4.39E-05	8.23E-05	8.16E-04	4.7%	8.7%	86.6%	9.42E-04	39
TX-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-106 solid	4.39E-05	8.23E-05	8.16E-04	4.7%	8.7%	86.6%	9.42E-04	39
241-TX-107	2.26E-05	7.29E-06	5.52E-04	3.9%	1.3%	94.9%	5.82E-04	24
TX-107 liquid	5.49E-07	3.66E-07	1.14E-09	59.9%	40.0%	0.1%	9.16E-07	0
TX-107 solid	2.21E-05	6.93E-06	5.52E-04	3.8%	1.2%	95.0%	5.81E-04	24

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-TX-108	9.81E-06	6.10E-06	6.28E-04	1.5%	0.9%	97.5%	6.44E-04	26
TX-108 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-108 solid	9.81E-06	6.10E-06	6.28E-04	1.5%	0.9%	97.5%	6.44E-04	26
241-TX-109	2.34E-05	5.18E-05	8.57E-04	2.5%	5.6%	91.9%	9.33E-04	38
TX-109 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-109 solid	2.34E-05	5.18E-05	8.57E-04	2.5%	5.6%	91.9%	9.33E-04	38
241-TX-110	3.86E-05	4.73E-05	9.18E-04	3.9%	4.7%	91.4%	1.00E-03	41
TX-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-110 solid	3.86E-05	4.73E-05	9.18E-04	3.9%	4.7%	91.4%	1.00E-03	41
241-TX-111	3.56E-05	2.83E-05	8.34E-04	4.0%	3.2%	92.9%	8.98E-04	37
TX-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-111 solid	3.56E-05	2.83E-05	8.34E-04	4.0%	3.2%	92.9%	8.98E-04	37
241-TX-112	3.44E-05	4.59E-05	1.06E-03	3.0%	4.0%	93.0%	1.14E-03	47
TX-112 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-112 solid	3.44E-05	4.59E-05	1.06E-03	3.0%	4.0%	93.0%	1.14E-03	47
241-TX-113	9.09E-05	3.73E-05	1.03E-03	7.9%	3.2%	88.9%	1.16E-03	47
TX-113 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-113 solid	9.09E-05	3.73E-05	1.03E-03	7.9%	3.2%	88.9%	1.16E-03	47
241-TX-114	1.88E-05	2.43E-05	9.66E-04	1.9%	2.4%	95.7%	1.01E-03	41
TX-114 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-114 solid	1.88E-05	2.43E-05	9.66E-04	1.9%	2.4%	95.7%	1.01E-03	41
241-TX-115	2.22E-05	2.15E-05	9.93E-04	2.1%	2.1%	95.8%	1.04E-03	42
TX-115 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-115 solid	2.22E-05	2.15E-05	9.93E-04	2.1%	2.1%	95.8%	1.04E-03	42

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-TX-116	5.23E-05	3.78E-05	1.05E-03	4.6%	3.3%	92.1%	1.14E-03	47
TX-116 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-116 solid	5.23E-05	3.78E-05	1.05E-03	4.6%	3.3%	92.1%	1.14E-03	47
241-TX-117	1.99E-05	1.93E-05	1.05E-03	1.8%	1.8%	96.4%	1.09E-03	45
TX-117 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-117 solid	1.99E-05	1.93E-05	1.05E-03	1.8%	1.8%	96.4%	1.09E-03	45
241-TX-118	7.88E-05	4.66E-05	7.74E-04	8.8%	5.2%	86.1%	8.99E-04	37
TX-118 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TX-118 solid	7.88E-05	4.66E-05	7.74E-04	8.8%	5.2%	86.1%	8.99E-04	37
241-TY-101	3.10E-06	5.76E-06	6.16E-04	0.5%	0.9%	98.6%	6.25E-04	26
TY-101 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-101 solid	3.10E-06	5.76E-06	6.16E-04	0.5%	0.9%	98.6%	6.25E-04	26
241-TY-102	1.58E-05	1.03E-05	5.68E-04	2.7%	1.7%	95.6%	5.94E-04	24
TY-102 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-102 solid	1.58E-05	1.03E-05	5.68E-04	2.7%	1.7%	95.6%	5.94E-04	24
241-TY-103	1.24E-05	4.23E-06	6.54E-04	1.8%	0.6%	97.5%	6.71E-04	27
TY-103 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-103 solid	1.24E-05	4.23E-06	6.54E-04	1.8%	0.6%	97.5%	6.71E-04	27
241-TY-104	9.31E-05	1.69E-06	5.52E-04	14.4%	0.3%	85.4%	6.47E-04	27
TY-104 liquid	3.18E-07	1.25E-07	4.03E-09	71.1%	28.0%	0.9%	4.47E-07	0
TY-104 solid	9.27E-05	1.56E-06	5.52E-04	14.3%	0.2%	85.4%	6.47E-04	27
241-TY-105	3.68E-05	1.45E-05	7.17E-04	4.8%	1.9%	93.3%	7.68E-04	31
TY-105 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-105 solid	3.68E-05	1.45E-05	7.17E-04	4.8%	1.9%	93.3%	7.68E-04	31

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Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-TY-106	1.63E-06	4.20E-07	5.33E-04	0.3%	0.1%	99.6%	5.35E-04	22
TY-106 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
TY-106 solid	1.63E-06	4.20E-07	5.33E-04	0.3%	0.1%	99.6%	5.35E-04	22
241-U-101	2.87E-05	7.64E-07	5.39E-04	5.1%	0.1%	94.8%	5.68E-04	23
U-101 liquid	3.36E-07	1.66E-07	4.06E-09	66.4%	32.8%	0.8%	5.07E-07	0
U-101 solid	2.84E-05	5.97E-07	5.39E-04	5.0%	0.1%	94.9%	5.68E-04	23
241-U-102	3.13E-04	4.38E-04	8.35E-04	19.7%	27.6%	52.6%	1.59E-03	65
U-102 liquid	1.71E-05	2.28E-05	2.10E-08	42.9%	57.0%	0.1%	3.99E-05	2
U-102 solid	2.96E-04	4.15E-04	8.35E-04	19.1%	26.9%	54.0%	1.55E-03	63
241-U-103	3.32E-04	6.16E-04	9.21E-04	17.8%	33.0%	49.3%	1.87E-03	77
U-103 liquid	1.62E-05	1.82E-05	1.49E-08	47.1%	52.8%	0.0%	3.45E-05	1
U-103 solid	3.16E-04	5.98E-04	9.21E-04	17.2%	32.6%	50.2%	1.84E-03	75
241-U-104	2.98E-04	9.55E-05	6.35E-04	29.0%	9.3%	61.7%	1.03E-03	42
U-104 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-104 solid	2.98E-04	9.55E-05	6.35E-04	29.0%	9.3%	61.7%	1.03E-03	42
241-U-105	3.35E-04	5.07E-04	8.59E-04	19.7%	29.8%	50.5%	1.70E-03	70
U-105 liquid	9.83E-05	7.94E-05	4.10E-08	55.3%	44.7%	0.0%	1.78E-04	7
U-105 solid	2.37E-04	4.27E-04	8.59E-04	15.6%	28.0%	56.4%	1.52E-03	62
241-U-106	5.24E-04	5.65E-04	7.09E-04	29.1%	31.4%	39.4%	1.80E-03	74
U-106 liquid	3.83E-05	3.76E-05	1.79E-08	50.5%	49.5%	0.0%	7.60E-05	3
U-106 solid	4.85E-04	5.28E-04	7.09E-04	28.2%	30.6%	41.2%	1.72E-03	71
241-U-107	3.77E-05	6.97E-05	8.46E-04	4.0%	7.3%	88.7%	9.54E-04	39
U-107 liquid	1.13E-05	8.19E-06	3.75E-08	57.8%	42.0%	0.2%	1.95E-05	1
U-107 solid	2.65E-05	6.15E-05	8.46E-04	2.8%	6.6%	90.6%	9.34E-04	38

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-U-108	2.57E-04	3.34E-04	9.09E-04	17.1%	22.3%	60.6%	1.50E-03	61
U-108 liquid	1.58E-05	1.91E-05	2.78E-08	45.3%	54.7%	0.1%	3.49E-05	1
U-108 solid	2.41E-04	3.15E-04	9.09E-04	16.5%	21.5%	62.0%	1.46E-03	60
241-U-109	7.81E-05	1.52E-04	9.08E-04	6.9%	13.4%	79.8%	1.14E-03	47
U-109 liquid	9.71E-06	1.02E-05	2.07E-08	48.7%	51.2%	0.1%	2.00E-05	1
U-109 solid	6.84E-05	1.42E-04	9.08E-04	6.1%	12.7%	81.2%	1.12E-03	46
241-U-110	3.21E-04	1.13E-05	6.87E-04	31.5%	1.1%	67.4%	1.02E-03	42
U-110 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-110 solid	3.21E-04	1.13E-05	6.87E-04	31.5%	1.1%	67.4%	1.02E-03	42
241-U-111	1.72E-04	1.59E-04	8.08E-04	15.1%	13.9%	70.9%	1.14E-03	47
U-111 liquid	not exist	not exist	not exist	not exist	not exist	not exist	not exist	not exist
U-111 solid	1.72E-04	1.59E-04	8.08E-04	15.1%	13.9%	70.9%	1.14E-03	47
241-U-112	7.76E-06	1.30E-06	5.57E-04	1.4%	0.2%	98.4%	5.66E-04	23
U-112 liquid	4.39E-07	1.99E-07	5.39E-09	68.2%	30.9%	0.8%	6.43E-07	0
U-112 solid	7.33E-06	1.10E-06	5.57E-04	1.3%	0.2%	98.5%	5.65E-04	23
241-U-201	6.66E-07	1.28E-07	4.93E-05	1.3%	0.3%	98.4%	5.01E-05	2
U-201 liquid	1.06E-07	4.08E-08	1.89E-08	63.9%	24.7%	11.4%	1.65E-07	0
U-201 solid	5.61E-07	8.71E-08	4.93E-05	1.1%	0.2%	98.7%	4.99E-05	2
241-U-202	6.94E-07	1.33E-07	4.93E-05	1.4%	0.3%	98.3%	5.01E-05	2
U-202 liquid	1.06E-07	4.11E-08	1.89E-08	63.8%	24.8%	11.4%	1.66E-07	0
U-202 solid	5.88E-07	9.20E-08	4.93E-05	1.2%	0.2%	98.6%	5.00E-05	2
241-U-203	5.17E-07	9.90E-08	4.29E-05	1.2%	0.2%	98.6%	4.35E-05	2
U-203 liquid	1.04E-07	3.81E-08	1.88E-08	64.6%	23.7%	11.7%	1.61E-07	0
U-203 solid	4.13E-07	6.09E-08	4.29E-05	1.0%	0.1%	98.9%	4.34E-05	2

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table A-4 Calculated Hydrogen Generation Rates In Dome Space in Cubic Feet and Liter Per Minute For 177 Tanks (23 Sheets)

Tank Name	G_{rad} (cfm) HGR from Radiolysis	G_{therm} (cfm) HGR from Thermolysis	G_{corr} (cfm) HGR from Corrosion	$(G_{rad})_{\%}$ Percent HGR from Radiolysis	$(G_{therm})_{\%}$ Percent HGR from Thermolysis	$(G_{corr})_{\%}$ Percent HGR from Corrosion	G_{mod} (cfm) Total HGR from Model	G_{mod} (L/Day) Total HGR from Model
241-U-204	1.05E-07	6.33E-08	4.29E-05	0.2%	0.1%	99.6%	4.31E-05	2
U-204 liquid	1.04E-07	3.77E-08	1.88E-08	64.8%	23.5%	11.7%	1.60E-07	0
U-204 solid	1.44E-09	2.56E-08	4.29E-05	0.0%	0.1%	99.9%	4.29E-05	2

APPENDIX B

Calculation Results of Steady State Flammability Evaluations at Tank Dome Space for 177 Hanford Tanks

Author [illegible] Date 4-24-00 Checked by S. [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-AN-101	0.0012	0.0011	0.0017	0.0011	160	166,700	113.0	0.07%	4.09E-04	1.28E-03	1.92E-03	1.20E-03
241-AN-102	0.0040	0.0300	0.0003	0.0053	1,060	46,387	119.0	0.31%	1.01E-02	3.57E-02	3.19E-04	6.31E-03
241-AN-103	0.0025	0.0007	0.0002	0.0007	958	60,023	100.0	0.07%	3.17E-03	6.65E-04	2.05E-04	6.50E-04
241-AN-104	0.0020	0.0021	0.0002	0.0007	1,053	47,323	100.0	0.07%	3.66E-03	2.10E-03	1.95E-04	7.09E-04
241-AN-105	0.0051	0.0015	0.0002	0.0013	1,126	37,564	100.0	0.14%	4.82E-03	1.51E-03	2.20E-04	1.28E-03
241-AN-106	0.0001	0.0000	0.0000	0.0002	39	182,875	117.0	0.00%	2.84E-04	0.00E+00	1.17E-05	2.32E-04
241-AN-107	0.0023	0.0400	0.0005	0.0053	1,044	48,526	129.0	0.33%	9.07E-03	5.16E-02	6.29E-04	6.84E-03
241-AP-101	0.0046	0.0125	0.0003	0.0061	1,115	39,035	108.0	0.21%	1.06E-03	1.35E-02	3.36E-04	6.63E-03
241-AP-102	0.0036	0.0075	0.0002	0.0048	1,092	42,109	135.0	0.15%	1.15E-03	1.02E-02	3.29E-04	6.50E-03
241-AP-103	0.0006	0.0000	0.0000	0.0008	285	149,990	200.0	0.02%	4.77E-04	0.00E+00	8.58E-05	1.70E-03
241-AP-104	0.0002	0.0003	0.0000	0.0002	24	184,881	71.0	0.01%	2.68E-04	2.23E-04	7.23E-06	1.43E-04
241-AP-105	0.0019	0.0007	0.0001	0.0026	765	85,823	176.0	0.06%	7.80E-04	1.29E-03	2.30E-04	4.55E-03
241-AP-106	0.0004	0.0005	0.0000	0.0005	93	175,657	111.0	0.01%	3.04E-04	5.92E-04	2.80E-05	5.53E-04
241-AP-107	0.0013	0.0005	0.0001	0.0017	976	57,616	342.0	0.04%	7.12E-04	1.71E-03	2.94E-04	5.81E-03
241-AP-108	0.0013	0.0027	0.0001	0.0017	369	138,761	129.0	0.05%	4.43E-04	3.43E-03	1.11E-04	2.20E-03
241-AW-101	0.0113	0.0005	0.0002	0.0007	1,126	37,564	100.0	0.29%	3.93E-03	5.15E-04	1.56E-04	7.29E-04
241-AW-102	0.0001	0.0003	0.0000	0.0002	80	177,394	292.0	0.00%	3.18E-04	7.44E-04	2.41E-05	4.76E-04
241-AW-103	0.0046	0.0138	0.0004	0.0009	510	119,912	134.0	0.21%	6.65E-04	1.85E-02	4.70E-04	1.23E-03
241-AW-104	0.0095	0.0006	0.0007	0.0009	1,119	38,500	141.0	0.26%	1.13E-03	8.46E-04	1.03E-03	1.30E-03
241-AW-105	0.0027	0.0043	0.0002	0.0009	429	130,740	194.0	0.10%	4.65E-04	8.30E-03	3.95E-04	1.78E-03
241-AW-106	0.0013	0.0028	0.0001	0.0018	473	124,858	158.0	0.05%	9.78E-04	4.40E-03	1.42E-04	2.81E-03
241-AY-101	0.0007	0.0005	0.0001	0.0009	154	167,502	250.0	0.02%	1.97E-03	1.25E-03	1.42E-04	2.21E-03
241-AY-102	0.0033	0.0004	0.0001	0.0010	622	104,939	250.0	0.09%	1.40E-02	1.07E-03	3.61E-04	2.50E-03

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-AZ-101	0.0043	0.0001	0.0005	0.0010	845	75,129	150.0	0.12%	8.80E-03	1.88E-04	7.79E-04	1.50E-03
241-AZ-102	0.0085	0.0006	0.0008	0.0010	931	63,632	112.0	0.23%	1.06E-02	6.19E-04	8.58E-04	1.12E-03
241-SY-101	0.0014	0.0004	0.0001	0.0015	1,189	29,142	461.0	0.04%	2.22E-02	1.84E-03	3.58E-04	7.07E-03
241-SY-102	0.0007	0.0012	0.0004	0.0005	612	106,276	363.0	0.03%	6.48E-04	4.24E-03	1.55E-03	1.95E-03
241-SY-103	0.0020	0.0059	0.0003	0.0016	744	88,630	116.4	0.10%	3.13E-03	6.92E-03	3.15E-04	1.87E-03
241-A-101	0.0272	0.0394	0.0006	0.0134	953	48,793	10.0	0.95%	1.48E-02	3.94E-03	5.51E-05	1.34E-03
241-A-102	0.0292	0.0254	0.0002	0.0224	41	170,710	7.6	0.90%	7.50E-04	1.93E-03	1.31E-05	1.71E-03
241-A-103	0.0468	0.0261	0.0004	0.0220	371	126,596	10.0	1.35%	1.07E-02	2.61E-03	3.92E-05	2.20E-03
241-A-104	0.0034	0.0005	0.0003	0.0040	28	172,448	10.0	0.09%	4.93E-03	5.00E-05	2.58E-05	4.02E-04
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	0.0119	0.0275	0.0012	0.0198	125	159,481	10.0	0.50%	1.45E-03	2.75E-03	1.15E-04	1.98E-03
241-AX-101	0.0049	0.0041	0.0002	0.0006	748	80,208	28.3	0.16%	4.83E-03	1.17E-03	5.95E-05	1.81E-04
241-AX-102	0.0008	0.0034	0.0001	0.0050	30	176,191	16.5	0.04%	6.73E-04	5.55E-04	9.04E-06	8.23E-04
241-AX-103	0.0026	0.0041	0.0002	0.0024	112	165,229	24.7	0.10%	1.63E-03	1.02E-03	4.94E-05	5.85E-04
241-AX-104	0.0014	0.0007	0.0001	0.0016	8	179,132	7.0	0.04%	6.61E-04	5.18E-05	7.37E-06	1.15E-04
241-B-101	0.0064	0.0013	0.0004	0.0086	113	98,389	7.8	0.18%	9.62E-04	9.81E-05	3.40E-05	6.72E-04
241-B-102	0.0017	0.0005	0.0001	0.0063	32	109,217	7.0	0.05%	5.50E-04	3.28E-05	9.64E-06	4.40E-04
241-B-103	0.0026	0.0008	0.0003	0.0061	59	105,608	7.0	0.08%	5.85E-04	5.82E-05	1.78E-05	4.26E-04
241-B-104	0.0633	0.0005	0.0049	0.0759	371	63,899	7.0	1.68%	1.80E-03	3.50E-05	3.41E-04	5.31E-03
241-B-105	0.0069	0.0012	0.0005	0.0092	158	92,373	7.0	0.19%	7.50E-04	8.40E-05	3.27E-05	6.45E-04
241-B-106	0.0200	0.0005	0.0015	0.0240	117	97,854	7.0	0.54%	9.52E-04	3.50E-05	1.08E-04	1.68E-03
241-B-107	0.0017	0.0021	0.0007	0.0017	165	91,438	7.0	0.07%	8.92E-04	1.47E-04	4.95E-05	1.19E-04
241-B-108	0.0074	0.0034	0.0004	0.0087	94	100,929	7.0	0.22%	6.10E-04	2.40E-04	3.00E-05	6.08E-04
241-B-109	0.0099	0.0042	0.0006	0.0117	127	96,518	7.0	0.29%	8.88E-04	2.92E-04	4.05E-05	8.21E-04
241-B-110	0.0416	0.0050	0.0032	0.0499	246	80,610	7.0	1.14%	7.72E-04	3.50E-04	2.24E-04	3.49E-03

Author [illegible] Date 4-26-00 Checked by [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-B-111	0.0749	0.0025	0.0058	0.0897	237	81,813	3.5	2.00%	8.02E-04	8.79E-05	2.02E-04	3.15E-03
241-B-112	0.0057	0.0031	0.0004	0.0068	33	109,084	7.0	0.17%	5.49E-04	2.14E-04	3.04E-05	4.74E-04
241-B-201	0.0050	0.0005	0.0004	0.0059	29	4,010	7.0	0.14%	1.24E-04	3.50E-05	2.67E-05	4.16E-04
241-B-202	0.0017	0.0003	0.0003	0.0017	27	4,278	7.2	0.05%	1.22E-04	1.92E-05	2.49E-05	1.23E-04
241-B-203	0.0087	0.0000	0.0007	0.0105	51	1,069	0.3	0.23%	1.91E-04	1.90E-09	1.89E-06	2.95E-05
241-B-204	0.0086	0.0000	0.0007	0.0103	50	1,203	0.3	0.23%	2.47E-04	2.11E-08	1.79E-06	2.79E-05
241-BX-101	0.0074	0.0050	0.0006	0.0088	43	107,880	7.0	0.23%	5.67E-04	3.50E-04	3.96E-05	6.17E-04
241-BX-102	0.0017	0.0003	0.0013	0.0017	96	100,795	7.0	0.07%	6.06E-04	1.79E-05	8.85E-05	1.19E-04
241-BX-103	0.0152	0.0090	0.0009	0.0079	71	104,137	7.0	0.46%	5.93E-04	6.27E-04	6.54E-05	5.52E-04
241-BX-104	0.0090	0.0212	0.0010	0.0130	99	100,394	8.7	0.39%	6.66E-04	1.85E-03	9.12E-05	1.14E-03
241-BX-105	0.0048	0.0145	0.0006	0.0116	51	106,811	8.5	0.23%	5.66E-04	1.23E-03	4.70E-05	9.76E-04
241-BX-106	0.0017	0.0047	0.0005	0.0043	38	108,549	7.0	0.08%	5.58E-04	3.26E-04	3.50E-05	3.02E-04
241-BX-107	0.0011	0.0082	0.0004	0.0012	345	67,509	7.0	0.09%	8.32E-04	5.74E-04	2.75E-05	8.34E-05
241-BX-108	0.0045	0.0024	0.0003	0.0053	26	110,153	7.0	0.13%	5.43E-04	1.68E-04	2.40E-05	3.73E-04
241-BX-109	0.0330	0.0020	0.0025	0.0396	193	87,828	7.0	0.89%	7.40E-04	1.40E-04	1.78E-04	2.77E-03
241-BX-110	0.0017	0.0063	0.0008	0.0017	207	85,957	7.0	0.10%	7.58E-04	4.40E-04	5.57E-05	1.19E-04
241-BX-111	0.0017	0.0062	0.0002	0.0017	162	91,972	7.0	0.09%	6.60E-04	4.35E-04	1.15E-05	1.19E-04
241-BX-112	0.0283	0.0122	0.0022	0.0339	165	91,571	7.0	0.83%	6.64E-04	8.51E-04	1.52E-04	2.37E-03
241-BY-101	0.0028	0.0059	0.0010	0.0056	387	88,363	7.0	0.13%	9.89E-04	4.15E-04	6.80E-05	3.91E-04
241-BY-102	0.0034	0.0173	0.0004	0.0017	277	103,068	7.0	0.21%	7.82E-04	1.21E-03	2.75E-05	1.22E-04
241-BY-103	0.0054	0.0029	0.0002	0.0017	400	86,625	14.4	0.16%	1.02E-03	4.12E-04	2.75E-05	2.43E-04
241-BY-104	0.0248	0.0259	0.0007	0.0250	326	96,518	7.6	0.81%	1.85E-03	1.98E-03	5.41E-05	1.92E-03
241-BY-105	0.0250	0.0083	0.0004	0.0076	503	72,856	15.9	0.69%	1.16E-03	1.32E-03	6.93E-05	1.21E-03
241-BY-106	0.0143	0.0079	0.0005	0.0132	562	64,969	5.9	0.42%	2.51E-03	4.64E-04	2.89E-05	7.75E-04

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-BY-107	0.0384	0.0962	0.0010	0.0704	266	104,538	5.2	1.62%	9.25E-04	5.03E-03	5.20E-05	3.68E-03
241-BY-108	0.0408	0.0870	0.0008	0.0553	228	109,618	6.8	1.62%	1.73E-03	5.88E-03	5.16E-05	3.74E-03
241-BY-109	0.0036	0.0045	0.0002	0.0011	290	101,330	14.7	0.12%	8.21E-04	6.57E-04	3.11E-05	1.57E-04
241-BY-110	0.0048	0.0397	0.0003	0.0102	398	86,893	13.3	0.39%	1.26E-03	5.30E-03	4.36E-05	1.37E-03
241-BY-111	0.0111	0.0059	0.0003	0.0082	459	78,738	6.0	0.32%	9.64E-04	3.51E-04	1.65E-05	4.93E-04
241-BY-112	0.0019	0.0063	0.0001	0.0039	291	101,196	13.6	0.09%	8.30E-04	8.55E-04	1.72E-05	5.34E-04
241-C-101	0.0432	0.0098	0.0012	0.0636	88	101,731	3.6	1.17%	6.77E-04	3.52E-04	4.30E-05	2.29E-03
241-C-102	0.0146	0.0187	0.0008	0.0141	316	71,252	11.8	0.51%	1.41E-03	2.20E-03	9.81E-05	1.66E-03
241-C-103	0.0778	0.0324	0.0016	0.0737	198	87,026	10.0	2.19%	2.44E-03	3.24E-03	1.58E-04	7.37E-03
241-C-104	0.0069	0.0044	0.0004	0.0063	295	74,059	67.1	0.21%	1.11E-03	2.96E-03	2.72E-04	4.24E-03
241-C-105	0.0022	0.0002	0.0000	0.0005	91	95,448	535.0	0.06%	7.77E-04	1.29E-03	1.24E-04	2.81E-03
241-C-106	0.0004	0.0002	0.0001	0.0004	107	99,191	176.1	0.01%	5.57E-04	4.38E-04	9.86E-05	6.49E-04
241-C-107	0.0400	0.0066	0.0010	0.0096	257	79,139	1.1	1.06%	1.46E-03	7.24E-05	1.08E-05	1.05E-04
241-C-108	0.0015	0.0003	0.0000	0.0178	66	104,672	7.0	0.04%	6.02E-04	1.84E-05	2.17E-06	1.25E-03
241-C-109	0.0120	0.0010	0.0001	0.0365	66	104,672	13.0	0.31%	6.61E-04	1.30E-04	1.19E-05	4.76E-03
241-C-110	0.0052	0.0123	0.0031	0.0014	178	89,700	7.9	0.27%	6.81E-04	9.69E-04	2.46E-04	1.08E-04
241-C-111	0.0015	0.0004	0.0001	0.0053	57	105,875	7.0	0.04%	6.95E-04	2.74E-05	3.54E-06	3.73E-04
241-C-112	0.0200	0.0023	0.0001	0.0538	104	99,592	11.2	0.52%	9.21E-04	2.52E-04	1.12E-05	6.02E-03
241-C-201	0.0006	0.0001	0.0000	0.0007	2	7,620	3.9	0.02%	4.30E-05	4.02E-06	1.84E-06	2.87E-05
241-C-202	0.0003	0.0001	0.0000	0.0004	1	7,753	3.6	0.01%	4.00E-05	2.48E-06	9.22E-07	1.44E-05
241-C-203	0.0009	0.0005	0.0001	0.0010	5	7,219	7.0	0.03%	5.82E-05	3.23E-05	4.61E-06	7.18E-05
241-C-204	0.0012	0.0001	0.0001	0.0014	3	7,486	3.0	0.03%	4.60E-05	2.18E-06	2.76E-06	4.31E-05
241-S-101	0.0332	0.0765	0.0007	0.0197	427	83,283	6.2	1.35%	3.32E-03	4.72E-03	4.36E-05	1.21E-03

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Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-S-102	0.0506	0.0588	0.0008	0.0394	514	71,653	2.2	1.67%	2.53E-03	1.29E-03	1.83E-05	8.68E-04
241-S-103	0.0078	0.0149	0.0005	0.0135	248	107,212	15.3	0.30%	9.72E-04	2.28E-03	6.96E-05	2.06E-03
241-S-104	0.0611	0.0025	0.0047	0.0731	294	101,063	5.6	1.64%	1.15E-03	1.40E-04	2.63E-04	4.10E-03
241-S-105	0.0020	0.0036	0.0002	0.0008	456	79,406	16.7	0.08%	1.00E-03	6.00E-04	3.84E-05	1.25E-04
241-S-106	0.0026	0.0014	0.0016	0.0006	426	83,417	9.2	0.11%	1.17E-03	1.27E-04	1.47E-04	5.11E-05
241-S-107	0.0137	0.0181	0.0010	0.0184	376	90,101	4.4	0.48%	1.09E-03	7.93E-04	4.45E-05	8.08E-04
241-S-108	0.0012	0.0025	0.0001	0.0003	450	80,208	7.0	0.05%	9.29E-04	1.77E-04	7.66E-06	2.08E-05
241-S-109	0.0028	0.0025	0.0196	0.0021	507	72,589	7.0	0.48%	1.09E-03	1.74E-04	1.37E-03	1.48E-04
241-S-110	0.0132	0.0146	0.0005	0.0039	390	88,229	10.4	0.44%	1.52E-03	1.52E-03	5.19E-05	4.07E-04
241-S-111	0.0095	0.0120	0.0003	0.0021	540	68,177	5.4	0.32%	1.11E-03	6.49E-04	1.50E-05	1.14E-04
241-S-112	0.0025	0.0088	0.0003	0.0006	523	70,450	4.0	0.13%	1.55E-03	3.52E-04	1.05E-05	2.53E-05
241-SX-101	0.0009	0.0004	0.0002	0.0007	448	113,228	40.0	0.03%	1.33E-03	1.51E-04	6.57E-05	2.74E-04
241-SX-102	0.0017	0.0000	0.0002	0.0006	514	104,405	40.0	0.05%	3.07E-03	0.00E+00	8.00E-05	2.40E-04
241-SX-103	0.0013	0.0031	0.0005	0.0010	634	88,363	52.5	0.06%	8.19E-03	1.61E-03	2.38E-04	5.41E-04
241-SX-104	0.0009	0.0000	0.0002	0.0007	467	110,688	30	0.03%	4.60E-03	0.00E+00	6.53E-05	2.00E-04
241-SX-105	0.0021	0.0027	0.0002	0.0008	637	87,962	40.5	0.07%	1.22E-02	1.09E-03	7.38E-05	3.38E-04
241-SX-106	0.0038	0.0177	0.0003	0.0023	423	116,570	38.8	0.22%	1.46E-03	6.86E-03	1.07E-04	9.10E-04
241-SX-107	0.0003	0.0002	0.0000	0.0004	104	159,214	387.0	0.01%	2.42E-03	6.73E-04	9.58E-05	1.49E-03
241-SX-108	0.0002	0.0001	0.0000	0.0003	87	161,486	455.0	0.01%	7.59E-04	5.63E-04	8.02E-05	1.25E-03
241-SX-109	0.0020	0.0017	0.0001	0.0009	250	139,696	30.0	0.06%	3.33E-03	5.05E-04	3.75E-05	2.72E-04
241-SX-110	0.0003	0.0001	0.0000	0.0003	62	164,828	293.0	0.01%	1.12E-03	4.01E-04	5.71E-05	8.90E-04
241-SX-111	0.0006	0.0003	0.0000	0.0007	122	156,808	264.0	0.02%	3.94E-03	7.89E-04	1.12E-04	1.75E-03
241-SX-112	0.0006	0.0003	0.0000	0.0007	108	158,679	225.0	0.02%	1.21E-03	6.99E-04	9.95E-05	1.55E-03

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-SX-113	0.0053	0.0029	0.0004	0.0064	31	168,972	7.0	0.16%	5.78E-04	2.01E-04	2.86E-05	4.45E-04
241-SX-114	0.0007	0.0004	0.0001	0.0008	181	148,920	325.0	0.02%	3.84E-03	1.17E-03	1.67E-04	2.60E-03
241-SX-115	0.0021	0.0003	0.0002	0.0025	12	171,512	7.0	0.06%	6.21E-04	1.75E-05	1.11E-05	1.72E-04
241-T-101	0.0052	0.0022	0.0004	0.0050	102	99,860	7.0	0.15%	7.35E-04	1.52E-04	2.76E-05	3.47E-04
241-T-102	0.0055	0.0005	0.0004	0.0066	32	109,217	7.0	0.15%	5.40E-04	3.50E-05	2.95E-05	4.59E-04
241-T-103	0.0046	0.0005	0.0004	0.0055	27	109,886	7.0	0.13%	5.78E-04	3.50E-05	2.49E-05	3.88E-04
241-T-104	0.0012	0.0104	0.0004	0.0008	326	69,915	7.0	0.11%	7.99E-04	7.30E-04	2.75E-05	5.26E-05
241-T-105	0.0168	0.0094	0.0013	0.0201	98	100,394	7.0	0.51%	6.27E-04	6.60E-04	9.03E-05	1.41E-03
241-T-106	0.0036	0.0100	0.0003	0.0043	21	110,688	7.0	0.16%	5.31E-04	7.00E-04	1.94E-05	3.01E-04
241-T-107	0.0092	0.0123	0.0023	0.0041	173	90,368	6.4	0.36%	6.81E-04	7.85E-04	1.48E-04	2.62E-04
241-T-108	0.0034	0.0020	0.0002	0.0041	44	107,613	7.0	0.10%	6.01E-04	1.40E-04	1.40E-05	2.85E-04
241-T-109	0.0037	0.0005	0.0002	0.0049	58	105,741	7.0	0.10%	5.92E-04	3.50E-05	1.75E-05	3.45E-04
241-T-110	0.0009	0.0107	0.0002	0.0015	387	61,761	7.0	0.10%	8.80E-04	7.48E-04	1.70E-05	1.02E-04
241-T-111	0.0092	0.0223	0.0058	0.0013	446	53,873	6.0	0.50%	9.04E-04	1.35E-03	3.52E-04	7.64E-05
241-T-112	0.0115	0.0029	0.0009	0.0137	67	104,538	7.0	0.32%	5.68E-04	2.01E-04	6.17E-05	9.62E-04
241-T-201	0.0050	0.0001	0.0004	0.0059	29	4,010	7.0	0.13%	1.25E-04	7.00E-06	2.67E-05	4.16E-04
241-T-202	0.0036	0.0002	0.0003	0.0043	21	5,080	7.0	0.10%	1.03E-04	1.60E-05	1.94E-05	3.01E-04
241-T-203	0.1100	0.0000	0.0085	0.1318	35	3,208	0.4	2.92%	1.46E-04	0.00E+00	3.23E-05	5.02E-04
241-T-204	0.0065	0.0001	0.0005	0.0078	38	2,807	7.0	0.17%	1.57E-04	8.75E-06	3.50E-05	5.45E-04
241-TX-101	0.0068	0.0014	0.0011	0.0050	87	128,467	7.0	0.20%	8.15E-04	9.65E-05	8.02E-05	3.47E-04
241-TX-102	0.0029	0.0168	0.0002	0.0054	217	111,089	11.5	0.19%	7.81E-04	1.93E-03	2.24E-05	6.28E-04
241-TX-103	0.0047	0.0107	0.0003	0.0086	157	119,110	7.0	0.19%	6.99E-04	7.49E-04	2.20E-05	6.05E-04

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Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-TX-104	0.0049	0.0028	0.0006	0.0050	65	131,408	3.5	0.15%	6.16E-04	9.83E-05	2.07E-05	1.73E-04
241-TX-105	0.0020	0.0020	0.0001	0.0013	609	58,686	14.4	0.07%	1.18E-03	2.83E-04	1.98E-05	1.82E-04
241-TX-106	0.0049	0.0252	0.0007	0.0050	341	94,512	7.0	0.30%	9.42E-04	1.77E-03	4.69E-05	3.47E-04
241-TX-107	0.0023	0.0204	0.0002	0.0031	36	135,285	7.0	0.20%	5.82E-04	1.43E-03	1.08E-05	2.14E-04
241-TX-108	0.0017	0.0025	0.0001	0.0022	134	122,184	9.0	0.06%	6.44E-04	2.21E-04	1.01E-05	1.99E-04
241-TX-109	0.0558	0.0400	0.0043	0.0668	384	88,764	7.0	1.75%	9.33E-04	2.80E-03	3.00E-04	4.68E-03
241-TX-110	0.0156	0.0974	0.0003	0.0129	462	78,337	7.0	1.05%	1.00E-03	6.82E-03	2.12E-05	9.01E-04
241-TX-111	0.0108	0.0605	0.0002	0.0175	370	90,636	9.7	0.68%	8.98E-04	5.88E-03	1.87E-05	1.70E-03
241-TX-112	0.0049	0.0112	0.0007	0.0050	649	53,339	7.0	0.21%	1.14E-03	7.84E-04	4.57E-05	3.47E-04
241-TX-113	0.0049	0.0021	0.0004	0.0050	607	58,953	9.3	0.14%	1.16E-03	1.99E-04	3.46E-05	4.61E-04
241-TX-114	0.0030	0.0160	0.0002	0.0040	535	68,578	12.0	0.19%	1.01E-03	1.93E-03	2.43E-05	4.79E-04
241-TX-115	0.0034	0.0014	0.0002	0.0046	568	64,167	10.0	0.10%	1.04E-03	1.38E-04	2.32E-05	4.58E-04
241-TX-116	0.0049	0.0014	0.0012	0.0050	631	55,745	3.1	0.16%	1.14E-03	4.34E-05	3.69E-05	1.55E-04
241-TX-117	0.0043	0.0014	0.0003	0.0050	626	56,413	6.5	0.12%	1.09E-03	8.97E-05	1.87E-05	3.22E-04
241-TX-118	0.0063	0.0036	0.0022	0.0018	300	99,993	10.0	0.22%	8.99E-04	3.57E-04	2.18E-04	1.80E-04
241-TY-101	0.0044	0.0016	0.0003	0.0097	118	124,590	3.2	0.13%	6.25E-04	5.23E-05	8.38E-06	3.15E-04
241-TY-102	0.0003	0.0004	0.0003	0.0066	64	131,809	7.0	0.02%	5.94E-04	2.84E-05	1.93E-05	4.65E-04
241-TY-103	0.0065	0.0045	0.0015	0.0198	162	118,709	8.2	0.22%	6.71E-04	3.73E-04	1.23E-04	1.63E-03
241-TY-104	0.0041	0.0059	0.0003	0.0097	46	134,215	13.4	0.15%	6.47E-04	7.87E-04	4.24E-05	1.30E-03
241-TY-105	0.0049	0.0003	0.0023	0.0051	231	109,485	7.0	0.17%	7.68E-04	1.75E-05	1.59E-04	3.54E-04
241-TY-106	0.0036	0.0019	0.0003	0.0043	21	137,558	7.0	0.11%	5.35E-04	1.36E-04	1.94E-05	3.01E-04
241-U-101	0.0043	0.0100	0.0003	0.0051	25	110,153	7.0	0.18%	5.68E-04	7.00E-04	2.30E-05	3.59E-04
241-U-102	0.0335	0.0651	0.0012	0.0805	375	63,365	2.1	1.29%	1.59E-03	1.37E-03	2.47E-05	1.69E-03

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels at Normal Vent Operation Condition (8 Sheets)

Tank Name	Hydrogen Headspace Conc. $[H_2](to)$ (%)	Ammonia HeadSpace Conc. $[NH_3](to)$ (%)	Methane HeadSpace Conc. $[CH_4](to)$ (%)	N_2O HeadSpace Conc. $[N_2O](to)$ (%)	Waste Volume Vw (kgal)	HeadSpace Volume Vol (ft3)	Normal Ventilation Rate (Vr)nom (cfm)	Lower Flammability Limit at To LFL(%)	Hydrogen Generation Rate $Rr(H_2)$ (cfm)	Ammonia Release Rate $Rr(NH_3)$ (cfm)	Methane Release Rate $Rr(CH_4)$ (cfm)	N_2O Release Rate $Rr(N_2O)$ (cfm)
241-U-103	0.0555	0.0722	0.0014	0.0761	468	50,932	2.4	1.90%	1.87E-03	1.73E-03	3.37E-05	1.83E-03
241-U-104	0.0017	0.0001	0.0006	0.0085	122	97,186	7.0	0.05%	1.03E-03	4.88E-06	3.89E-05	5.96E-04
241-U-105	0.1039	0.1936	0.0039	0.2780	418	57,616	5.0	3.97%	1.70E-03	9.68E-03	1.96E-04	1.39E-02
241-U-106	0.0212	0.0940	0.0052	0.0554	226	83,283	1.3	1.26%	1.80E-03	1.22E-03	6.81E-05	7.20E-04
241-U-107	0.0364	0.0448	0.0010	0.0578	408	58,953	11.8	1.23%	9.54E-04	5.27E-03	1.12E-04	6.80E-03
241-U-108	0.0405	0.0684	0.0011	0.0485	468	50,932	3.6	1.49%	1.50E-03	2.47E-03	3.94E-05	1.75E-03
241-U-109	0.0386	0.0000	0.0010	0.0499	465	51,333	4.3	0.99%	1.14E-03	0.00E+00	4.45E-05	2.14E-03
241-U-110	0.1184	0.0225	0.0091	0.1418	186	88,630	1.9	3.29%	1.02E-03	4.24E-04	1.71E-04	2.67E-03
241-U-111	0.0244	0.0669	0.0012	0.0324	329	69,514	1.9	1.08%	1.14E-03	1.27E-03	2.27E-05	6.15E-04
241-U-112	0.0113	0.0301	0.0035	0.0203	49	106,945	1.3	0.55%	5.66E-04	3.85E-04	4.52E-05	2.60E-04
241-U-201	0.0009	0.0005	0.0001	0.0010	5	7,219	7.0	0.03%	5.01E-05	3.23E-05	4.61E-06	7.18E-05
241-U-202	0.0009	0.0005	0.0001	0.0010	5	7,219	7.0	0.03%	5.01E-05	3.23E-05	4.61E-06	7.18E-05
241-U-203	0.0018	0.0001	0.0001	0.0021	3	7,486	2.1	0.05%	4.35E-05	1.77E-06	2.76E-06	4.31E-05
241-U-204	0.0004	0.0000	0.0000	0.0004	3	7,486	10.2	0.01%	4.31E-05	1.35E-06	2.76E-06	4.31E-05

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-AN-101	0.52	0.08	0.24	0.37	0.23	1.96	1.63	7.33	10.93
241-AN-102	0.14	6.52	19.76	0.22	4.17	163.05	131.74	4.39	299.19
241-AN-103	0.19	1.66	0.35	0.11	0.35	41.56	2.36	2.18	46.10
241-AN-104	0.15	2.41	1.40	0.13	0.48	60.37	9.33	2.63	72.34
241-AN-105	0.12	3.94	1.27	0.19	1.08	98.62	8.49	3.74	110.86
241-AN-106	0.57	0.05	0.00	0.00	0.04	1.24	0.00E+00	0.04	1.28
241-AN-107	0.15	5.64	25.39	0.41	4.31	141.12	169.25	8.26	318.63
241-AP-101	0.12	0.86	9.96	0.27	5.16	21.57	66.43	5.49	93.49
241-AP-102	0.13	0.87	7.16	0.25	4.71	21.64	47.77	4.99	74.39
241-AP-103	0.47	0.10	0.00	0.02	0.36	2.54	0.00	0.37	2.91
241-AP-104	0.58	0.05	0.04	0.00	0.02	1.16	0.26	0.03	1.44
241-AP-105	0.27	0.29	0.48	0.09	1.67	7.25	3.19	1.72	12.16
241-AP-106	0.55	0.06	0.11	0.01	0.10	1.38	0.72	0.10	2.20
241-AP-107	0.18	0.39	0.94	0.16	3.12	9.85	6.27	3.26	19.38
241-AP-108	0.43	0.10	0.79	0.03	0.50	2.55	5.23	0.51	8.30
241-AW-101	0.12	3.24	0.44	0.13	0.62	81.04	2.91	2.65	86.60
241-AW-102	0.55	0.06	0.13	0.00	0.09	1.44	0.89	0.09	2.42
241-AW-103	0.37	0.18	4.69	0.13	0.33	4.43	31.29	2.51	38.22
241-AW-104	0.12	0.93	0.70	0.85	1.07	23.26	4.66	17.00	44.91
241-AW-105	0.41	0.11	1.99	0.10	0.43	2.84	13.27	1.93	18.05
241-AW-106	0.39	0.25	1.11	0.04	0.72	6.25	7.43	0.73	14.41
241-AY-101	0.52	0.38	0.24	0.03	0.42	9.39	1.59	0.54	11.52
241-AY-102	0.33	4.11	0.33	0.11	0.76	102.65	2.17	2.20	107.02

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-AZ-101	0.23	3.61	0.08	0.33	0.63	90.34	0.53	6.61	97.49
241-AZ-102	0.20	5.07	0.31	0.43	0.56	126.65	2.07	8.59	137.31
241-SY-101	0.09	19.60	1.98	0.39	7.20	489.92	13.23	7.83	510.98
241-SY-102	0.33	0.19	1.26	0.46	0.58	4.86	8.39	9.27	22.53
241-SY-103	0.28	1.12	2.44	0.11	0.67	27.95	16.25	2.27	46.47
241-A-101	0.15	8.82	2.52	0.04	0.87	220.56	16.81	0.72	238.09
241-A-102	0.53	0.14	0.36	0.00	0.32	3.51	2.40	0.05	5.96
241-A-103	0.40	2.62	0.66	0.01	0.55	65.55	4.37	0.20	70.11
241-A-104	0.54	0.91	0.01	0.00	0.07	22.67	0.06	0.10	22.83
241-A-105	NA	NA	NA	NA	NA	NA	NA	NA	NA
241-A-106	0.50	0.29	0.55	0.02	0.40	7.23	3.65	0.46	11.35
241-AX-101	0.25	1.89	0.47	0.02	0.07	47.26	3.11	0.47	50.84
241-AX-102	0.55	0.12	0.10	0.00	0.15	3.05	0.67	0.03	3.76
241-AX-103	0.52	0.31	0.20	0.01	0.11	7.86	1.31	0.19	9.36
241-AX-104	0.56	0.12	0.01	0.00	0.02	2.95	0.06	0.03	3.04
241-B-101	0.31	0.31	0.03	0.01	0.22	7.80	0.21	0.22	8.23
241-B-102	0.34	0.16	0.01	0.00	0.13	4.02	0.06	0.06	4.14
241-B-103	0.33	0.18	0.02	0.01	0.13	4.42	0.12	0.11	4.65
241-B-104	0.20	0.89	0.02	0.17	2.59	22.34	0.12	3.41	25.87
241-B-105	0.29	0.26	0.03	0.01	0.22	6.48	0.19	0.23	6.90
241-B-106	0.31	0.31	0.01	0.04	0.55	7.76	0.08	0.70	8.54
241-B-107	0.29	0.31	0.05	0.02	0.04	7.78	0.34	0.35	8.47
241-B-108	0.32	0.19	0.08	0.01	0.19	4.82	0.51	0.19	5.52
241-B-109	0.30	0.29	0.10	0.01	0.27	7.34	0.64	0.27	8.25
241-B-110	0.25	0.31	0.14	0.09	1.37	7.64	0.92	1.78	10.34

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State *Total Lower* Flammability Limit (%)
241-B-111	0.26	0.31	0.03	0.08	1.22	7.82	0.23	1.58	9.63
241-B-112	0.34	0.16	0.06	0.01	0.14	4.02	0.42	0.18	4.62
241-B-201	0.01	0.98	0.28	0.21	3.21	24.41	1.86	4.26	30.52
241-B-202	0.01	0.90	0.14	0.19	0.91	22.58	0.95	3.72	27.25
241-B-203	0.003	5.41	0.00	0.06	0.88	135.15	0.00	1.13	136.28
241-B-204	0.004	6.17	0.00	0.05	0.74	154.32	0.00	0.95	155.27
241-BX-101	0.34	0.17	0.10	0.01	0.18	4.20	0.69	0.24	5.13
241-BX-102	0.31	0.19	0.01	0.03	0.04	4.80	0.04	0.56	5.40
241-BX-103	0.33	0.18	0.19	0.02	0.17	4.55	1.28	0.40	6.23
241-BX-104	0.31	0.21	0.59	0.03	0.36	5.29	3.90	0.58	9.78
241-BX-105	0.33	0.17	0.37	0.01	0.29	4.23	2.44	0.28	6.95
241-BX-106	0.34	0.16	0.10	0.01	0.09	4.11	0.64	0.21	4.96
241-BX-107	0.21	0.39	0.27	0.01	0.04	9.83	1.81	0.26	11.89
241-BX-108	0.34	0.16	0.05	0.01	0.11	3.94	0.33	0.14	4.40
241-BX-109	0.27	0.27	0.05	0.06	1.00	6.72	0.34	1.30	8.35
241-BX-110	0.27	0.28	0.16	0.02	0.04	7.03	1.09	0.41	8.54
241-BX-111	0.29	0.23	0.15	0.00	0.04	5.73	1.01	0.08	6.82
241-BX-112	0.29	0.23	0.30	0.05	0.82	5.79	1.98	1.06	8.83
241-BY-101	0.28	0.36	0.15	0.02	0.14	8.92	1.00	0.49	10.42
241-BY-102	0.32	0.24	0.37	0.01	0.04	6.05	2.50	0.17	8.72
241-BY-103	0.27	0.38	0.15	0.01	0.09	9.40	1.01	0.20	10.61
241-BY-104	0.30	0.61	0.65	0.02	0.63	15.23	4.34	0.36	19.93
241-BY-105	0.23	0.51	0.58	0.03	0.53	12.72	3.84	0.61	17.18
241-BY-106	0.20	1.22	0.23	0.01	0.38	30.54	1.52	0.29	32.34

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration [H_2] (%)	Ammonia Steady State Concentration [NH_3] (%)	Methane Steady State Concentration [CH_4] (%)	N_2O Steady State Concentration [N_2O] (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-BY-107	0.33	0.28	1.52	0.02	1.11	7.06	10.10	0.32	17.48
241-BY-108	0.34	0.50	1.69	0.02	1.08	12.56	11.26	0.30	24.12
241-BY-109	0.32	0.26	0.21	0.01	0.05	6.47	1.38	0.20	8.04
241-BY-110	0.27	0.46	1.91	0.02	0.50	11.58	12.77	0.32	24.67
241-BY-111	0.25	0.39	0.14	0.01	0.20	9.76	0.95	0.13	10.84
241-BY-112	0.32	0.26	0.27	0.01	0.17	6.54	1.80	0.11	8.45
241-C-101	0.32	0.21	0.11	0.01	0.72	5.31	0.74	0.27	6.32
241-C-102	0.22	0.63	0.98	0.04	0.74	15.79	6.52	0.88	23.19
241-C-103	0.27	0.89	1.18	0.06	2.64	22.21	7.84	1.16	31.22
241-C-104	0.23	0.48	1.26	0.12	1.80	11.90	8.41	2.35	22.66
241-C-105	0.30	0.26	0.43	0.04	0.93	6.50	2.88	0.83	10.21
241-C-106	0.31	0.18	0.14	0.03	0.21	4.48	0.94	0.64	6.06
241-C-107	0.25	0.59	0.03	0.00	0.04	14.69	0.20	0.09	14.97
241-C-108	0.33	0.18	0.01	0.00	0.38	4.59	0.04	0.01	4.64
241-C-109	0.33	0.20	0.04	0.00	1.43	5.05	0.26	0.07	5.38
241-C-110	0.28	0.24	0.34	0.09	0.04	6.06	2.30	1.75	10.11
241-C-111	0.33	0.21	0.01	0.00	0.11	5.24	0.06	0.02	5.32
241-C-112	0.31	0.30	0.08	0.00	1.90	7.38	0.54	0.07	7.99
241-C-201	0.02	0.18	0.02	0.01	0.12	4.50	0.11	0.15	4.77
241-C-202	0.02	0.16	0.01	0.00	0.06	4.12	0.07	0.08	4.27
241-C-203	0.02	0.26	0.14	0.02	0.32	6.43	0.95	0.41	7.79
241-C-204	0.02	0.20	0.01	0.01	0.18	4.91	0.06	0.24	5.21
241-S-101	0.26	1.26	1.78	0.02	0.46	31.52	11.87	0.34	43.73

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-S-102	0.22	1.12	0.57	0.01	0.39	27.97	3.83	0.16	31.96
241-S-103	0.34	0.29	0.68	0.02	0.61	7.23	4.50	0.42	12.15
241-S-104	0.32	0.36	0.04	0.08	1.28	9.04	0.30	1.67	11.00
241-S-105	0.25	0.40	0.24	0.02	0.05	10.04	1.61	0.31	11.95
241-S-106	0.26	0.45	0.05	0.06	0.02	11.13	0.32	1.13	12.58
241-S-107	0.28	0.39	0.28	0.02	0.29	9.68	1.87	0.32	11.87
241-S-108	0.25	0.37	0.07	0.00	0.01	9.23	0.47	0.06	9.76
241-S-109	0.23	0.48	0.08	0.60	0.07	11.92	0.51	12.00	24.43
241-S-110	0.28	0.55	0.55	0.02	0.15	13.70	3.64	0.38	17.72
241-S-111	0.21	0.52	0.30	0.01	0.05	12.94	2.02	0.14	15.11
241-S-112	0.22	0.70	0.16	0.00	0.01	17.43	1.06	0.10	18.58
241-SX-101	0.35	0.37	0.04	0.02	0.08	9.33	0.28	0.37	9.99
241-SX-102	0.33	0.93	0.00	0.02	0.07	23.30	0.00	0.49	23.79
241-SX-103	0.28	2.88	0.58	0.09	0.20	72.04	3.86	1.72	77.62
241-SX-104	0.35	1.31	0.00	0.02	0.06	32.84	0.00	0.38	33.22
241-SX-105	0.27	4.26	0.40	0.03	0.12	106.53	2.64	0.54	109.71
241-SX-106	0.36	0.40	1.85	0.03	0.25	9.95	12.32	0.59	22.86
241-SX-107	0.50	0.48	0.14	0.02	0.30	12.12	0.90	0.39	13.41
241-SX-108	0.50	0.15	0.11	0.02	0.25	3.76	0.74	0.32	4.82
241-SX-109	0.44	0.76	0.12	0.01	0.06	18.94	0.77	0.17	19.88
241-SX-110	0.52	0.22	0.08	0.01	0.17	5.40	0.52	0.22	6.14
241-SX-111	0.49	0.80	0.16	0.02	0.36	19.94	1.07	0.46	21.47
241-SX-112	0.50	0.24	0.14	0.02	0.31	6.10	0.94	0.40	7.44

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	*Off-Nromal* Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	*Ammonia* Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-SX-113	0.53	0.11	0.04	0.01	0.08	2.73	0.25	0.11	3.09
241-SX-114	0.47	0.82	0.25	0.04	0.56	20.48	1.67	0.72	22.87
241-SX-115	0.54	0.12	0.00	0.00	0.03	2.90	0.02	0.04	2.96
241-T-101	0.31	0.23	0.05	0.01	0.11	5.87	0.32	0.18	6.37
241-T-102	0.34	0.16	0.01	0.01	0.13	3.95	0.07	0.17	4.19
241-T-103	0.34	0.17	0.01	0.01	0.11	4.20	0.07	0.14	4.41
241-T-104	0.22	0.36	0.33	0.01	0.02	9.11	2.22	0.25	11.58
241-T-105	0.31	0.20	0.21	0.03	0.45	4.98	1.40	0.58	6.96
241-T-106	0.35	0.15	0.20	0.01	0.09	3.83	1.35	0.11	5.29
241-T-107	0.28	0.24	0.28	0.05	0.09	6.01	1.85	1.04	8.90
241-T-108	0.34	0.18	0.04	0.00	0.08	4.46	0.28	0.08	4.82
241-T-109	0.33	0.18	0.01	0.01	0.10	4.47	0.07	0.11	4.65
241-T-110	0.19	0.45	0.39	0.01	0.05	11.35	2.57	0.18	14.10
241-T-111	0.17	0.53	0.80	0.21	0.05	13.35	5.30	4.17	22.82
241-T-112	0.33	0.17	0.06	0.02	0.29	4.34	0.41	0.38	5.13
241-T-201	0.01	0.98	0.06	0.21	3.21	24.61	0.37	4.26	29.24
241-T-202	0.02	0.64	0.10	0.12	1.86	16.09	0.67	2.44	19.20
241-T-203	0.01	1.44	0.00	0.32	4.77	35.96	0.00	6.41	42.38
241-T-204	0.01	1.76	0.10	0.40	5.85	43.99	0.66	7.95	52.60
241-TX-101	0.40	0.20	0.02	0.02	0.09	5.06	0.16	0.40	5.62
241-TX-1019	0.35	0.22	0.55	0.01	0.18	5.61	3.69	0.13	9.43
241-TX-102	0.37	0.19	0.20	0.01	0.16	4.68	1.34	0.12	6.14

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Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-TX-103	0.41	0.15	0.02	0.01	0.04	3.74	0.16	0.10	4.00
241-TX-104	0.18	0.64	0.15	0.01	0.10	15.96	1.03	0.22	17.21
241-TX-105	0.30	0.32	0.59	0.02	0.12	7.95	3.96	0.32	12.23
241-TX-106	0.42	0.14	0.34	0.00	0.05	3.43	2.24	0.05	5.73
241-TX-107	0.38	0.17	0.06	0.00	0.05	4.21	0.39	0.05	4.65
241-TX-108	0.28	0.34	1.00	0.11	1.66	8.38	6.66	2.16	17.20
241-TX-110	0.24	0.41	2.71	0.01	0.37	10.21	18.07	0.17	28.45
241-TX-111	0.28	0.32	2.03	0.01	0.60	7.90	13.56	0.13	21.59
241-TX-112	0.17	0.68	0.47	0.03	0.21	16.99	3.12	0.55	20.66
241-TX-113	0.18	0.62	0.11	0.02	0.25	15.59	0.72	0.38	16.69
241-TX-114	0.21	0.47	0.89	0.01	0.22	11.72	5.94	0.23	17.89
241-TX-115	0.20	0.51	0.07	0.01	0.23	12.86	0.46	0.23	13.55
241-TX-116	0.17	0.65	0.02	0.02	0.09	16.29	0.17	0.42	16.88
241-TX-117	0.18	0.61	0.05	0.01	0.18	15.33	0.34	0.21	15.88
241-TX-118	0.31	0.29	0.11	0.07	0.06	7.18	0.76	1.39	9.33
241-TY-101	0.39	0.16	0.01	0.00	0.08	4.00	0.09	0.04	4.14
241-TY-102	0.41	0.14	0.01	0.00	0.11	3.60	0.05	0.09	3.74
241-TY-103	0.37	0.18	0.10	0.03	0.44	4.51	0.67	0.66	5.85
241-TY-104	0.42	0.15	0.19	0.01	0.31	3.85	1.25	0.20	5.30
241-TY-105	0.34	0.22	0.01	0.05	0.10	5.60	0.03	0.93	6.56
241-TY-106	0.43	0.12	0.03	0.00	0.07	3.11	0.21	0.09	3.41
241-U-101	0.34	0.16	0.20	0.01	0.10	4.12	1.35	0.13	5.61
241-U-102	0.20	0.79	0.69	0.01	0.85	19.86	4.57	0.25	24.68

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-2 Steady-State Gas Concentrations and Flammability Levels at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Off-Nromal Ventilation Rate (Vr)bb (cfm)	Hydrogen Steady State Concentration $[H_2]$ (%)	Ammonia Steady State Concentration $[NH_3]$ (%)	Methane Steady State Concentration $[CH_4]$ (%)	N_2O Steady State Concentration $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Lower Flammability Limit (%)
241-U-103	0.16	1.16	1.08	0.02	1.13	29.03	7.18	0.42	36.64
241-U-104	0.30	0.34	0.00	0.01	0.20	8.43	0.01	0.26	8.70
241-U-105	0.18	0.94	5.10	0.11	7.17	23.39	34.01	2.17	59.58
241-U-106	0.26	0.69	0.47	0.03	0.28	17.15	3.11	0.52	20.79
241-U-107	0.18	0.52	2.78	0.06	3.56	12.88	18.55	1.21	32.65
241-U-108	0.16	0.93	1.53	0.02	1.09	23.34	10.21	0.50	34.04
241-U-109	0.16	0.70	0.00	0.03	1.31	17.61	0.00	0.55	18.16
241-U-110	0.28	0.37	0.15	0.06	0.95	9.16	1.02	1.24	11.42
241-U-111	0.22	0.52	0.58	0.01	0.28	13.03	3.88	0.21	17.12
241-U-112	0.33	0.17	0.12	0.01	0.08	4.23	0.77	0.27	5.26
241-U-201	0.02	0.22	0.14	0.02	0.32	5.54	0.95	0.41	6.90
241-U-202	0.02	0.22	0.14	0.02	0.32	5.54	0.95	0.41	6.91
241-U-203	0.02	0.19	0.01	0.01	0.18	4.64	0.05	0.24	4.93
241-U-204	0.02	0.18	0.01	0.01	0.18	4.60	0.04	0.24	4.87

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Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility 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	17	2.01	0.51	1.80	0.02	0.32	12.70	11.97	0.32
241-AN-103	171	0.36	0.90	0.19	0.06	0.19	22.56	1.27	1.17
241-AN-104	92	0.44	0.84	0.48	0.04	0.16	20.89	3.21	0.90
241-AN-105	54	0.55	0.89	0.28	0.04	0.24	22.31	1.87	0.82
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	15	2.35	0.39	2.21	0.03	0.30	9.70	14.74	0.55
241-AP-101	64	0.49	0.22	2.72	0.07	1.35	5.49	18.14	1.37
241-AP-102	86	0.41	0.28	2.45	0.08	1.58	7.06	16.33	1.61
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	73	0.42	0.94	0.12	0.04	0.17	23.44	0.82	0.74
241-AW-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AW-103	226	0.59	0.11	3.08	0.08	0.21	2.87	20.53	1.60
241-AW-104	178	0.22	0.52	0.39	0.47	0.59	13.00	2.58	9.42
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	57	1.48	0.96	0.07	0.02	0.17	24.01	0.49	0.50

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Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility at Time $t_{25\%}$ (%)	Methane Flammability at Time $t_{25\%}$ (%)
241-AZ-101	63	0.96	0.93	0.02	0.08	0.16	23.21	0.13	1.65
241-AZ-102	42	1.16	0.93	0.05	0.08	0.10	23.13	0.36	1.50
241-SY-101	9	2.32	0.97	0.08	0.02	0.31	24.13	0.54	0.31
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	168	0.53	0.60	1.32	0.06	0.36	14.99	8.80	1.21
241-A-101	22	1.60	0.92	0.28	0.00	0.09	23.07	1.84	0.08
241-A-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-103	91	1.15	0.93	0.24	0.00	0.20	23.33	1.59	0.07
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	147	0.53	0.93	0.23	0.01	0.04	23.24	1.52	0.23
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	734	0.21	0.86	0.02	0.16	2.51	21.60	0.11	3.29
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 4-24-00 Checked by [illegible] Date 4-24-00

Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility 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	376	0.02	0.80	0.23	0.17	2.66	20.01	1.52	3.48
241-B-202	549	0.01	0.83	0.13	0.17	0.83	20.72	0.87	3.40
241-B-203	42	0.02	0.99	0.00	0.01	0.16	24.79	0.00	0.21
241-B-204	36	0.03	0.99	0.00	0.01	0.12	24.84	0.00	0.15
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	323	0.27	0.94	0.18	0.01	0.29	23.60	1.18	0.22

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Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility 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	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	339	0.35	0.71	0.93	0.05	2.10	17.87	6.22	0.91
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	179	0.47	0.72	1.03	0.01	0.27	17.94	6.87	0.19

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Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility at Time $t_{25\%}$ (%)	Methane Flammability at Time $t_{25\%}$ (%)
241-S-102	323	0.29	0.87	0.46	0.01	0.31	21.84	3.03	0.13
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	84	0.89	0.93	0.18	0.03	0.06	23.22	1.23	0.55
241-SX-104	306	0.47	0.99	0.00	0.01	0.04	24.72	0.00	0.28
241-SX-105	55	1.27	0.97	0.09	0.01	0.03	24.28	0.59	0.12
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

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility at Time $t_{25\%}$ (%)	Methane Flammability at Time $t_{25\%}$ (%)
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
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	424	0.01	0.84	0.05	0.18	2.77	21.05	0.32	3.63
241-T-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-203	180	0.02	0.85	0.00	0.18	2.79	21.36	0.00	3.64
241-T-204	140	0.02	0.84	0.05	0.19	2.87	20.95	0.31	3.74
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

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Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility at Time $t_{25\%}$ (%)	Methane Flammability at Time $t_{25\%}$ (%)
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
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	452	0.29	0.36	2.39	0.01	0.32	8.93	15.92	0.15
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

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-3 Gas Concentrations, Time to Reach 25% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	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 Flammibility at Time $t_{25\%}$ (%)	Methane Flammability at Time $t_{25\%}$ (%)
241-U-103	240	0.24	0.79	0.74	0.01	0.78	19.77	4.94	0.29
241-U-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-105	102	0.45	0.41	2.08	0.04	2.97	10.31	13.84	0.85
241-U-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-107	308	0.25	0.40	2.13	0.05	2.73	9.91	14.17	0.92
241-U-108	282	0.22	0.68	1.13	0.02	0.80	17.12	7.51	0.36
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 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ $[CH4](t)$ (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility 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	79	0.48	2.06	7.07	0.07	1.29	51.51	47.16	1.32
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	497	0.13	3.56	1.14	0.17	0.97	89.04	7.61	3.34
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	69	0.55	1.59	8.70	0.11	1.20	39.76	58.00	2.23
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	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	581	0.35	3.84	0.30	0.10	0.70	95.95	2.01	2.04

Author [illegible] Date 4-26-00 Checked by S. [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ [CH4](t) (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility at Time $t_{100\%}$ (%)	Methane Flammability at Time $t_{100\%}$ (%)
241-AZ-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AZ-102	276	0.28	3.70	0.22	0.31	0.40	92.40	1.47	6.12
241-SY-101	39	0.55	3.86	0.33	0.06	1.25	96.54	2.18	1.27
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	110	0.38	3.71	1.03	0.01	0.35	92.85	6.86	0.29
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 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ [CH4](t) (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility 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	278	0.00	3.97	0.00	0.04	0.63	99.19	0.00	0.81
241-B-204	215	0.01	3.98	0.00	0.03	0.46	99.40	0.00	0.59
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 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ $[CH4](t)$ (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility 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

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ $[CH4](t)$ (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility at Time $t_{100\%}$ (%)	Methane Flammability at Time $t_{100\%}$ (%)
241-S-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
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	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SX-105	516	0.30	3.89	0.36	0.02	0.11	97.13	2.39	0.48
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

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ [CH4](t) (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility at Time $t_{100\%}$ (%)	Methane Flammability at Time $t_{100\%}$ (%)
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
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

Author [illegible] Date 4-24-00 Checked by [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ [CH4](t) (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility at Time $t_{100\%}$ (%)	Methane Flammability at Time $t_{100\%}$ (%)
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
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

Author [illegible] Date 4-24-00 Checked by S. [illegible] Date 4-24-00

Table B-4 Gas Concentrations, Time to Reach 100% LFL and Flammability Distribution Among Gases at Off-Normal Vent Conditions (8 Sheets)

Tank Name	Time to Reach 100% LFL $t_{100\%}$ (day)	Minimum Vent rate to prevent reaching 100% LFL (cfm)	Hydrogen Concebtration at time $t_{100\%}$ $[H_2](t)$ (%)	Ammonia Concentration at Time $t_{100\%}$ $[NH_3](t)$ (%)	Methane Concentration at time $t_{100\%}$ [CH4](t) (%)	N_2O Concentration at Time $t_{100\%}$ $[N_2O](t)$ (%)	Hydrogen Flammability at Time $t_{100\%}$ (%)	Ammonia Flammibility at Time $t_{100\%}$ (%)	Methane Flammability at Time $t_{100\%}$ (%)
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	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
241-U-108	not occur	not occur	not occur	not occur	not occur	not occur	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 C

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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CH2MHILL
Hanford Group, Inc.

SA Barker

Hydrogen Generation Rate Calculations

Check of calculations, Single-Point Calculation

References

Hu, T. A., 2000, "*Empirical Rate Equation Model and Rate Calculations of Hydrogen Generation for Hanford Tank Waste*", HNF-3851, Rev. 0A, Lockheed Martin Hanford, Corp., Richland, WA.

Kufahl, M A, and D. A. Hendengren, 2000, "*Hydrogen Generation Rate Model Calculation Input Data*", RPP-6069, Rev 0, CH2M HILL Hanford Group, Inc., Richland, WA.

Bingham, J. D., M. A. Kufahl, S. A. Barker, 2000, "*Collection And Analysis Of Selected Tank Headspace Parameter Data*", RPP-5660, Rev 0, CH2M Hill Hanford Group, Inc., Richland, WA.

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-AN-104"

...The following data is from Kufhal 2000, except where noted

$$[TOC] := \begin{pmatrix} 3110 \\ 3110 \\ 3110 \\ 3110 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_2] := \begin{pmatrix} 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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

$$[Al] := \begin{pmatrix} 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[NO_3] := \begin{pmatrix} 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

$$[137Cs] := \begin{pmatrix} 4.67 \cdot 10^2 \\ 3.84 \cdot 10^{-12} \\ 5.38 \cdot 10^2 \\ 3.83 \cdot 10^2 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

$$[90Sr] := \begin{pmatrix} 1.70 \cdot 10^1 \\ 3.91 \cdot 10^{-12} \\ 7.31 \cdot 10^{-2} \\ 3.7 \cdot 10^1 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$$

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$$\rho_{waste} := \begin{pmatrix} 1.48 \\ 1.39 \\ 1.40 \\ 1.59 \end{pmatrix} \cdot \frac{gm}{mL}$$

$$vol_{waste} := \begin{pmatrix} 3986 \\ 10^{-9} \\ 2286 \\ 1700 \end{pmatrix} \cdot kilo \cdot L \qquad F_{H2O} := \begin{pmatrix} 48.7 \\ 45.0 \\ 50.9 \\ 45.8 \end{pmatrix} \cdot \% \qquad F_{liquid} := \begin{pmatrix} 96 \\ 89 \\ 100 \\ 90 \end{pmatrix} \cdot \%$$

$$Temp_{waste} := \begin{pmatrix} 308.93 \\ 308.93 \\ 308.93 \\ 308.93 \end{pmatrix} \cdot K \qquad Temp_{vap} := 302.372 \cdot K$$

From (Bingham 2000)

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

$$HeatLoad_{137Cs,90Sr} := \begin{pmatrix} 1.367 \cdot 10^{4} \\ 10^{-9} \\ 8.129 \cdot 10^{3} \\ 5.555 \cdot 10^{3} \end{pmatrix} \cdot watt$$

Calculated by Barker in
"Decay Heat Generation Rate AN-104.MCD"

$vol_{tank} := (1407) \cdot kilo \cdot gal$

$vent_rate := 100 \cdot cfm$ From (Bingham 2000)

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

$$vent_rate_{bb} = 0.148\, cfm$$

AN Tank farm: Tank Data

$diam_{tank} := 75 \cdot ft$

$$ht_{tank} := \frac{vol_{waste}}{2754 \cdot \frac{gal}{in}}$$

estimation of waste depth

$$ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592 \times 10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix} in$$

$$vol_{head} := vol_{tank} - vol_{waste_1}$$

$$vol_{head} = 4.732 \times 10^{4}\, ft^{3}$$

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

$[H_2] := .0020 \cdot \%$ $[CH_4] := .000195 \cdot \%$ $[N2O] := .000709 \cdot \%$ $[NH_3] := .0021 \cdot \%$

Gas Concentrations at LFL

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

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

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

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)

$E_{thm} := 89.33 \frac{kilo\ J}{g_mol}$ *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

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

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$$W_{H2O} = \begin{pmatrix} 2.873 \times 10^{6} \\ 6.255 \times 10^{-7} \\ 1.629 \times 10^{6} \\ 1.238 \times 10^{6} \end{pmatrix} kg$$

Check units on input data

$$[TOC] = \begin{pmatrix} 3.110 \times 10^{3} \\ 3.110 \times 10^{3} \\ 3.110 \times 10^{3} \\ 3.110 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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

$$[TOC_{wt\%}] = \begin{pmatrix} 0.222 \\ 0.222 \\ 0.222 \\ 0.222 \end{pmatrix}$$

$$[Al] = \begin{pmatrix} 38.600 \times 10^{3} \\ 38.600 \times 10^{3} \\ 38.600 \times 10^{3} \\ 38.600 \times 10^{3} \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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

$$[Al_{wt\%}] = \begin{pmatrix} 2.757 \\ 2.757 \\ 2.757 \\ 2.757 \end{pmatrix}$$

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Calculate the Hydrogen Generation Rate due to Thermolysis (HGR_{therm})

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

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

$$HGR_{therm} = \begin{pmatrix} 4.867 \times 10^{-7} \\ 4.512 \times 10^{-7} \\ 5.070 \times 10^{-7} \\ 4.563 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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

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

$$HGR_{thermv} = \begin{pmatrix} 2.502 \\ 5.496 \times 10^{-13} \\ 1.422 \\ 1.081 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv} = \begin{pmatrix} 1.738 \times 10^{-3} \\ 3.816 \times 10^{-16} \\ 9.873 \times 10^{-4} \\ 7.505 \times 10^{-4} \end{pmatrix} cfm$$

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

$$HGR_{thermv_scf} = \begin{pmatrix} 2.261 \\ 4.965 \times 10^{-13} \\ 1.284 \\ 0.976 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.570 \times 10^{-3} \\ 3.448 \times 10^{-16} \\ 8.919 \times 10^{-4} \\ 6.780 \times 10^{-4} \end{pmatrix} cfm$$

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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)

$a_{rad} := 2.49 \cdot 10^6 \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential factor of G in organic radiolysis (Hu, 2000 - eqn 4-16)

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

Reactivity coefficient of TOC (0.7 for DSTs, 0.4 for SSts) (Hu, 2000 - eqn 4-16)

$r_f = 0.700$

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

Check units on input data

$Temp_{waste_2} = 308.930\,K$

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

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

$$[NO_3] = \begin{pmatrix} 170.000 \times 10^3 \\ 170.000 \times 10^3 \\ 170.000 \times 10^3 \\ 170.000 \times 10^3 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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

$$[NO_{3_molar}] = \begin{pmatrix} 2.742 \\ 2.742 \\ 2.742 \\ 2.742 \end{pmatrix} \frac{g_mol}{liter}$$

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$$[NO_2] = \begin{pmatrix} 125.000 \times 10^3 \\ 125.000 \times 10^3 \\ 125.000 \times 10^3 \\ 125.000 \times 10^3 \end{pmatrix} \frac{\mu \cdot gm}{mL}$$

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

$$[NO_{2_molar}] = \begin{pmatrix} 2.717 \\ 2.717 \\ 2.717 \\ 2.717 \end{pmatrix} \frac{g_mol}{liter}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 2.897 \times 10^{12} \\ 0.212 \\ 1.723 \times 10^{12} \\ 1.177 \times 10^{12} \end{pmatrix} \mu \cdot Ci$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 4.664 \times 10^4 \\ 3.412 \times 10^{-9} \\ 2.774 \times 10^4 \\ 1.895 \times 10^4 \end{pmatrix} \frac{BTU}{hr}$$

$$HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 1.367 \times 10^4 \\ 1.000 \times 10^{-9} \\ 8.129 \times 10^3 \\ 5.555 \times 10^3 \end{pmatrix} watt$$

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

$$H_{load} = \begin{pmatrix} 2.317 \times 10^{-3} \\ 7.194 \times 10^{-4} \\ 2.540 \times 10^{-3} \\ 2.055 \times 10^{-3} \end{pmatrix} \frac{watt}{kg}$$

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Calculate the Hydrogen Generation Rate due to Radiolysis (HGR_{rad})

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

$$G_{org} = \begin{pmatrix} 0.012 \\ 0.012 \\ 0.012 \\ 0.012 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \overrightarrow{\left[\left[0.45 - 0.56 \cdot \left[\frac{[NO_{3_molar}]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO_{2_molar}]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}}\right] \cdot \frac{molecules}{100 \cdot eV}\right]}$$

$$G_{H2O} = \begin{pmatrix} -0.934 \\ -0.934 \\ -0.934 \\ -0.934 \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

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

$$G_{H2O} = \begin{pmatrix} 5.000 \times 10^{-3} \\ 5.000 \times 10^{-3} \\ 5.000 \times 10^{-3} \\ 5.000 \times 10^{-3} \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

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

$$HGR_{rad} = \begin{pmatrix} 2.749 \times 10^{-7} \\ 7.913 \times 10^{-8} \\ 3.139 \times 10^{-7} \\ 2.286 \times 10^{-7} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad} = \begin{pmatrix} 3.473 \times 10^{-7} \\ 9.996 \times 10^{-8} \\ 3.966 \times 10^{-7} \\ 2.888 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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

$$HGR_{radv} = \begin{pmatrix} 1.7952 \\ 1.2175 \times 10^{-13} \\ 1.1120 \\ 0.6839 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 1.247 \times 10^{-3} \\ 8.455 \times 10^{-17} \\ 7.723 \times 10^{-4} \\ 4.750 \times 10^{-4} \end{pmatrix} cfm$$

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

$$HGR_{radv_scf} = \begin{pmatrix} 1.622 \\ 1.100 \times 10^{-13} \\ 1.005 \\ 0.618 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_scf} = \begin{pmatrix} 1.126 \times 10^{-3} \\ 7.638 \times 10^{-17} \\ 6.976 \times 10^{-4} \\ 4.291 \times 10^{-4} \end{pmatrix} cfm$$

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

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

$$R_{corr} := \begin{cases} 1.2 \cdot 10^{-7} \cdot \frac{ft^3}{ft^2 \cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 1.2 \cdot 10^{-7} \cdot \frac{ft^3}{ft^2 \cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 6.0 \cdot 10^{-8} \cdot \frac{ft^3}{ft^2 \cdot min} & \text{otherwise} \end{cases}$$

Corrosion coefficient (6.0E-08 for DSTs, 1.2E-07 for SSts) ($ft^3/min/ft^2$) Reference temperature is 25°C (Hu, 2000 - eqn 4-17)

$$R_{corr} = 6.000 \times 10^{-8} \frac{ft^3}{ft^2 \cdot min}$$

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

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

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

$$Awet = \begin{pmatrix} 1.193 \times 10^4 \\ 1.883 \times 10^{-9} \\ 4.306 \times 10^3 \\ 7.620 \times 10^3 \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due to Corrosion

$$HGR_{corr_mol} := \overrightarrow{\frac{R_{corr} \cdot Awet}{(vol_{waste} \cdot \rho_{waste})}} \cdot \frac{273.15 \cdot K}{298.15 \cdot K} \qquad HGR_{corr_mol_i} = \begin{pmatrix} 2.022 \times 10^{-7} \\ 1.355 \times 10^{-7} \\ 1.345 \times 10^{-7} \\ 2.819 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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

$$HGR_{corr} = \begin{pmatrix} 7.256 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.620 \times 10^{-4} \\ 4.637 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr} = \begin{pmatrix} 1.045 \\ 1.650 \times 10^{-13} \\ 0.377 \\ 0.668 \end{pmatrix} \frac{ft^3}{day}$$

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

$$HGR_{corr_scf} = \begin{pmatrix} 6.555 \times 10^{-4} \\ 1.035 \times 10^{-16} \\ 2.367 \times 10^{-4} \\ 4.188 \times 10^{-4} \end{pmatrix} \frac{ft^3}{min}$$

$$HGR_{corr_scf} = \begin{pmatrix} 0.944 \\ 1.491 \times 10^{-13} \\ 0.341 \\ 0.603 \end{pmatrix} \frac{ft^3}{day}$$

Total Hydrogen Generation Rate

$$mass_{waste} = \begin{pmatrix} 5.899 \times 10^6 \\ 1.390 \times 10^{-6} \\ 3.200 \times 10^6 \\ 2.703 \times 10^6 \end{pmatrix} kg$$

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$$HGR_{thermv} = \begin{pmatrix} 2.502 \\ 5.496 \times 10^{-13} \\ 1.422 \\ 1.081 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv} = \begin{pmatrix} 1.795 \\ 1.218 \times 10^{-13} \\ 1.112 \\ 0.684 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr} = \begin{pmatrix} 1.045 \\ 1.650 \times 10^{-13} \\ 0.377 \\ 0.668 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR := HGR_{thermv} + HGR_{radv} + HGR_{corr}$$

$$HGR = \begin{pmatrix} 3.710 \times 10^{-3} \\ 5.808 \times 10^{-16} \\ 2.022 \times 10^{-3} \\ 1.689 \times 10^{-3} \end{pmatrix} cfm$$

$$HGR = \begin{pmatrix} 151.287 \\ 2.368 \times 10^{-11} \\ 82.432 \\ 68.875 \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

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

$$HGR_{stp} = \begin{pmatrix} 3.352 \times 10^{-3} \\ 5.247 \times 10^{-16} \\ 1.826 \times 10^{-3} \\ 1.526 \times 10^{-3} \end{pmatrix} cfm$$

$$HGR_{stp} = \begin{pmatrix} 4.826 \\ 7.555 \times 10^{-13} \\ 2.630 \\ 2.197 \end{pmatrix} \frac{ft^3}{day}$$

At Standard conditions...

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Steady-State Hydrogen Concentration (assuming normal ventilation rate)

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

$$[H2_{ss}] = 37.100\,ppmv$$

$$[H2_{ss}] = 3.710 \times 10^{-3}\,\%$$

Steady-State Hydrogen Concentration (assuming barometric breathing ventilation rate)

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

$$[H2_{ss_bb}] = 2.447 \times 10^{4}\,ppmv$$

$$[H2_{ss_bb}] = 2.447\,\%$$

$$[H2_{ss_bb}] = 61.184\,\%LFL_{H2}$$

Gas release Rate (independent of ventilation rate)

$$rate_{H2_rel} := [H2_{ss}] \cdot \frac{vent_rate}{1 - [H2_{ss}]} \qquad rate_{H2_rel_bb} := [H2_{ss_bb}] \cdot \frac{vent_rate_{bb}}{1 - [H2_{ss_bb}]}$$

$$rate_{H2_rel} = 3.710 \times 10^{-3}\,cfm \qquad rate_{H2_rel_bb} = 3.710 \times 10^{-3}\,cfm$$

Calculate generation Rates of Ammonia, Methane, and Nitrous Oxide (assuming no gas retention)

$$GR_{NH3} := \frac{[NH_3] \cdot vent_rate}{1 - [NH_3]} \qquad GR_{NH3} = 2.100 \times 10^{-3}\,cfm$$

$$GR_{CH4} := \frac{[CH_4] \cdot vent_rate}{1 - [CH_4]} \qquad GR_{CH4} = 1.950 \times 10^{-4}\,cfm$$

$$GR_{N2O} := \frac{[N2O] \cdot vent_rate}{1 - [N2O]} \qquad GR_{N2O} = 7.090 \times 10^{-4}\,cfm$$

Steady-State Ammonia, Methane, and Nitrous Oxide Concentration (assuming normal ventilation rate)(just a check of methodology)

$$[NH3_{ss}] := \frac{GR_{NH3}}{GR_{NH3} + vent_rate} \qquad [NH3_{ss}] = 2.100 \times 10^{-3}\,\%$$

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$$[CH4_{ss}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate} \qquad [CH4_{ss}] = 1.950 \times 10^{-4}\%$$

$$[N2O_{ss}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate} \qquad [N2O_{ss}] = 7.090 \times 10^{-4}\%$$

Steady-State Ammonia, Methane, and Nitrous Oxide Concentration (assuming barometric breathing ventilation rate)

$$[NH3_{ss_bb}] := \frac{GR_{NH3}}{GR_{NH3} + vent_rate_{bb}} \qquad [NH3_{ss_bb}] = 1.400\%$$

$$[NH3_{ss_bb}] = 9.334\%LFL_{NH3}$$

$$[CH4_{ss_bb}] := \frac{GR_{CH4}}{GR_{CH4} + vent_rate_{bb}} \qquad [CH4_{ss_bb}] = 0.132\%$$

$$[CH4_{ss_bb}] = 2.634\%LFL_{CH4}$$

$$[N2O_{ss_bb}] := \frac{GR_{N2O}}{GR_{N2O} + vent_rate_{bb}} \qquad [N2O_{ss_bb}] = 0.477\%$$

Determine the Overall Steady-State Flammable Gas Concentration with Loss of Ventilation

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

$$[Conc_mix_{ss_bb}] = 73.152\%LFL$$

Set Variables into Array, where 1 => H2, 2 => NH3, 3 => CH4, and 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} 3.710 \times 10^{-3} \\ 2.100 \times 10^{-3} \\ 1.950 \times 10^{-4} \\ 7.090 \times 10^{-4} \end{pmatrix} cfm$$

Generation Rate

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ GR_{NH3} \\ GR_{CH4} \\ GR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} 3.710 \times 10^{-3} \\ 2.100 \times 10^{-3} \\ 1.950 \times 10^{-4} \\ 7.090 \times 10^{-4} \end{pmatrix} cfm$$

Release Rate (Assume no retention)

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$$Conc_{init} := \begin{pmatrix} [H2_{ss}] \\ [NH3_{ss}] \\ [CH4_{ss}] \\ [N2O_{ss}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 3.710 \times 10^{-3} \\ 2.100 \times 10^{-3} \\ 1.950 \times 10^{-4} \\ 7.090 \times 10^{-4} \end{pmatrix} \%$$

Initial Concentration Rate (Assume at Steady-State with normal ops)

Calculate the composition of all components at time 't'

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

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

$$conc(t,i) := Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]$$

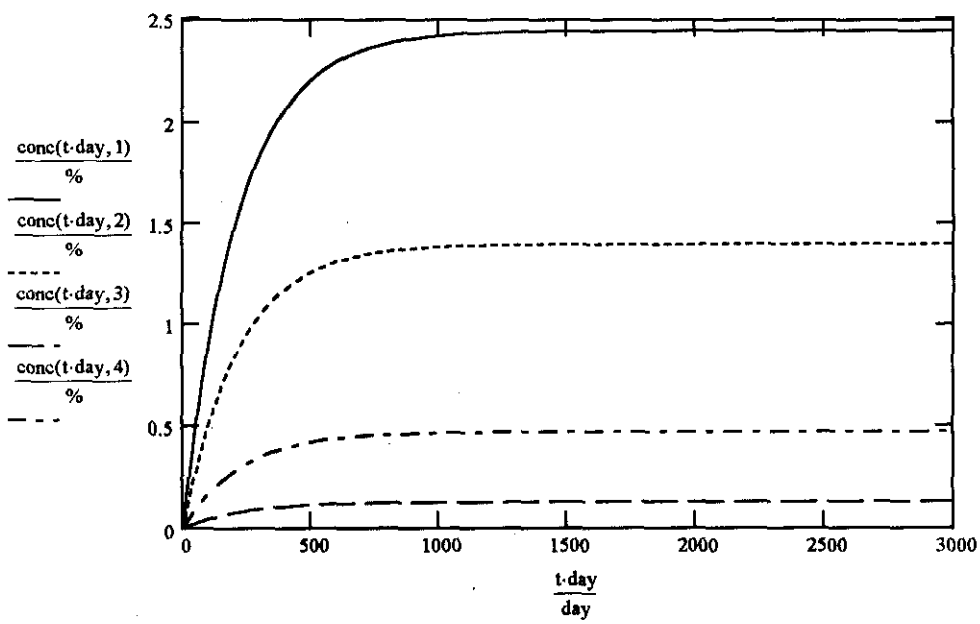
$conc(0 \cdot sec, 1) = 3.710 \times 10^{-3}\%$ $\quad conc(1000 \cdot day, 1) = 2.423\%$ $\quad conc(1000 \cdot day, 1) = 60.578\%LFL_{H2}$

$conc(0 \cdot sec, 2) = 2.100 \times 10^{-3}\%$ $\quad conc(1000 \cdot day, 2) = 1.386\%$ $\quad conc(1000 \cdot day, 2) = 9.237\%LFL_{NH3}$

$conc(0 \cdot sec, 3) = 1.950 \times 10^{-4}\%$ $\quad conc(1000 \cdot day, 3) = 0.130\%$ $\quad conc(1000 \cdot day, 3) = 2.605\%LFL_{CH4}$

$conc(0 \cdot sec, 4) = 7.090 \times 10^{-4}\%$ $\quad conc(1000 \cdot day, 4) = 0.472\%$

$t := 0, 10 .. 3000$



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Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

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

$LFL_{mix}(0 \cdot day) = 9.037 \times 10^{4}\,\%$

$LFL_{mix}(1000000 \cdot day) = 136.702\,\%$

Calculate the time to reach various fractions of the LFL

time to reach 25 %LFL

TOL := .00001

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

$tlfl := 25$

$z := 10 \cdot day$ **Initial Guess** $temp_{25} := -5 \cdot day$ ***Initial Value in case solution cannot be found***

$temp_{25} := Re(root(f(z,tlfl),z))$

$temp_{25} = 90.525\,day$

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

$Time_{1_25\%LFL} = 90.525\,day$

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***

$temp_{50} := Re(root(f(z,tlfl),z))$

$temp_{50} = 249.624\,day$

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

$Time_{1_50\%LFL} = 249.624\,day$

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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**

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

$temp_{75} = 798.849\ day$

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

$Time_{1_75\%LFL} = 1.000 \times 10^9\ day$

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**

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

$temp_{100} = 217.412\ day$

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

$Time_{1_100\%LFL} = 1.000 \times 10^9\ day$

Minimum Ventilation Rates Need to Prevent Headspace Concentrations from Reaching Various Levels

$$Conc_vr(V,i) := \frac{Rate_{rel_i} \cdot 100\%}{Rate_{rel_i} + V} \cdot \left[1 - e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right] + Conc_{init_i} \cdot \left[e^{\left(-\frac{V + Rate_{rel_i}}{vol_{head}} \cdot 10^9 \cdot day\right)}\right]$$

ventilation Rate to keep concentration less than 25 %LFL

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

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$z := .001 \cdot cfm$ **Initial Guess** $temp_{25} := -5 \cdot cfm$ **Initial Value in case solution cannot be found**

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

$temp_{25} = 0.439254\,cfm$

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

$vent_rate_{1_25\%LFL} = 0.440\,cfm$

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**

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

$temp_{50} = 0.217934\,cfm$

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

$vent_rate_{1_50\%LFL} = 0.219\,cfm$

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**

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

$temp_{75} = 0.144163\,cfm$

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

$vent_rate_{1_75\%LFL} = 0.145\,cfm$

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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**

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

$temp_{100} = 0.107279\,cfm$

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

$vent_rate_{1_100\%LFL} = 0.108\,cfm$

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Summary Section

Input Data

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

Tank_id = "241-AN-104" $class_{waste}$ = "dst"

$$[TOC] = \begin{pmatrix} 3.110\times10^{3} \\ 3.110\times10^{3} \\ 3.110\times10^{3} \\ 3.110\times10^{3} \end{pmatrix} \frac{\mu\cdot gm}{mL} \qquad [NO_3] = \begin{pmatrix} 1.700\times10^{5} \\ 1.700\times10^{5} \\ 1.700\times10^{5} \\ 1.700\times10^{5} \end{pmatrix} \frac{\mu\cdot gm}{mL} \qquad [NO_2] = \begin{pmatrix} 1.250\times10^{5} \\ 1.250\times10^{5} \\ 1.250\times10^{5} \\ 1.250\times10^{5} \end{pmatrix} \frac{\mu\cdot gm}{mL}$$

$$[Al] = \begin{pmatrix} 3.860\times10^{4} \\ 3.860\times10^{4} \\ 3.860\times10^{4} \\ 3.860\times10^{4} \end{pmatrix} \frac{\mu\cdot gm}{mL} \qquad [137Cs] = \begin{pmatrix} 467.000 \\ 3.840\times10^{-12} \\ 538.000 \\ 383.000 \end{pmatrix} \frac{\mu\cdot Ci}{gm} \qquad [90Sr] = \begin{pmatrix} 17.000 \\ 3.910\times10^{-12} \\ 0.073 \\ 37.000 \end{pmatrix} \frac{\mu\cdot Ci}{gm}$$

$$vol_{waste} = \begin{pmatrix} 1.408\times10^{5} \\ 3.531\times10^{-8} \\ 8.073\times10^{4} \\ 6.003\times10^{4} \end{pmatrix} ft^3 \qquad \rho_{waste} = \begin{pmatrix} 1.480 \\ 1.390 \\ 1.400 \\ 1.590 \end{pmatrix} \frac{gm}{mL} \qquad Temp_{waste} = \begin{pmatrix} 308.930 \\ 308.930 \\ 308.930 \\ 308.930 \end{pmatrix} K$$

$$F_{H2O} = \begin{pmatrix} 48.700 \\ 45.000 \\ 50.900 \\ 45.800 \end{pmatrix} \% \qquad HeatLoad_{137Cs_90Sr} = \begin{pmatrix} 1.367\times10^{4} \\ 1.000\times10^{-9} \\ 8.129\times10^{3} \\ 5.555\times10^{3} \end{pmatrix} watt \qquad Temp_{vap} = 302.372\,K$$

$vol_{tank} = 1.407\times10^{3}$ kilo·gal vent_rate = 100.000 cfm $vent_rate_{bb} = 0.148$ cfm

AN Tank farm: Tank Data

$diam_{tank} = 75.000$ ft

$$ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592\times10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix} in$$

estimation of waste depth

Dome-Space Compositions

$[CH_4] = 1.950\times10^{-4}\%$ $[N2O] = 7.090\times10^{-4}\%$ $[NH_3] = 2.100\times10^{-3}\%$

End of Input Data

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Output Data

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

Hydrogen Generation Rate due to Thermolysis, Radiolysis, and Corrosion...

$$HGR_{thermv} = \begin{pmatrix} 1.738 \times 10^{-3} \\ 3.816 \times 10^{-16} \\ 9.873 \times 10^{-4} \\ 7.505 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv} = \begin{pmatrix} 1.247 \times 10^{-3} \\ 8.455 \times 10^{-17} \\ 7.723 \times 10^{-4} \\ 4.750 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{corr} = \begin{pmatrix} 7.256 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.620 \times 10^{-4} \\ 4.637 \times 10^{-4} \end{pmatrix} cfm$$

Overall Hydrogen Generation Rate...

at the headspace conditions... **at standard conditions (273°K)...**

$$HGR = \begin{pmatrix} 3.710 \times 10^{-3} \\ 5.808 \times 10^{-16} \\ 2.022 \times 10^{-3} \\ 1.689 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{stp} = \begin{pmatrix} 3.352 \times 10^{-3} \\ 5.247 \times 10^{-16} \\ 1.826 \times 10^{-3} \\ 1.526 \times 10^{-3} \end{pmatrix} cfm$$

$$HGR = \begin{pmatrix} 5.343 \\ 8.364 \times 10^{-13} \\ 2.911 \\ 2.432 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{stp} = \begin{pmatrix} 4.826 \\ 7.555 \times 10^{-13} \\ 2.630 \\ 2.197 \end{pmatrix} \frac{ft^3}{day}$$

Steady-State Compositions

Hydrogen at Normal Ventilation Rate...at Barometric Breathing Ventilation Rate

$[H2_{ss}] = 0.093\,\%LFL_{H2}$ $[H2_{ss_bb}] = 61.184\,\%LFL_{H2}$

Ammonia at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[NH3_{ss}] = 0.014\,\%LFL_{NH3}$ $[NH3_{ss_bb}] = 9.334\,\%LFL_{NH3}$

Methane at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[CH4_{ss}] = 3.900 \times 10^{-3}\,\%LFL_{CH4}$ $[CH4_{ss_bb}] = 2.634\,\%LFL_{CH4}$

Nitrous Oxide at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[N2O_{ss}] = 7.090 \times 10^{-4}\,\%$ $[N2O_{ss_bb}] = 0.477\,\%$

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Flammable Gas Concentrations after Loss of Ventilation at Selected Time Periods

$conc_{mix}(0 \cdot day) = 0.111\,\%LFL$

$conc_{mix}(10 \cdot day) = 3.396\,\%LFL$

$conc_{mix}(100 \cdot day) = 27.055\,\%LFL$

$conc_{mix}(10^9 \cdot day) = 73.152\,\%LFL$

Time to Reach Various LFL Levels

$Time_{1_25\%LFL} = 90.525\,day$

$Time_{1_75\%LFL} = 1.000 \times 10^9\,day$

$Time_{1_50\%LFL} = 249.624\,day$

$Time_{1_100\%LFL} = 1.000 \times 10^9\,day$

Minimum Ventilation Rates to Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL} = 0.440\,cfm$

$vent_rate_{1_75\%LFL} = 0.145\,cfm$

$vent_rate_{1_50\%LFL} = 0.219\,cfm$

$vent_rate_{1_100\%LFL} = 0.108\,cfm$

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Hydrogen Generation Rate Calculations

Check of calculations - Calculation notes 116 & 117 combined. Monte Carlo Analysis.

This calculation allows the user to assign uncertainty information and perform a monte carlo analysis to determine uncertainty bound for an answer.

References

Hu, T. A., 2000, "*Empirical Rate Equation Model and Rate Calculations of Hydrogen Generation for Hanford Tank Waste*", HNF-3851, Rev. 0A, Lockheed Martin Hanford, Corp., Richland, WA

Kufahl, M A, and D. A. Hendengren, 2000, "*Hydrogen Generation Rate Model Calculation Input Data*", RPP-6069, Rev 0, CH2M HILL Hanford Group, Inc., Richland, WA.

Bingham, J. D., M. A. Kufahl, S. A. Barker, 2000, "*Collection And Analysis Of Selected Tank Headspace Parameter Data*", RPP-5660, Rev 0, CH2M Hill Hanford Group, Inc., Richland, WA

Input Data

Waste Properties (Crust material is included in solids layer in this example) (1 ==> Total Waste, 2 ==> Crust 3 ==> Liquid Waste, 4 ==> Solid Waste)

$Tank_id := \text{"241-AN-104"}$

Set Monte Carlo sampling parameters:

$NSamples := 100$ number of individual samples to collect

$SSize := 50$ number of data points in each sample

Input waste property data

...The following data is from Kufhal 2000, except where noted

For the following parameters use liquid data only...

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

$[TOC_m] := 3110 \cdot \frac{\mu \cdot gm}{mL}$

$[TOC_{sd}] := 311 \cdot \frac{\mu \cdot gm}{mL}$

$[NO_{2_m}] := 1.25 \cdot 10^{5} \cdot \frac{\mu \cdot gm}{mL}$

$[NO_{2_sd}] := 1.25 \cdot 10^{4} \cdot \frac{\mu \cdot gm}{mL}$

$[NO_{3_m}] := 1.70 \cdot 10^5 \cdot \frac{\mu \cdot gm}{mL}$

$[NO_{3_sd}] := 1.70 \cdot 10^4 \cdot \frac{\mu \cdot gm}{mL}$

$[Al_m] := 3.86 \cdot 10^4 \cdot \frac{\mu \cdot gm}{mL}$

$[Al_{sd}] := 3.86 \cdot 10^3 \cdot \frac{\mu \cdot gm}{mL}$

For the following parameters use layer specific data...

$[137Cs_m] := \begin{pmatrix} 4.67 \cdot 10^2 \\ 10^{-18} \\ 5.38 \cdot 10^2 \\ 3.83 \cdot 10^2 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$

$[137Cs_{sd}] := \begin{pmatrix} 4.67 \cdot 10^1 \\ 10^{-19} \\ 5.38 \cdot 10^1 \\ 3.83 \cdot 10^1 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$

$[90Sr_m] := \begin{pmatrix} 1.70 \cdot 10^1 \\ 10^{-18} \\ 7.31 \cdot 10^{-2} \\ 3.7 \cdot 10^1 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$

$[90Sr_{sd}] := \begin{pmatrix} 1.70 \cdot 10^0 \\ 10^{-19} \\ 7.31 \cdot 10^{-3} \\ 3.7 \cdot 10^0 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$

$\rho_{waste_m} := \begin{pmatrix} 1.48 \\ 1.39 \\ 1.40 \\ 1.59 \end{pmatrix} \cdot \frac{gm}{mL}$

$\rho_{waste_sd} := \begin{pmatrix} 0.1 \\ 0.1 \\ 0.1 \\ 0.1 \end{pmatrix} \cdot \frac{gm}{mL}$

$vol_{waste_m} := \begin{pmatrix} 3986 \\ 10^{-9} \\ 2286 \\ 1700 \end{pmatrix} \cdot kilo \cdot L$

$vol_{waste_sd} := \begin{pmatrix} 200 \\ 10^{-10} \\ 114 \\ 170 \end{pmatrix} \cdot kilo \cdot L$

$F_{H2O_m} := \begin{pmatrix} 48.7 \\ 45.0 \\ 50.9 \\ 45.8 \end{pmatrix} \cdot \%$

$F_{H2O_sd} := \begin{pmatrix} 48.7 \\ 45.0 \\ 50.9 \\ 45.8 \end{pmatrix} \cdot 0.10 \cdot \%$

$F_{liquid_m} := \begin{pmatrix} 96 \\ 89 \\ 100 \\ 90 \end{pmatrix} \cdot \%$

$F_{liquid_sd} := \begin{pmatrix} 9.6 \\ 8.9 \\ 1 \\ 9.0 \end{pmatrix} \cdot \%$

$Temp_{vap_m} := 302.372 \cdot K$

$Temp_{vap_sd} := 4 \cdot K$

From (Bingham 2000)

$Temp_{waste_m} := \begin{pmatrix} 308.93 \\ 308.93 \\ 308.93 \\ 308.93 \end{pmatrix} \cdot K$

$Temp_{waste_sd} := \begin{pmatrix} 5 \\ 5 \\ 5 \\ 5 \end{pmatrix} \cdot K$

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

Heat Load Calculated by Barker in "Decay Heat Generation Rate AN-104.MCD"

$HeatLoad_{137Cs_90Sr_m} := \begin{pmatrix} 1.372 \cdot 10^4 \\ 10^{-18} \\ 8.160 \cdot 10^3 \\ 5.554 \cdot 10^3 \end{pmatrix} \cdot watt$

$HeatLoad_{137Cs_90Sr_sd} := \begin{pmatrix} 1 \cdot 10^3 \\ 10^{-19} \\ 1 \cdot 10^2 \\ 1 \cdot 10^2 \end{pmatrix} \cdot watt$

$vol_{tank} := (1407) \cdot kilo \cdot gal$

43.5790

$vent_rate := 100 \cdot cfm$

From (Bingham 2000)

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

$vent_rate_{bb} = 0.148\,cfm$

AN Tank farm: Tank Data

$diam_{tank} := 75 \cdot ft$

$ht_{tank} := \frac{vol_{waste_m}}{2754 \cdot \frac{gal}{in}}$

estimation of waste depth

$ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592 \times 10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix} in$

$vol_{head} := vol_{tank} - vol_{waste_m_1}$

$vol_{head} = 4.732 \times 10^4\,ft^3$

$i := 1..4$ $k := 1..NSamples$

$vol_{waste_i} := \left(rnorm\left(NSamples, \frac{vol_{waste_m_i}}{kilo \cdot gal}, \frac{vol_{waste_sd_i}}{kilo \cdot gal}\right)\right) \cdot kilo \cdot gal$

$vol_{head} := vol_{tank} - vol_{waste_1}$

$vol_{head_m} := mean(vol_{head})$ $vol_{head_sd} := Stdev(vol_{head})$

$vol_{head_m} = 4.839 \times 10^4 ft^3$ $vol_{head_sd} = 6.936 \times 10^3 ft^3$

$$\rho_{waste_i} := \left(rnorm\left(NSamples, \frac{\rho_{waste_m_i}}{\frac{gm}{mL}}, \frac{\rho_{waste_sd_i}}{\frac{gm}{mL}}\right)\right) \cdot \frac{gm}{mL}$$

$$mass_{waste_i} := \overrightarrow{\left(vol_{waste_i} \cdot \rho_{waste_i}\right)}$$

$mass_{waste_m_i} := mean\left(mass_{waste_i}\right)$ $mass_{waste_sd_i} := Stdev\left(mass_{waste_i}\right)$

$$mass_{waste_m_i} = \begin{pmatrix} 5.792 \times 10^6 \\ 1.400 \times 10^{-6} \\ 3.146 \times 10^6 \\ 2.667 \times 10^6 \end{pmatrix} kg \qquad mass_{waste_sd_i} = \begin{pmatrix} 5.013 \times 10^5 \\ 1.679 \times 10^{-7} \\ 2.663 \times 10^5 \\ 3.024 \times 10^5 \end{pmatrix} kg$$

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

$[H_{2_m}] := .0020 \cdot \%$ $[CH_{4_m}] := .0002 \cdot \%$ $[N2O_m] := .0007 \cdot \%$ $[NH_{3_m}] := .0021 \cdot \%$

$[H_{2_sd}] := .00020 \cdot \%$ $[CH_{4_sd}] := .00002 \cdot \%$ $[N2O_{sd}] := .00007 \cdot \%$ $[NH_{3_sd}] := .00021 \cdot \%$

Gas Concentrations at LFL

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

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

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

End of Input Data

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)

$E_{thm} := 89.33 \frac{kilo \cdot J}{g_mol}$ 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

$F_{H2O_i} := \left(rnorm\left(NSamples, F_{H2O_m_i}, F_{H2O_sd_i}\right)\right)$

$W_{H2O_i} := \overrightarrow{\left(vol_{waste_i} \cdot \rho_{waste_i} \cdot F_{H2O_i}\right)}$

$W_{H2O_m_i} := mean\left(W_{H2O_i}\right)$ $W_{H2O_sd_i} := Stdev\left(W_{H2O_i}\right)$

$$W_{H2O_m_i} = \begin{pmatrix} 2.839 \times 10^{6} \\ 6.303 \times 10^{-7} \\ 1.618 \times 10^{6} \\ 1.221 \times 10^{6} \end{pmatrix} kg \qquad W_{H2O_sd_i} = \begin{pmatrix} 3.841 \times 10^{5} \\ 8.470 \times 10^{-8} \\ 2.063 \times 10^{5} \\ 1.903 \times 10^{5} \end{pmatrix} kg$$

Check units on input data

$$[TOC] := \left(rnorm\left(NSamples, \frac{[TOC_m]}{\frac{\mu \cdot gm}{mL}}, \frac{[TOC_{sd}]}{\frac{\mu \cdot gm}{mL}}\right)\right) \cdot \frac{\mu \cdot gm}{mL}$$

$$[TOC_{wt\%}] := \frac{\overrightarrow{[TOC]}}{\rho_{waste_3}} \cdot 100$$

$[TOC_{wt\%_m}] := mean([TOC_{wt\%}])$ $[TOC_{wt\%_sd}] := Stdev([TOC_{wt\%}])$

$[TOC_{wt\%_m}] = 0.224$ $[TOC_{wt\%_sd}] = 0.025$

$$[Al] := \left(rnorm\left(NSamples, \frac{[Al_m]}{\frac{\mu \cdot gm}{mL}}, \frac{[Al_{sd}]}{\frac{\mu \cdot gm}{mL}}\right)\right) \cdot \frac{\mu \cdot gm}{mL}$$

$$[Al_{wt\%}] := \frac{\overrightarrow{[Al]}}{\rho_{waste_3}} \cdot 100$$

$[Al_{wt\%_m}] := mean([Al_{wt\%}])$ $[Al_{wt\%_sd}] := Stdev([Al_{wt\%}])$

$[Al_{wt\%_m}] = 2.804$ $[Al_{wt\%_sd}] = 0.343$

Calculate the Hydrogen Generation Rate due to Thermolysis (HGR_{therm})

$$Temp_{waste_i} := \left(rnorm\left(NSamples, \frac{Temp_{waste_m_i}}{K}, \frac{Temp_{waste_sd_i}}{K}\right)\right) \cdot K$$

$$F_{liquid1} := \left(rnorm\left(NSamples, F_{liquid_m_1}, F_{liquid_sd_1}\right)\right)$$

$$F_{liquid1_k} := \begin{cases} F_{liquid1_k} & \text{if } F_{liquid1_k} \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$F_{liquid2} := \left(rnorm\left(NSamples, F_{liquid_m_2}, F_{liquid_sd_2}\right)\right)$$

$$F_{liquid2_k} := \begin{cases} F_{liquid2_k} & \text{if } F_{liquid2_k} \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$F_{liquid3} := \left(rnorm\left(NSamples, F_{liquid_m_3}, F_{liquid_sd_3}\right)\right)$$

$$F_{liquid3_k} := \begin{cases} F_{liquid3_k} & \text{if } F_{liquid3_k} \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$F_{liquid4} := \left(rnorm\left(NSamples, F_{liquid_m_4}, F_{liquid_sd_4}\right)\right)$$

$$F_{liquid4_k} := \begin{cases} F_{liquid4_k} & \text{if } F_{liquid4_k} \le 1.0 \\ 1 & \text{otherwise} \end{cases}$$

$$F_{liquid_1} := \overrightarrow{F_{liquid1}} \qquad F_{liquid_2} := \overrightarrow{F_{liquid2}}$$

$$F_{liquid_3} := \overrightarrow{F_{liquid3}} \qquad F_{liquid_4} := \overrightarrow{F_{liquid4}}$$

$$i := 1..4$$

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

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

$$HGR_{therm_m_i} := mean(HGR_{therm_i}) \qquad HGR_{therm_sd_i} := Stdev(HGR_{therm_i})$$

$$HGR_{therm_m} = \begin{pmatrix} 5.746 \times 10^{-7} \\ 5.030 \times 10^{-7} \\ 6.414 \times 10^{-7} \\ 5.846 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day} \qquad HGR_{therm_sd} = \begin{pmatrix} 3.564 \times 10^{-7} \\ 3.512 \times 10^{-7} \\ 4.456 \times 10^{-7} \\ 3.594 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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

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

$$HGR_{thermv_m_i} := mean(HGR_{thermv_i}) \qquad HGR_{thermv_sd_i} := Stdev(HGR_{thermv_i})$$

$$HGR_{thermv_m} = \begin{pmatrix} 3.108 \\ 6.278 \times 10^{-13} \\ 1.747 \\ 1.361 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{thermv_scf_i} := HGR_{thermv_m_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

$$HGR_{thermv_m} = \begin{pmatrix} 2.158 \times 10^{-3} \\ 4.359 \times 10^{-16} \\ 1.213 \times 10^{-3} \\ 9.451 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{thermv_scf} = \begin{pmatrix} 2.807 \\ 5.671 \times 10^{-13} \\ 1.578 \\ 1.229 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.950 \times 10^{-3} \\ 3.938 \times 10^{-16} \\ 1.096 \times 10^{-3} \\ 8.537 \times 10^{-4} \end{pmatrix} cfm$$

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)

$a_{rad} := 2.49 \cdot 10^6 \cdot \frac{molecules}{100 \cdot eV}$ pre-exponential factor of G in organic radiolysis (Hu, 2000 - eqn 4-16)

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

Reactivity coefficient of TOC (0.7 for DSTs, 0.4 for SSts) (Hu, 2000 - eqn 4-16)

$r_f = 0.700$

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

Check units on input data

$Temp_{waste_m_2} = 308.315\,K$

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

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

$[NO_{3_m}] = 170.000 \times 10^3 \frac{\mu \cdot gm}{mL}$

$$[NO_3] := \left(\text{rnorm}\left(\text{NSamples}, \frac{[NO_{3_m}]}{\frac{\mu\cdot gm}{mL}}, \frac{[NO_{3_sd}]}{\frac{\mu\cdot gm}{mL}}\right)\right)\cdot\frac{\mu\cdot gm}{mL}$$

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

$$[NO_{3_molar_m}] := \text{mean}([NO_{3_molar}]) \qquad [NO_{3_molar_sd}] := \text{Stdev}([NO_{3_molar}])$$

$$[NO_{3_molar_m}] = 2.718\,\frac{g_mol}{L} \qquad [NO_{3_molar_sd}] = 0.293\,\frac{g_mol}{L}$$

$$[NO_{2_m}] = 125.000\times 10^3\,\frac{\mu\cdot gm}{mL}$$

$$[NO_2] := \left(\text{rnorm}\left(\text{NSamples}, \frac{[NO_{2_m}]}{\frac{\mu\cdot gm}{mL}}, \frac{[NO_{2_sd}]}{\frac{\mu\cdot gm}{mL}}\right)\right)\cdot\frac{\mu\cdot gm}{mL}$$

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

$$[NO_{2_molar_m}] := \text{mean}([NO_{2_molar}]) \qquad [NO_{2_molar_sd}] := \text{Stdev}([NO_{2_molar}])$$

$$[NO_{2_molar_m}] = 2.752\,\frac{g_mol}{L} \qquad [NO_{2_molar_sd}] = 0.268\,\frac{g_mol}{L}$$

$$\text{HeatLoad}_{137Cs_90Sr_i} := \left[\text{rnorm}\left[\text{NSamples}, \frac{\text{HeatLoad}_{137Cs_90Sr_m_i}}{\mu\cdot Ci}, \frac{\text{HeatLoad}_{137Cs_90Sr_sd_i}}{(\mu\cdot Ci)}\right]\right]\cdot\mu\cdot Ci$$

$$\text{HeatLoad}_{137Cs_90Sr_md_i} := \text{mean}(\text{HeatLoad}_{137Cs_90Sr_i})$$

$$\text{HeatLoad}_{137Cs_90Sr_md_i} = \begin{pmatrix} 2.927\times 10^{12} \\ 2.136\times 10^{-10} \\ 1.730\times 10^{12} \\ 1.178\times 10^{12} \end{pmatrix}\mu\cdot Ci$$

$$\text{HeatLoad}_{137Cs_90Sr_sdd_i} := \text{Stdev}(\text{HeatLoad}_{137Cs_90Sr_i})$$

$$\text{HeatLoad}_{137Cs_90Sr_sdd_i} = \begin{pmatrix} 2.102\times 10^{11} \\ 0.000 \\ 2.476\times 10^{10} \\ 2.180\times 10^{10} \end{pmatrix}\mu\cdot Ci$$

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

$$HeatLoad_{m_i} := mean\left(H_{load_i}\right)$$

$$HeatLoad_{m_i} = \begin{pmatrix} 2.385 \times 10^{-5} \\ 7.199 \times 10^{-15} \\ 2.595 \times 10^{-5} \\ 2.083 \times 10^{-5} \end{pmatrix} \frac{watt}{kg}$$

Calculate the Hydrogen Generation Rate due to Radiolysis (HGR_{rad})

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

$$G_{org_m_i} := mean\left(G_{org_i}\right) \qquad G_{org_sd_i} := Stdev\left(G_{org_i}\right)$$

$$G_{org_m_i} = \begin{pmatrix} 0.013 \\ 0.013 \\ 0.013 \\ 0.014 \end{pmatrix} \frac{molecules}{100 \cdot eV} \qquad G_{org_sd_i} = \begin{pmatrix} 3.943 \times 10^{-3} \\ 4.070 \times 10^{-3} \\ 4.480 \times 10^{-3} \\ 4.032 \times 10^{-3} \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

$$G_{H2O} := \left[\left[0.45 - 0.56 \cdot \left[\frac{[NO_{3_molar}]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}} - 0.43 \cdot \left[\frac{[NO_{2_molar}]}{\left(\frac{g_mol}{liter}\right)}\right]^{\frac{1}{3}}\right] \cdot \frac{molecules}{100 \cdot eV}\right]$$

$$G_{H2O_k} := \begin{cases} G_{H2O_k} & \text{if } G_{H2O_k} > G_{H2O_sat} \\ G_{H2O_sat} & \text{otherwise} \end{cases}$$

$$G_{H2O_m} := mean\left(G_{H2O}\right) \qquad G_{H2O_sd} := Stdev\left(G_{H2O}\right)$$

$$G_{H2O_m} = 5.000 \times 10^{-3} \frac{molecules}{100 \cdot eV} \qquad G_{H2O_sd} = 0.000 \frac{molecules}{100 \cdot eV}$$

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

$$HGR_{rad_m_i} := mean\left(HGR_{rad_i}\right) \qquad HGR_{rad_sd_i} := Stdev\left(HGR_{rad_i}\right)$$

$$HGR_{rad_m} = \begin{pmatrix} 2.875 \times 10^{-7} \\ 8.025 \times 10^{-17} \\ 3.383 \times 10^{-7} \\ 2.451 \times 10^{-7} \end{pmatrix} \frac{ft^3}{kg \cdot day} \qquad HGR_{rad_sd} = \begin{pmatrix} 2.648 \times 10^{-8} \\ 0.000 \\ 1.951 \times 10^{-9} \\ 2.753 \times 10^{-8} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

$$HGR_{radv_i} := \overrightarrow{\left[HGR_{rad_i} \cdot \left(vol_{waste_i} \cdot \rho_{waste_i}\right)\right]} \cdot \frac{Temp_{vap_m}}{273.15 \cdot K}$$

$$HGR_{radv_m_i} := mean\left(HGR_{radv_i}\right) \qquad HGR_{radv_sd_i} := Stdev\left(HGR_{radv_i}\right)$$

$$HGR_{radv_m} = \begin{pmatrix} 1.8431 \\ 1.2413 \times 10^{-22} \\ 1.1783 \\ 0.7227 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_sd} = \begin{pmatrix} 0.2074 \\ 0.0000 \\ 0.1004 \\ 0.0982 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.280 \times 10^{-3} \\ 8.620 \times 10^{-26} \\ 8.182 \times 10^{-4} \\ 5.019 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{radv_scf_i} := HGR_{radv_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

$$HGR_{radv_scf_m_i} := mean\left(HGR_{radv_scf_i}\right) \qquad HGR_{radv_scf_sd_i} := Stdev\left(HGR_{radv_scf_i}\right)$$

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.665 \\ 1.121 \times 10^{-22} \\ 1.064 \\ 0.653 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_scf_sd} = \begin{pmatrix} 0.187 \\ 0.000 \\ 0.091 \\ 0.089 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.156 \times 10^{-3} \\ 7.787 \times 10^{-26} \\ 7.392 \times 10^{-4} \\ 4.534 \times 10^{-4} \end{pmatrix} cfm$$

Written By: SA Barker Date: 4/27/00 Checked By: _____ Date: _____

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

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

$$R_{corr} := \begin{cases} 1.2\cdot 10^{-7}\cdot\dfrac{ft^3}{ft^2\cdot min} & \text{if } class_{waste} = \text{"sst"} \\ 1.2\cdot 10^{-7}\cdot\dfrac{ft^3}{ft^2\cdot min} & \text{if } class_{waste} = \text{"SST"} \\ 6.0\cdot 10^{-8}\cdot\dfrac{ft^3}{ft^2\cdot min} & \text{otherwise} \end{cases}$$

Corrosion coefficient (6.0E-08 for DSTs, 1.2E-07 for SSTs) ($ft^3/min/ft^2$)
Referenced to 25°C
(Hu, 2000 - eqn 4-17)

$$R_{corr} = 6.000\times 10^{-8}\,\frac{ft^3}{ft^2\cdot min}$$

Calculate the wetted area of steel (vertical waste storage tank, assuming a flat bottom)

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

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

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

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

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

$$Awet = \begin{pmatrix} 1.193\times 10^4 \\ 1.883\times 10^{-9} \\ 4.306\times 10^3 \\ 7.620\times 10^3 \end{pmatrix} ft^2$$

Calculate Hydrogen Generation Due to Corrosion

$$Temp_{vap} := \left(rnorm\left(NSamples, \frac{Temp_{vap_m}}{K}, \frac{Temp_{vap_sd}}{K}\right)\right)\cdot K$$

$$HGR_{corr_i} := \overrightarrow{\left(R_{corr}\cdot Awet_i\cdot\frac{Temp_{vap}}{298.15\cdot K}\right)}$$

$HGR_{corr_m_i} := mean(HGR_{corr_i})$ $HGR_{corr_sd_i} := Stdev(HGR_{corr_i})$

$$HGR_{corr_m} = \begin{pmatrix} 1.0447 \\ 1.6499 \times 10^{-13} \\ 0.3772 \\ 0.6675 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_sd} = \begin{pmatrix} 0.0149 \\ 0.0000 \\ 5.3747 \times 10^{-3} \\ 9.5119 \times 10^{-3} \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.635 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{corr_scf_i} := HGR_{corr_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

$HGR_{corr_scf_m_i} := mean(HGR_{corr_scf_i})$ $HGR_{corr_scf_sd_i} := Stdev(HGR_{corr_scf_i})$

$$HGR_{corr_scf_m} = \begin{pmatrix} 0.944 \\ 1.490 \times 10^{-13} \\ 0.341 \\ 0.603 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_scf_sd} = \begin{pmatrix} 0.013 \\ 0.000 \\ 4.855 \times 10^{-3} \\ 8.593 \times 10^{-3} \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_scf_m} = \begin{pmatrix} 6.554 \times 10^{-4} \\ 1.035 \times 10^{-16} \\ 2.366 \times 10^{-4} \\ 4.187 \times 10^{-4} \end{pmatrix} cfm$$

Total Hydrogen Generation Rate

$$mass_{waste_m} = \begin{pmatrix} 5.792 \times 10^{6} \\ 1.400 \times 10^{-6} \\ 3.146 \times 10^{6} \\ 2.667 \times 10^{6} \end{pmatrix} kg$$

$$HGR_{thermv_m} = \begin{pmatrix} 2.158 \times 10^{-3} \\ 4.359 \times 10^{-16} \\ 1.213 \times 10^{-3} \\ 9.451 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{radv_m} = \begin{pmatrix} 1.280 \times 10^{-3} \\ 8.620 \times 10^{-26} \\ 8.182 \times 10^{-4} \\ 5.019 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.635 \times 10^{-4} \end{pmatrix} cfm$$

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

$$HGR_{m_i} := mean(HGR_i) \qquad HGR_{sd_i} := Stdev(HGR_i)$$

$$HGR_m = \begin{pmatrix} 4.164 \times 10^{-3} \\ 5.505 \times 10^{-16} \\ 2.293 \times 10^{-3} \\ 1.911 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{sd} = \begin{pmatrix} 1.154 \times 10^{-3} \\ 0.000 \\ 7.914 \times 10^{-4} \\ 5.921 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_m = \begin{pmatrix} 169.777 \\ 2.245 \times 10^{-11} \\ 93.513 \\ 77.903 \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

$$HGR_{stp_i} := HGR_i \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

$$HGR_{stp_m_i} := mean\left(HGR_{stp_i}\right) \qquad HGR_{stp_sd_i} := Stdev\left(HGR_{stp_i}\right)$$

$$HGR_{stp_m} = \begin{pmatrix} 3.761 \times 10^{-3} \\ 4.973 \times 10^{-16} \\ 2.072 \times 10^{-3} \\ 1.726 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{stp_sd} = \begin{pmatrix} 1.043 \times 10^{-3} \\ 0.000 \\ 7.149 \times 10^{-4} \\ 5.349 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{stp_m} = \begin{pmatrix} 5.416 \\ 7.161 \times 10^{-13} \\ 2.983 \\ 2.485 \end{pmatrix} \frac{ft^3}{day}$$

At Standard conditions...

Steady-State Hydrogen Concentration (assuming normal ventilation rate)

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

$[H2_{ss_m}] := mean([H2_{ss}])$ $\quad$ $[H2_{ss_sd}] := Stdev([H2_{ss}])$

$[H2_{ss_m}] = 4.163 \times 10^{-3}\%$ $\quad$ $[H2_{ss_sd}] = 1.154 \times 10^{-3}\%$

$[H2_{ss_m}] = 0.104\,\%LFL_{H2}$ $\quad$ $[H2_{ss_sd}] = 0.029\,\%LFL_{H2}$

Steady-State Hydrogen Concentration (assuming barometric breathing ventilation rate)

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

$[H2_{ss_bb_m}] := mean([H2_{ss_bb}])$ $\quad$ $[H2_{ss_bb_sd}] := Stdev([H2_{ss_bb}])$

$[H2_{ss_bb_m}] = 2.733\,\%$ $\quad$ $[H2_{ss_bb_sd}] = 0.729\,\%$

$[H2_{ss_bb_m}] = 68.320\,\%LFL_{H2}$ $\quad$ $[H2_{ss_bb_sd}] = 18.219\,\%LFL_{H2}$

Gas release Rate (independent of ventilation rate)

$rate_{H2_rel} := [H2_{ss}] \cdot \frac{vent_rate}{1 - [H2_{ss}]}$ $\quad$ $rate_{H2_rel_bb} := [H2_{ss_bb}] \cdot \frac{vent_rate_{bb}}{1 - [H2_{ss_bb}]}$

$rate_{H2_rel} = 0.416\,cfm$ $\quad$ $rate_{H2_rel_bb} = 0.416\,cfm$

Calculate Release Rates of Ammonia, Methane, and Nitrous Oxide (assuming no gas retention)

$$[NH_3] := (rnorm(NSamples, [NH_{3_m}], [NH_{3_sd}]))$$

$$RR_{NH3} := \overrightarrow{\left(\frac{[NH_3] \cdot vent_rate}{1 - [NH_3]}\right)}$$

$RR_{NH3_m} := mean(RR_{NH3})$ $\quad$ $RR_{NH3_sd} := Stdev(RR_{NH3})$

$RR_{NH3_m} = 2.098 \times 10^{-3}\,cfm$ $\quad$ $RR_{NH3_sd} = 2.127 \times 10^{-4}\,cfm$

$$[CH_4] := (rnorm(NSamples, [CH_{4_m}], [CH_{4_sd}]))$$

$$RR_{CH4} := \overrightarrow{\left(\frac{[CH_4]\cdot vent_rate}{1-[CH_4]}\right)}$$

$RR_{CH4_m} := mean(RR_{CH4})$ $\qquad$ $RR_{CH4_sd} := Stdev(RR_{CH4})$

$RR_{CH4_m} = 2.042 \times 10^{-4}\,cfm$ $\qquad$ $RR_{CH4_sd} = 1.894 \times 10^{-5}\,cfm$

$[N2O] := (rnorm(NSamples, [N2O_m], [N2O_{sd}]))$

$$RR_{N2O} := \overrightarrow{\left(\frac{[N2O]\cdot vent_rate}{1-[N2O]}\right)}$$

$RR_{N2O_m} := mean(RR_{N2O})$ $\qquad$ $RR_{N2O_sd} := Stdev(RR_{N2O})$

$RR_{N2O_m} = 7.112 \times 10^{-4}\,cfm$ $\qquad$ $RR_{N2O_sd} = 6.556 \times 10^{-5}\,cfm$

Steady-State Ammonia, Methane, and Nitrous Oxide Concentration (assuming normal ventilation rate)(just a check of methodology)

$$[NH3_{ss_m}] := \frac{RR_{NH3_m}}{RR_{NH3_m} + vent_rate}$$ $\qquad$ $[NH3_{ss_m}] = 2.098 \times 10^{-3}\%$

$$[CH4_{ss_m}] := \frac{RR_{CH4_m}}{RR_{CH4_m} + vent_rate}$$ $\qquad$ $[CH4_{ss_m}] = 2.042 \times 10^{-4}\%$

$$[N2O_{ss_m}] := \frac{RR_{N2O_m}}{RR_{N2O_m} + vent_rate}$$ $\qquad$ $[N2O_{ss_m}] = 7.112 \times 10^{-4}\%$

Steady-State Ammonia, Methane, and Nitrous Oxide Concentration (assuming barometric breathing ventilation rate)

$$[NH3_{ss_bb}] := \overrightarrow{\frac{RR_{NH3}}{RR_{NH3} + vent_rate_{bb}}}$$

$[NH3_{ss_bb_m}] := mean([NH3_{ss_bb}])$ $\qquad$ $[NH3_{ss_bb_sd}] := Stdev([NH3_{ss_bb}])$

$[NH3_{ss_bb_m}] = 1.399\%$ $\qquad$ $[NH3_{ss_bb_sd}] = 0.140\%$

$[NH3_{ss_bb_m}] = 9.325\%LFL_{NH3}$ $\qquad$ $[NH3_{ss_bb_sd}] = 0.932\%LFL_{NH3}$

$$[CH4_{ss_bb}] := \overrightarrow{\frac{RR_{CH4}}{RR_{CH4} + vent_rate_{bb}}}$$

$[CH4_{ss_bb_m}] := mean([CH4_{ss_bb}])$ $[CH4_{ss_bb_sd}] := Stdev([CH4_{ss_bb}])$

$[CH4_{ss_bb_m}] = 0.138\%$ $[CH4_{ss_bb_sd}] = 0.013\%$

$[CH4_{ss_bb_m}] = 2.758\%LFL_{CH4}$ $[CH4_{ss_bb_sd}] = 0.255\%LFL_{CH4}$

$$[N2O_{ss_bb}] := \overrightarrow{\frac{RR_{N2O}}{RR_{N2O} + vent_rate_{bb}}}$$

$[N2O_{ss_bb_m}] := mean([N2O_{ss_bb}])$ $[N2O_{ss_bb_sd}] := Stdev([N2O_{ss_bb}])$

$[N2O_{ss_bb_m}] = 0.479\%$ $[N2O_{ss_bb_sd}] = 0.044\%$

Determine the Overall Steady-State Flammable Gas Concentration with Loss of Ventilation

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

$[Conc_mix_{ss_bb_m}] := mean([Conc_mix_{ss_bb}])$

$[Conc_mix_{ss_bb_m}] = 80.403\%LFL$

$[Conc_mix_{ss_bb_sd}] := Stdev([Conc_mix_{ss_bb}])$

$[Conc_mix_{ss_bb_sd}] = 18.269\%LFL$

Set Variables into Array, where 1 => H2, 2 => NH3, 3 => CH4, and 4 => N2O

$$GR := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} \{100,1\} \\ \{100,1\} \\ \{100,1\} \\ \{100,1\} \end{pmatrix} cfm$$

Generation Rate

$$GR_m := \begin{pmatrix} HGR_{m_1} \\ RR_{NH3_m} \\ RR_{CH4_m} \\ RR_{N2O_m} \end{pmatrix} \qquad GR_m = \begin{pmatrix} 4.164 \times 10^{-3} \\ 2.098 \times 10^{-3} \\ 2.042 \times 10^{-4} \\ 7.112 \times 10^{-4} \end{pmatrix} cfm$$

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} \{100,1\} \\ \{100,1\} \\ \{100,1\} \\ \{100,1\} \end{pmatrix} cfm$$

Release Rate (Assume no retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss_m}] \\ [NH3_{ss_m}] \\ [CH4_{ss_m}] \\ [N2O_{ss_m}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 4.163 \times 10^{-3} \\ 2.098 \times 10^{-3} \\ 2.042 \times 10^{-4} \\ 7.112 \times 10^{-4} \end{pmatrix} \%$$

Initial Concentration Rate (Assume at Steady-State with normal ops)

Calculate the composition of all components at time 't'

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

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

$$conc(t,i) := \overrightarrow{\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]}$$

$$conc_m(t,i) := \overrightarrow{mean\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]}$$

$$concm(t,i) := mean(conc(t,i))$$

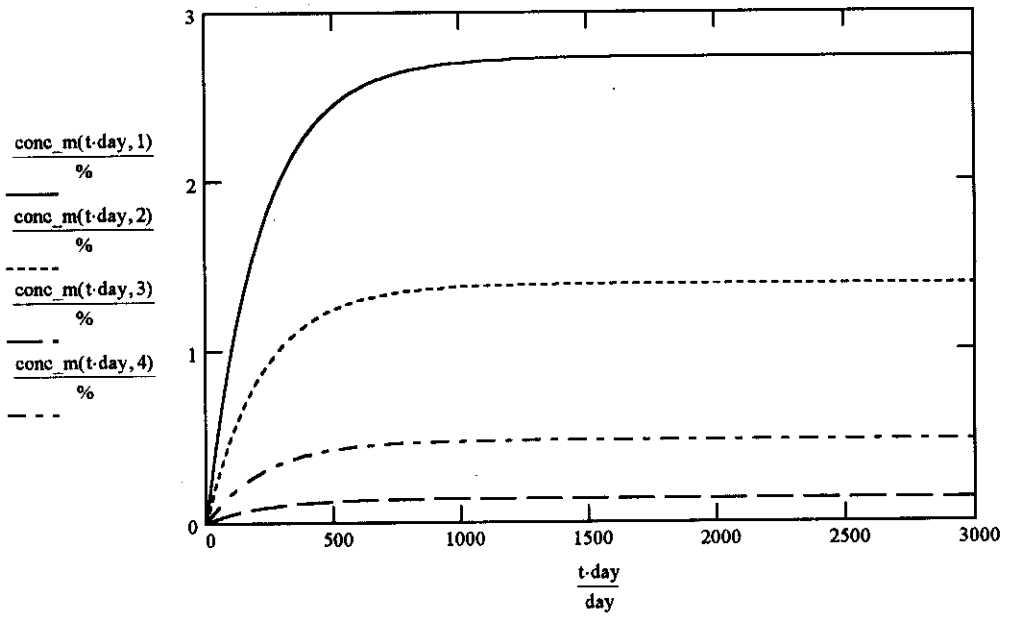
$conc_m(0 \cdot sec, 1) = 4.163 \times 10^{-3}\%$ $\quad conc_m(1000 \cdot day, 1) = 2.700\%$ $\quad conc_m(1000 \cdot day, 1) = 67.511\%LFL_{H2}$

$conc_m(0 \cdot sec, 2) = 2.098 \times 10^{-3}\%$ $\quad conc_m(1000 \cdot day, 2) = 1.381\%$ $\quad conc_m(1000 \cdot day, 2) = 9.207\%LFL_{NH3}$

$conc_m(0 \cdot sec, 3) = 2.042 \times 10^{-4}\%$ $\quad conc_m(1000 \cdot day, 3) = 0.136\%$ $\quad conc_m(1000 \cdot day, 3) = 2.721\%LFL_{CH4}$

$conc_m(0 \cdot sec, 4) = 7.112 \times 10^{-4}\%$ $\quad conc_m(1000 \cdot day, 4) = 0.472\%$

$t := 0, 30 .. 3000$



Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

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

$LFL_{mix_m}(z) := mean(LFL_{mix}(z))$

$LFL_{mix_sd}(z) := Stdev(LFL_{mix}(z))$

$LFL_{mix_m}(0 \cdot day) = 8.186 \times 10^4 \%$

$LFL_{mix_sd}(0 \cdot day) = 0.000 \%$

$LFL_{mix_m}(1000000 \cdot day) = 129.769 \%$

$LFL_{mix_sd}(1000000 \cdot day) = 25.294 \%$

Calculate the time to reach various fractions of the LFL

time to reach 25 %LFL

$TOL := .00001$

$$fm(z, ll) := \frac{\left(\frac{1}{LFL_{mix_m}(z)}\right)}{\%LFL} - ll$$

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

$$f_sd(z,ll) := Stdev\left(\overrightarrow{\left(\frac{conc(z,1)}{LFL_{H2}} + \frac{conc(z,2)}{LFL_{NH3}} + \frac{conc(z,3)}{LFL_{CH4}}\right)} - ll\right)\cdot\%$$

$tlfl := 25$

$z := 10\cdot day$ **Initial Guess**

$temp_{25} := -5\cdot day$ **Initial Value in case solution cannot be found**

$temp_{25} := Re(root(f(z,tlfl),z))$

$temp_{25} = 80.578\,day$

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**

$temp_{25_m} := Re(root(fm(zm,tlfl),zm))$

$temp_{25_m} = 86.778\,day$

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

$Time_{1_25\%LFL_m} = 86.778\,day$

$Time_{1_25\%LFL_sd} := if\left([Conc_mix_{ss_bb_m}] > .25, if\left(temp_{25} < 0\cdot day, 0\cdot day, f_sd(temp_{25}, tlfl)\cdot temp_{25}\right), 10^9\cdot day\right)$

$Time_{1_25\%LFL_sd} = 5.301\,day$

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**

$temp_{50} := Re(root(f(z,tlfl),z))$

$temp_{50} = 212.384\,day$

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**

$temp_{50_m} := -5\cdot day$ **Initial Value in case solution cannot be found**

$temp_{50_m} := Re(root(fm(zm,tlfl),zm))$

$temp_{50_m} = 232.597\,day$

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

$Time_{1_50\%LFL_m} = 232.597\,day$

$Time_{1_50\%LFL_sd} := if\left([Conc_mix_{ss_bb_m}] > .50, if\left(temp_{50} < 0\cdot day, 0\cdot day, f_sd(temp_{50}, tlfl)\cdot temp_{50}\right), 10^9\cdot day\right)$

$Time_{1_50\%LFL_sd} = 26.212\,day$

time to reach 75 %LFL

$tlfl := 75$

$z := 10 \cdot day$ **Initial Guess** $temp_{75} := -5 \cdot day$ *Initial Value in case solution cannot be found*

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

$temp_{75} = 600.728\ day$

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** $temp_{75_m} := -5 \cdot day$ **Initial Value in case solution cannot be found**

$temp_{75_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{75_m} = 819.654\ day$

$Time_{1_75\%LFL_m} := if([Conc_mix_{ss_bb_m}] > 75\%, if(temp_{75_m} < 0 \cdot day, 0 \cdot day, temp_{75_m}), 10^9 \cdot day)$

$Time_{1_75\%LFL_m} = 819.654\ day$

$Time_{1_75\%LFL_sd} := if([Conc_mix_{ss_bb_m}] > 75\%, if(temp_{75} < 0 \cdot day, 0 \cdot day, f_sd(temp_{75}, tlfl) \cdot temp_{75}), 10^9 \cdot day)$

$Time_{1_75\%LFL_sd} = 103.977\ day$

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**

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

$temp_{100} = 289.332\ day$

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**

$temp_{100_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{100_m} = 250.507\ day$

$Time_{1_100\%LFL_m} := if([Conc_mix_{ss_bb_m}] > 100\%, if(temp_{100_m} < 0 \cdot day, 0 \cdot day, temp_{100_m}), 10^9 \cdot day)$

$Time_{1_100\%LFL_m} = 1.000 \times 10^9\ day$

$Time_{1_100\%LFL_sd} := if[[Conc_mix_{ss_bb_m}] > 1, if[temp_{100} < 0 \cdot day, 0 \cdot day, f_sd(temp_{100}, tlfl) \cdot (temp_{100})], 10^9 \cdot day]$

$Time_{1_100\%LFL_sd} = 1.000 \times 10^9\ day$

Minimum Ventilation Rates Need to Prevent Headspace Concentrations from Reaching Various Levels

$$Conc_vr(V,i) := \overrightarrow{\left[\frac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]\right]}$$

$$Conc_vr_m(V,i) := mean\left(\overrightarrow{\left[\frac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]\right]}\right)$$

Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

$$LFL_{mix_vr}(v) := \overrightarrow{\frac{1}{\frac{Conc_vr(v,1)}{LFL_{H2}}+\frac{Conc_vr(v,2)}{LFL_{NH3}}+\frac{Conc_vr(v,3)}{LFL_{CH4}}}}$$

$LFL_{mix_vr_m}(z) := mean(LFL_{mix_vr}(z))$ $\qquad$ $LFL_{mix_vr_sd}(z) := Stdev(LFL_{mix_vr}(z))$

$LFL_{mix_vr_m}(0.148\cdot cfm) = 129.864\,\%$ $\qquad$ $LFL_{mix_vr_sd}(0.148\cdot cfm) = 25.313\,\%$

$LFL_{mix_vr_m}(1\cdot cfm) = 859.680\,\%$ $\qquad$ $LFL_{mix_vr_sd}(1\cdot cfm) = 171.714\,\%$

ventilation Rate to keep concentration less than 25 %LFL

$$f2m(z,ll) := \frac{\left(\frac{1}{LFL_{mix_vr_m}(z)}\right)}{\%LFL}-ll$$

$$f2(z,ll) := mean\left(\frac{\overrightarrow{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}}{\%LFL}-ll\right)$$

$$f2_sd(z,ll) := Stdev\left(\frac{\overrightarrow{\left(\frac{Conc_vr(z,1)}{LFL_{H2}}+\frac{Conc_vr(z,2)}{LFL_{NH3}}+\frac{Conc_vr(z,3)}{LFL_{CH4}}\right)}}{\%LFL}-ll\right)\cdot\%$$

$tlfl := 24.999$

$z := .001 \cdot cfm$ Initial Guess $temp_{25} := -5 \cdot cfm$ Initial Value in case solution cannot be found

$temp_{25} := root(f2(z, tlfl), z)$

$temp_{25} = 0.484606\,cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{25_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{25_m} := root(f2m(zm, tlfl), zm)$

$temp_{25_m} = 0.463377\,cfm$

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

$vent_rate_{1_25\%LFL_m} = 0.464\,cfm$

$vent_rate_{1_25\%LFL_sd} := if(temp_{25} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{25}, tlfl) \cdot temp_{25})$

$vent_rate_{1_25\%LFL_sd} = 0.028\,cfm$

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

$temp_{50} := root(f2(z, tlfl), z)$

$temp_{50} = 0.240273\,cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{50_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{50_m} := root(f2m(zm, tlfl), zm)$

$temp_{50_m} = 0.229881\,cfm$

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

$vent_rate_{1_50\%LFL_m} = 0.231\,cfm$

$vent_rate_{1_50\%LFL_sd} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{50}, tlfl) \cdot temp_{50})$

$vent_rate_{1_50\%LFL_sd} = 0.028\,cfm$

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

$temp_{75} := root(f2(z, tlfl), z)$

$temp_{75} = 0.158834\,cfm$

$zm := .001 \cdot cfm$ **Initial Guess** $temp_{75_m} := -5 \cdot day$ **Initial Value in case solution cannot be found**

$temp_{75_m} := root(f2m(zm, tlfl), zm)$

$temp_{75_m} = 0.152052\,cfm$

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

$vent_rate_{1_75\%LFL_m} = 0.153\,cfm$

$vent_rate_{1_75\%LFL_sd} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{75}, tlfl) \cdot temp_{75})$

$vent_rate_{1_75\%LFL_sd} = 0.027\,cfm$

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**

$temp_{100} := root(f2(z, tlfl), z)$

$temp_{100} = 0.118118\,cfm$

$zm := .001 \cdot cfm$ **Initial Guess** $temp_{100_m} := -5 \cdot day$ **Initial Value in case solution** ***cannot be found***

$temp_{100_m} := root(f2m(zm, tlfl), zm)$

$temp_{100_m} = 0.113138\,cfm$

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

$vent_rate_{1_100\%LFL_m} = 0.114\,cfm$

$vent_rate_{1_100\%LFL_sd} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{100}, tlfl) \cdot temp_{100})$

$vent_rate_{1_100\%LFL_sd} = 0.027\,cfm$

Written By: SA Barker Date: 4/27/00 Checked By: _____ Date: _____

Summary Section

Input Data

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

Tank_id = "241-AN-104" $class_{waste}$ = "dst"

$[TOC_m] = 3.110 \times 10^3 \frac{\mu \cdot gm}{mL}$ $[NO_{3_m}] = 1.700 \times 10^5 \frac{\mu \cdot gm}{mL}$ $[NO_{2_m}] = 1.250 \times 10^5 \frac{\mu \cdot gm}{mL}$

$[Al_m] = 3.860 \times 10^4 \frac{\mu \cdot gm}{mL}$ $[137Cs_m] = \begin{pmatrix} 467.000 \\ 1.000 \times 10^{-18} \\ 538.000 \\ 383.000 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$ $[90Sr_m] = \begin{pmatrix} 17.000 \\ 1.000 \times 10^{-18} \\ 0.073 \\ 37.000 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$

$vol_{waste_m} = \begin{pmatrix} 1.408 \times 10^5 \\ 3.531 \times 10^{-8} \\ 8.073 \times 10^4 \\ 6.003 \times 10^4 \end{pmatrix} ft^3$ $\rho_{waste_m} = \begin{pmatrix} 1.480 \\ 1.390 \\ 1.400 \\ 1.590 \end{pmatrix} \frac{gm}{mL}$ $Temp_{waste_m} = \begin{pmatrix} 309.162 \\ 308.315 \\ 309.445 \\ 309.850 \end{pmatrix} K$

$F_{H2O_m} = \begin{pmatrix} 48.700 \\ 45.000 \\ 50.900 \\ 45.800 \end{pmatrix} \%$ $HeatLoad_{137Cs_90Sr_m} = \begin{pmatrix} 1.372 \times 10^4 \\ 1.000 \times 10^{-18} \\ 8.160 \times 10^3 \\ 5.554 \times 10^3 \end{pmatrix} watt$ $Temp_{vap_m} = 302.372\,K$

$vol_{tank} = 1.407 \times 10^3\,kilo \cdot gal$ $vent_rate = 100.000\,cfm$ $vent_rate_{bb} = 0.148\,cfm$

AN Tank farm: Tank Data

$diam_{tank} = 75.000\,ft$ $ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592 \times 10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix} in$ estimation of waste depth

Dome-Space Compositions

$[CH_{4_m}] = 2.000 \times 10^{-4}\%$ $[N2O_m] = 7.000 \times 10^{-4}\%$ $[NH_{3_m}] = 2.100 \times 10^{-3}\%$

End of Input Data

Output Data

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

Hydrogen Generation Rate due to Thermolysis, Radiolysis, and Corrosion...

$$HGR_{thermv_m} = \begin{pmatrix} 2.158 \times 10^{-3} \\ 4.359 \times 10^{-16} \\ 1.213 \times 10^{-3} \\ 9.451 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{thermv_sd} = \begin{pmatrix} 1.128 \times 10^{-3} \\ 0.000 \\ 7.926 \times 10^{-4} \\ 5.764 \times 10^{-4} \end{pmatrix} \text{cfm}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.280 \times 10^{-3} \\ 8.620 \times 10^{-26} \\ 8.182 \times 10^{-4} \\ 5.019 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{radv_sd} = \begin{pmatrix} 1.440 \times 10^{-4} \\ 0.000 \\ 6.973 \times 10^{-5} \\ 6.817 \times 10^{-5} \end{pmatrix} \text{cfm}$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.635 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{corr_sd} = \begin{pmatrix} 1.034 \times 10^{-5} \\ 0.000 \\ 3.732 \times 10^{-6} \\ 6.605 \times 10^{-6} \end{pmatrix} \text{cfm}$$

Overall Hydrogen Generation Rate...

at the headspace conditions... **at standard conditions (273.15°K)...**

$$HGR_m = \begin{pmatrix} 4.164 \times 10^{-3} \\ 5.505 \times 10^{-16} \\ 2.293 \times 10^{-3} \\ 1.911 \times 10^{-3} \end{pmatrix} \text{cfm} \qquad HGR_{stp_m} = \begin{pmatrix} 3.761 \times 10^{-3} \\ 4.973 \times 10^{-16} \\ 2.072 \times 10^{-3} \\ 1.726 \times 10^{-3} \end{pmatrix} \text{cfm}$$

$$HGR_m = \begin{pmatrix} 5.996 \\ 7.928 \times 10^{-13} \\ 3.302 \\ 2.751 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{stp_m} = \begin{pmatrix} 5.416 \\ 7.161 \times 10^{-13} \\ 2.983 \\ 2.485 \end{pmatrix} \frac{ft^3}{day}$$

Written By: SA Barker Date: 4/27/00 Checked By: _____ Date: _____

Steady-State Compositions

Hydrogen at Normal Ventilation Rate...at Barometric Breathing Ventilation Rate

$[H2_{ss_m}] = 0.104\,\%LFL_{H2}$ $[H2_{ss_bb_m}] = 68.320\,\%LFL_{H2}$

Ammonia at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[NH3_{ss_m}] = 0.014\,\%LFL_{NH3}$ $[NH3_{ss_bb_m}] = 9.325\,\%LFL_{NH3}$

Methane at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[CH4_{ss_m}] = 4.084 \times 10^{-3}\,\%LFL_{CH4}$ $[CH4_{ss_bb_m}] = 2.758\,\%LFL_{CH4}$

Nitrous Oxide at Normal Ventilation Rate... at Barometric Breathing Ventilation Rate

$[N2O_{ss_m}] = 7.112 \times 10^{-4}\,\%$ $[N2O_{ss_bb_m}] = 0.479\,\%$

Flammable Gas Concentrations after Loss of Ventilation at Selected Time Periods

$conc_{mix_m}(0 \cdot day)$ $conc_{mix_m}(10 \cdot day) = 3.516\,\%LFL$

$conc_{mix_m}(100 \cdot day) = 28.005\,\%LFL$ $conc_{mix_m}(489.445 \cdot day) = 68.410\,\%LFL$

$conc_{mix_m}(10^9 \cdot day) = 77.060\,\%LFL$

Time to Reach Various LFL Levels

$Time_{1_25\%LFL_m} = 86.778\,day$ $Time_{1_75\%LFL_m} = 819.654\,day$

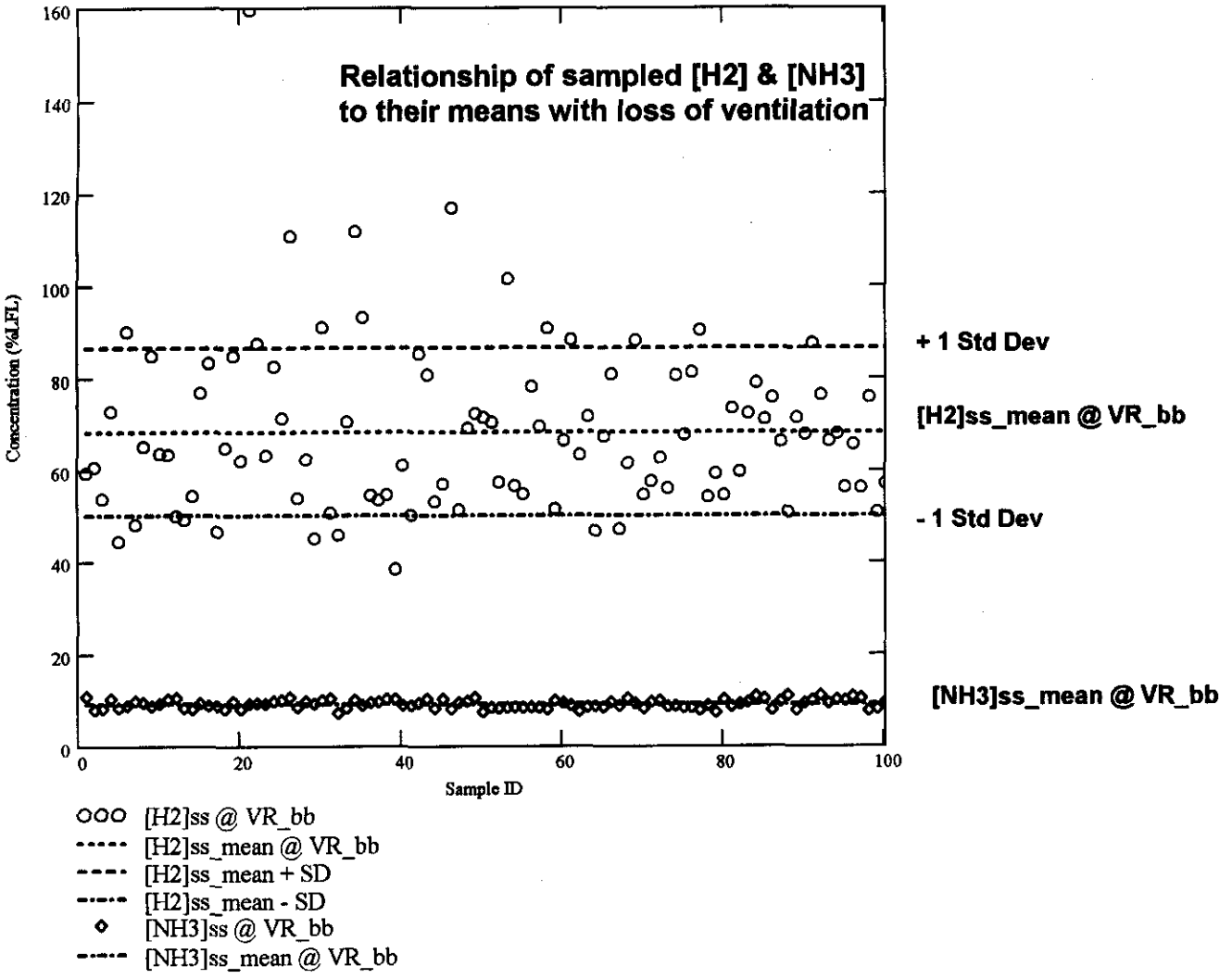
$Time_{1_50\%LFL_m} = 232.597\,day$ $Time_{1_100\%LFL_m} = 1.000 \times 10^9\,day$

Minimum Ventilation Rates to Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL_m} = 0.464\,cfm$ $vent_rate_{1_75\%LFL_m} = 0.153\,cfm$

$vent_rate_{1_50\%LFL_m} = 0.231\,cfm$ $vent_rate_{1_100\%LFL_m} = 0.114\,cfm$

Written By: SA Barker Date: 4/27/00 Checked By: _____ Date: _____



CHECKLIST FOR INDEPENDENT REVIEW

Document: RPP-5926 Rev. 0
Author: T. A. Hu, S. A. Barker, J. D. Bingham, M. A. Kufahl
Scope of Review:

Yes	No	N/A	
[X]	[ ]	[ ]	Previous reviews complete and cover analysis, up to scope of the review, with no gaps
[X]	[ ]	[ ]	Problem completely defined.
[X]	[ ]	[ ]	Necessary assumptions explicitly stated and supported.
[X]	[ ]	[ ]	Computer codes and data files documented.
[X]	[ ]	[ ]	Data used in calculations explicitly stated in document.
[X]	[ ]	[ ]	Data checked for consistency with original source information as applicable.
[X]	[ ]	[ ]	Mathematical derivations checked including dimensional consistency of results.
[X]	[ ]	[ ]	Models appropriate and used within range of validity or use outside range of established validity justified.
[X]	[ ]	[ ]	Hand calculations checked for errors. *Spreadsheet results should be treated exactly the same as hand calculations.*
[ ]	[ ]	[X]	Software/Code input correct and consistent with analysis documentation.
[ ]	[ ]	[X]	Software/Code output consistent with input and with results reported in analysis documentation.
[ ]	[ ]	[X]	Limits/criteria/guidelines applied to analysis results are appropriate and referenced. Limits/criteria/guidelines checked against references.
[ ]	[ ]	[X]	Safety margins consistent with good engineering practices.
[X]	[ ]	[ ]	Conclusions consistent with analytical results and applicable limits.
[X]	[ ]	[ ]	Results and conclusions address all points required in the problem statement.
[X]	[ ]	[ ]	Format consistent with appropriate standards.
[X]		[ ]*	Review calculations, comments, and/or notes attached.
[X]	[ ]	[ ]	Document approved.

K. M. Hodgson K.M. Hodgson
Reviewer (Printed Name and Signature

* Any calculation, comments, or notes generated as part of this review should be signed, dated, and attached to the checklist. Such material should be labeled and recorded in such a manner as to be intelligible to a technically qualified third party.