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ENGINEERING CHANGE NOTICE

Page 1 of 2

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Proj. ECN

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13a. Description of Change

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This ECN is to 1) Redefine the ventilation variable in the methodology of flammability assessment, 2) Update the analysis on tank 241-SY-101 to reflect the current status after over 500 kgal of waste being transferred out, 3) Derived the equations for ammonia anlaysis using liquid/vapor equilibrium model and performed calculations based on field observed data, and 4) Redo the flammability assessment calculations. In addition, minor wording changes were made throughout for clarification and editorial purposes. Because of this the total document is being reissued.

14a. Justification (mark one)	14b. Justification Details
Criteria Change ☐ Design Improvement ☐ Environmental ☐ Facility Deactivation ☐ As-Found ☒ Facilitate Const. ☐ Const. Error/Omission ☐ Design Error/Omission ☐	This document reports flammability assessment for 177 tanks to support the closure of flammable gas issues. The change is necessary to correct the errors identified, to update current status of tank 241-SY-101, and to remove some of the conservatism used in the ammonia analysis.

15. Distribution (include name, MSIN, and no. of copies)

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Cog. Mgr.	J. S. Garfield *JS Garfield*	2-23-01	QA		
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ADDITIONAL

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

T. A. Hu
CH2M HILL Hanford Group, Inc.
Richland, WA 99352
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Revision 1

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Prepared for the U.S. Department of Energy
Office of River Protection

CH2MHILL
Hanford Group, Inc.
Richland, Washington
Contractor for the U.S. Department of Energy
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T. A. Hu
S. A. Barker
D. C. Hedengren
CH2M HILL Hanford Group, Inc.

M. A. Kufahl
Meier Enterprises, Inc.

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CH2MHILL
Hanford Group, Inc.

P. O. Box 1500
Richland, Washington

Contractor for the U.S. Department of Energy
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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 of the Hanford Site high-level waste tanks. This report assesses the steady-state flammability level under normal and off-normal ventilation conditions in the tank dome space for 177 double-shell 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 the gas release rate and ventilation rates in the dome space, has been developed for both soluble and insoluble gases. With this dynamic model, the time required to reach the specified flammability level at a given ventilation condition can be calculated. In the evaluation hydrogen, the major flammable gas observed in the dome space will be estimated with the newly developed empirical rate equation model (Hu 2000). Hydrogen generation rates can be calculated for a given tank waste composition and its physical properties. The release rate of other insoluble gases and the mass transport properties of the soluble gas can be derived from the observed steady-state gas concentration under normal ventilation conditions. The off-normal ventilation 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 was used based on data from tanks belonging to a similar waste group. Overall, the flammability assessment indicates that no tank will exceed 25% of the LFL under normal ventilation conditions. For off-normal ventilation conditions, which rarely occur and require shut down of the active ventilation and the gas inlet valve, the shortest time to reach 25% of the LFL is 21 days for single-shell tanks (SSTs) (241-A-101) and 32 days for double-shell tanks (DSTs) (241-AN-102).

This revision of RPP-5926 has modified the mass balance equation and the associated equations derived from it in the methodology of flammability assessment in Section 3.0. The modification redefines the ventilation variable measured or estimated at the outlet. To address the highly soluble gas ammonia, the liquid/vapor equilibrium and mass transport model (Hedengren et al. 2000) is used for the ammonia analysis. In order to predict the ammonia concentration under off-normal conditions, the equations to calculate mass transport properties were derived in terms of the steady-state vapor ammonia concentration and ventilation rate in the tank dome space under normal conditions along with the ammonia liquid concentration. The related calculations have been redone based on the modified equations. Most of the input data used were current as of October 1999; these are the same data used in Revision 0 of this report. The one exception is for tank 241-SY-101, which has been updated based on the grab sample results on April 2000 (Esch 2000) to reflect the status of the tank waste after it was remediated. The updated 241-SY-101 calculation shows that the hydrogen generation rate has dropped by a factor of 10. Combined with the new ammonia analysis, the flammability hazard in this tank has decreased significantly.

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LIST OF TERMS

atm	atmosphere
cfm	cubic feet per minute
DST	double-shell tank
eV	electron volt
ft^3	cubic feet
GRE	gas release event
HGR	hydrogen generation rate
kg	kilograms
kJ/mole	KiloJoule per mole
L	liters
LFL	Lower Flammability Limit
m^2	square meters
m^3/kg-min	cubic meters per kilogram per minute
mole/kg-day	mole per kilogram per day
ppm	parts per million
ppmv	parts per million by volume
SST	single-shell tank
TOC	total organic carbon
°C	degrees Celsius
°F	degrees Fahrenheit
°K	degrees Kelvin
μg/mL	micrograms per milliliter

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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 at the Hanford Site. 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 dome space; (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 DSTs and SSTs; (3) estimates of the minimum ventilation rate required to maintain less than 25% of the LFL; and (4) estimates of the maximum dome space concentrations attainable following an extended loss of normal ventilation. It also provides the methodology that can be used in other applications.

Revision 1 was updated as follows: (1) The mass balance equation (Equation 3-5) and its derived equations in the methodology of flammability assessment section (Section 3.0) were modified by redefining the ventilation rate as the outlet measurement or calculated outlet flow for natural breathing plus gas generation to reflect total gas leaving the tank. (2) The input data and calculations of tank 241-SY-101 were updated to reflect the current tank waste status after 616 kilogallons of active flammable gas generation waste material was transferred during December 1999 to February 2000 (Johnson et al. 2000). The current hydrogen generation rate in tank 241-SY-101 is 2.7 E-3 cfm, which is one-tenth the generation rate prior to the remediation task. Other th0an the data for tank 241-SY-101, all the input data used are from Revision 0 of this document, which presents data as of October 1999. (3) The liquid/vapor equilibrium model to address the behavior of the highly soluble gas ammonia was added. (4) The off-normal ventilation calculations used in the flammability assessment were more clearly defined and additional text was added.

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

The gases generated in the 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 layers of waste. Ninety-nine percent of the ammonia generated is dissolved and stored in the liquid waste (Shekarriz et al. 1997) rather than being 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 an air mixture.

Understanding gas generation phenomena 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. Systematic tank waste characterization programs and various tank safety programs have generated a tremendous amount of tank waste data. All of this information provided the basis for 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 contents, but also for tanks whose contents have changed. The other observed gases, such as ammonia, methane, and nitrous oxide, do not have a general rate equation for calculating 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, ventilation rates in the dome space, and other tank waste information.

During the course of updating the tank 241-SY-101 calculations, the dome space steady-state ammonia concentration in tank 241-SY-101 rose from a pre-remediation concentration of 4 ppm (prior to waste being transferred) to 400 ppm (January 14, 2001). Based on the value of 400 ppm, the derived ammonia release rate, if used as a constant, will predict a value of 108% of the LFL as the steady-state ammonia concentration under the off-normal condition of a loss of ventilation. This is a factor of 50 larger than the equilibrium value predicted by the model. Therefore, the liquid/vapor equilibrium model (Hedengren et al. 2000) is introduced into the methodology to address the dome space calculations for ammonia. A time-dependent equation for gas concentration in the tank dome space was developed by solving the mass balance equations for the gas volume. Once the steady-state gas release rates or the

mass transport properties of soluble gas are obtained, a time-dependent gas concentration can be derived from the equation for a given ventilation condition. Therefore, the flammability level of the gas mixture in the dome space can be calculated under both normal and off-normal ventilation conditions. Also, the time required to reach a specified flammability level in the dome space, and the minimum ventilation rate required to prevent reaching that level, can be estimated.

In this report, Section 2.0 describes the hydrogen generation rate model calculation. The empirical equation of hydrogen generation rates is summarized and discussed. Section 3.0 describes the methodology to evaluate the flammability level of the gas mixture in the dome space. Details of the validity of the LFLs in air, ammonia liquid/vapor equilibrium model, the time-dependent gas concentration model, and the flammability level calculations will be discussed. Section 4.0 discusses the data and results of the model calculations and the flammability evaluations. Section 5.0 gives the overall summary and conclusions. Detailed calculation results are given in Appendices A through E.

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2.0 HYDROGEN GENERATION RATE MODEL

Several models (Hopkins 1994, 1995; Graves 1994; Pederson and Bryan 1996; Hu 1997) have been previously proposed to estimate the hydrogen generation rate, but these models were limited by the availability of waste data. Recently a more comprehensive hydrogen generation rate model (Hu et al. 1999, Hu 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 mechanisms of thermal chemical reactions, radiolysis of water and organic components, and corrosion processes. The rate equations are formulated as a function of physical and chemical properties of tank waste and are able to estimate the hydrogen generation rate of current waste conditions including newly mixed waste of known waste properties. The model has been applied to calculate the rate of more than thirty SSTs and DSTs 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 day per kilogram of total waste 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 levels, and liquid fractions.

$$HGR = HGR_{thm} + HGR_{rad} + HGR_{corr} \tag{2-1}$$

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

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

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

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

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

and E_{thm} 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 (2.76 E+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), and
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 reactions follows Arrhenius behavior, and the rate from radiolysis is proportional to the radiation dose. In addition, the HGRs from radiation effects in tank waste samples have been observed to be temperature dependent (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 that is initiated by radiolysis, 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 dome space for all DSTs and SSTs. The methodology also provides a technical basis for flammable gas control in tank farm operations. The evaluation will address the flammability level in the 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 under given ventilation conditions. Based on the flammable gas concentrations, the level of flammability of the mixture can be calculated. At current normal ventilation conditions, the steady-state flammability level in the tank dome space is below 25% of the LFL for all tanks (Hu 1998). The primary evaluation is focused on the flammable gas level under off-normal ventilation conditions.

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 dome space and have no general model for calculating the gas generation rate; therefore, the steady-state gas release rates of ammonia and methane are estimated by their steady-state gas concentrations under normal ventilation conditions. Nitrous oxide is an oxidizer, and the concern is whether its concentration is high enough to lower the LFL of those flammable gases as established in air. The gas release rate of nitrous oxide is also derived by the steady-state gas concentration under normal ventilation conditions.

In the following sections, the LFL, the normal and off-normal ventilation conditions in the dome space, the 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 was established. From this model, the steady-state flammability level can be calculated for a given ventilation condition. It also can estimate the time required to reach certain flammability levels in the dome space under different ventilation conditions and calculate the minimum ventilation rate to keep the dome space below the specified flammability limit.

3.1 LOWER FLAMMABILITY LIMITS

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 LFL 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 C_i is the volume percent of fuel gas *i* in the fuel gas mixture, and
LFL_i 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. For simplicity, flammable gases with concentrations less than that of methane are omitted.

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

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, and
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% in air. 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 show that the ratio of 4.5-10.1-85.4 is not flammable. For a H_2-N_2O-Air mixture, the data show 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 each case, the concentration of nitrous oxide was evaluated and did not exceed 8%, therefore, the oxidizer effect of lowering the above flammability limits can be ignored.

3.2 VENTILATION CONDITIONS IN TANK DOME SPACE

In normal operating conditions, the ventilation conditions can be active ventilation or passive ventilation. For all DSTs and some SSTs, the tank dome space is equipped with an active ventilation system. For active ventilation systems, the main ventilation flow is designed to go through an installed inlet filter. AP-Farm is an exception; inlet air flows through cover blocks or gaps in riser covers, and other tank openings. The size of the inlet openings was designed either to be fully adjustable or just an on-off valve. These filtered inlets are used to control the ventilation rate and to adjust the negative pressure for preventing leakage of tank hazardous materials or to provide control for any other operational needs. For passively ventilated tanks, the ventilation flow goes mainly through HEPA breather filters. Under normal operating conditions, the active ventilation rates range from 100 cubic feet per minute (cfm) to 700 cfm, while the passive ventilation rates typically range from 0.5 cfm to 10 cfm.

The off-normal operating ventilation condition considered in this flammability assessment is as follows: The active ventilation system is shut down and the venting air inlet is closed; therefore, the only venting flow is through the cracks or cover blocks. In the off-normal condition, there are three possible tank ventilation conditions: no ventilation flow, ventilation flow is caused only by barometric breathing, or ventilation flow is due to natural breathing, which is a combination of ventilation by barometric breathing plus thermal convection. The barometric breathing rate, V_{bb}, is estimated as 0.45% of the dome space volume per day (Crippen 1993) and is given as

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

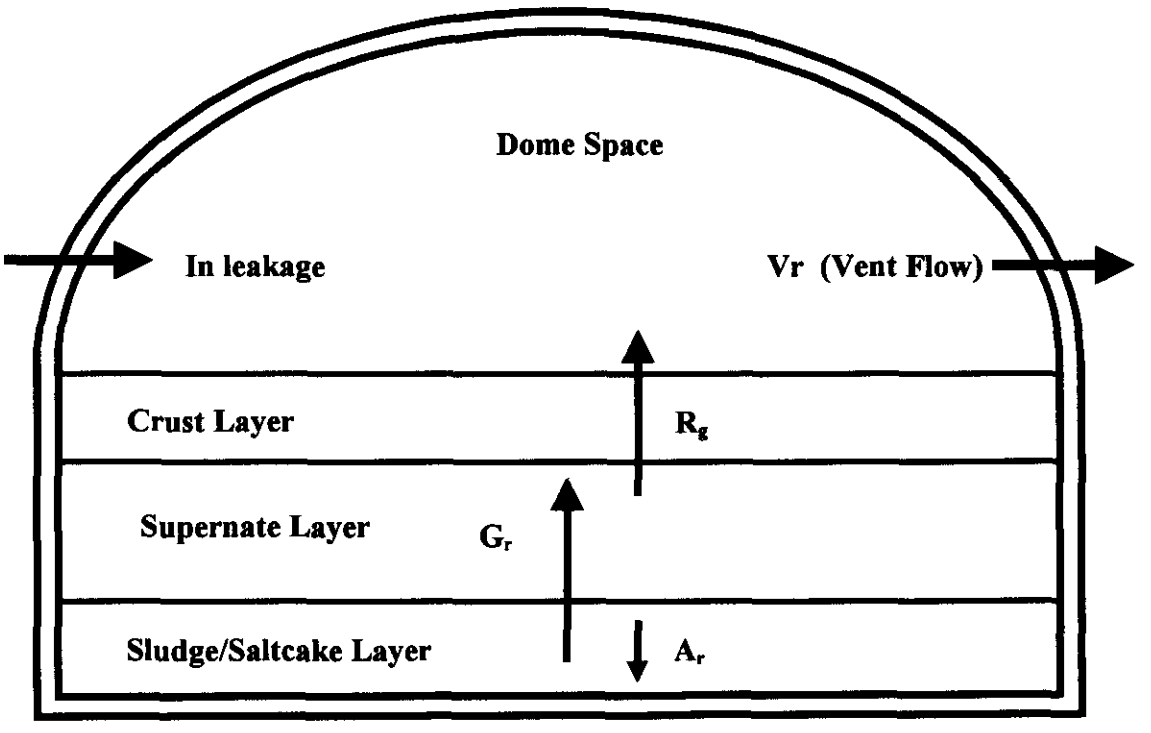
where $Vol_{headspace}$ is the volume of the tank dome space (ft^3).

During off-normal operating conditions, the most likely ventilation rate is either natural breathing or barometric breathing. The natural breathing rate is estimated to be five to ten times the V_{bb}. 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 normal ventilation is not present. Using a tracer gas, the measured passive ventilation rates (Huckaby et al. 1998) under normal ventilation conditions in SSTs ranged from 1.7 to 10 cfm for most tanks. No similar measurements for the passive rates (i.e., the active ventilation system is shut down with the air-inlet open) are available for DSTs. Unfortunately, no ventilation rate measurements have been made for the condition where the air inlet is shut off. For the off-normal condition, based on Equation 3-3, the calculated barometric breathing rate for most tanks is around 0.5 cfm or less (as shown in Table C-2 of Appendix C), which is one-third to one-twentieth of normal conditions.

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. A simplified tank dome space system is 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 supernatant and sludge/saltcake layers. A few tanks, such as tank 241-AN-103, have a thin crust layer above the supernatant. The gas release rate (Rg) is the net result of the generation rate (Gr) and the accumulation rate (Ar). The gas accumulation rate refers to the rate at which gas is trapped in the sludge/saltcake layer. The ventilation flows (Vr) are available as field measurements taken at the output streams. These flows are the sum of air inflows from the inlets and tank cracks/openings and the gases released from tank waste. 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)

For the less soluble gases such as hydrogen or methane, the gas release rate can be considered to be constant; therefore, the mass balance equation can be written as a differential equation as given below:

$$Vol\frac{\partial[C_g]}{\partial t} = R_g - V_r \cdot [C_g] \tag{3-5}$$

where $[C_g]$ is the gas concentration (volume percent),
Vol is the volume of the tank dome space (volume),
R_g is the gas release rate from the waste surface (volume/time), and
V_r is the ventilation rate in the dome space (volume/time).

As given above, the gas exhaust rate is simply the gas concentration times the output ventilation rate. By solving the differential Equation 3-5, a time-dependent gas concentration at time t, $[C_g](t)$, in units of volume percent is given as follows:

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

with λ $= V_r / Vol$

where R_g 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), and
λ is the decay parameter from the venting (inverse time).

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

For a highly soluble gas, such as ammonia, the gas release rate from liquid waste is not a constant but is dependent on the material transport properties and the ammonia concentration gradient between the liquid and vapor phase and appropriate Henry's Law constants. Thus the differential equation of mass balance equation in Equation 3-5 and the time-dependent gas concentration Equation 3-6 have a different format. For a closed system, Henry's Law describes the relationship of a soluble gas in the liquid and vapor phase as follows:

$$C_l = K_H \cdot P_g \tag{3-7}$$

where	C_l	is the ammonia concentration in the liquid phase (mole/L),
	K_H	is the Henry's constant (mole/L-atm), and
	P_g	is the partial pressure of the ammonia (atm).

The Henry's Law constant is a function of temperature in pure water. In mixed salt solutions, Henry's Law constants are functions of both temperature and the concentrations of the ions in the solution. Weisenberger and Schumpe (1996) provide a formula to calculate the Henry's constant as follows:

$$K_H = K_H{}^{o} \cdot 10^{-\sum_i (h_i + h_g) \cdot C_i} \tag{3-8}$$

with $K_H{}^{o} = e^{(-8.0964+3917.5/T-0.00314T)}$

where	$K_H{}^{o}$	is the Henry's constant in the pure water (g-mole/L-atm),
	h_i	is the ionic dependent coefficient,
	h_g	is the gas specific constant for ammonia, and
	C_i	is the ion concentration in the solution.

However, the Schumpe's formula is only good for the solution up to 5 molar. Hedengren et al. (2000) has reported Henry's Law constants for SY-101 simulant waste at different dilution conditions and temperatures. This study covers solution concentrations ranging from 5 to 21 molar at temperatures of 20 to 70 °C. These results provide a correction factor to the calculated Henry's law constant from Schumpe's formula above.

For example, the measured Henry's constant is five times the calculation from Schumpe's formula for the undiluted sample of 21 molar at 70 °C.

For soluble gas, the gas release rate depends on the equilibrium mechanism between the liquid and vapor phases described above. A comprehensive soluble gas transfer methodology applied to Hanford waste has been described in Hedengren et al. (2000). Discussion and derivation for the steady-state calculation of soluble ammonia is given as follows. Consider the two-film theory of gas transfer: the ammonia release will encounter the resistance from two films, one is the liquid film and the other is the gas film, between the bulk liquid and bulk vapor phases. The release rate is proportional to the difference between the ammonia liquid and the ammonia vapor concentration before reaching equilibrium. It is also proportional to the mass transport coefficient, h, and the effective area, A. Therefore, the release rate can be derived as follows:

$$R_g = h \cdot A \cdot (C_l - C_l^{EQ}) = h \cdot A \cdot (C_l - K_H \cdot P_g) = h \cdot A \cdot (C_l - K_H \cdot P \cdot v \cdot C_g) \qquad (3\text{-}9)$$

where	h	is the overall mass transport coefficient from liquid to vapor (L/sec),
	A	is the effective area for the transport (m^2/1000),
	C_l^{eq}	is the corresponding liquid ammonia concentration in equilibrium current ammonia vapor pressure (g-mole/L),
	C_l	is the current ammonia concentration in liquid (g-mole/L),
	P_g	is the gas partial pressure (atm),
	P	is the dome space total pressure (atm),
	v	is the specific molar volume of gas in the dome space (L/mole),
	C_{NH3}	is the current ammonia concentration in the dome space (g-mole/L), and
	K_H	is the Henry's constant (mole/L-atm).

As shown in Equation 3-9, it is clear that the ammonia gas release rate is a function of the ammonia concentrations in the liquid and vapor phases, and the Henry's Law constant for ammonia in the solution. In the two-film-theory of gas transfer, the overall mass transport coefficient h contains the transport coefficient h_l for gas through the liquid film and h_g for the gas through the gas film. Detailed equations of the calculated h are described in Hedengren et al. (2000) and are summarized in Appendix A.

A sensitivity study indicates that the overall mass transport coefficient h varies by several factors while the effective area A for mass transport is difficult to determine for the tank waste, particularly for the SSTs, where the waste surfaces are mostly crusts. Dome space ammonia concentrations would be greatly overestimated by several orders of magnitude if the full area for the SST is used as the effective transport surface. As discussed in Section 3.4, however, the product of h and A can be determined by field data at steady-state conditions. Once h x A is determined, the gas release rate can be calculated by Equation 3-9. Applying the ammonia release

rate from Equation 3-8 to the mass balance in Equation 3-5 results in Equation 3-10:

$$Vol\frac{\partial[C_g]}{\partial t} = h \cdot A \cdot (C_l - K_H \cdot P \cdot v \cdot C_g) - [V_r] \cdot [C_g] \tag{3-10}$$

Dividing by Vol and rearranging Equation 3-10, it becomes:

$$\frac{\partial[C_g]}{\partial t} = k_2 - k_1 \cdot [C_g] \tag{3-11}$$

with $k_1 = [V_r + h \cdot A \cdot K_H \cdot P \cdot v]/[Vol]$ and

$k_2 = [h \cdot A \cdot C_l]/[Vol]$

The solution of Equation 3-11 is given as:

$$[C_g](t) = [C_g](t_0)\exp(-k_1 \cdot t) + \left[\frac{k_2}{k_1}\right][1 - \exp(-k_1 \cdot t)]. \tag{3-12}$$

3.4 STEADY-STATE GAS CONCENTRATION AND GAS RELEASE RATE

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:

$$[C_g]_{\%}^{ss} = \left[\frac{R_g}{V_r}\right]_{\%} \times 100 \tag{3-13}$$

where $[C_g]_{\%}^{ss}$ is the steady-state gas concentration,
R_g is the gas release rate (volume/time), and
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 gas fraction and the ventilation rate. For soluble gases, from Equation 3-6, the steady-state concentration can be expressed as:

$$[C_g]^{ss} = \left[\frac{V_r + h \cdot A \cdot K_H \cdot P \cdot v \cdot}{h \cdot A \cdot C_l}\right]. \tag{3-14}$$

The gas release rate R_g can be estimated by subtracting the gas accumulation rate from the gas generation rate as follows:

$$R_g = G_r - A_r \tag{3-15}$$

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

For hydrogen, the generation rate can be calculated using the empirical rate equation described in Section 2.1. The accumulation rate (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 insoluble gases, no gas generation rate model is available. Therefore, the steady-state gas release rate can be estimated from the known steady-state concentration in the dome space under normal ventilation conditions by rearranging Equation 3-13 as follows:

$$R_g = \left(\frac{[C_g]_{\%}^{ss}}{100}\right) \cdot V_r \tag{3-16}$$

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

In this report, the gas release rates for methane and nitrous oxide were obtained from their steady-state concentrations under normal ventilation conditions using the Equation 3-16. Then the calculated gas release rate is used to calculate the steady-state concentrations for off-normal conditions. This methodology is a reasonable way to determine methane concentrations under off-normal conditions, since methane and nitrous oxide are very insoluble and whatever gases are generated are directly released to the dome space.

For highly soluble gases, as mentioned in Section 3.3, the mass transport properties, the product of h and A, is difficult to estimate directly from tank waste properties, particularly for tank waste covered with irregular crust layer. However, for the known steady-state vapor concentration C^{ss}, the liquid concentration C_l along with Henry's Law constant and the ventilation rate Vr, the product of h and A can be determined. By rearranging Equation 3-14, the product of h and A can be expressed as:

$$h \cdot A = \left[\frac{C_g^{\ ss} \cdot V_r}{(C_l - K_H \cdot P \cdot v \cdot C_g^{\ ss})} \right] \tag{3-17}$$

Once the product of h and A is determined from the steady-state under normal ventilation conditions, the ammonia concentration under off-normal ventilation conditions can be estimated using the time-dependent gas concentration C(t) of Equation 3-12, as well as the gas release rate of Equation 3-9. Note that the product of h and A is waste configuration dependent and will be different if the waste is perturbed or changed physically. For the off-normal ventilation calculations, the overall steady-state ammonia concentration is governed by the liquid ammonia concentration. The product of h and A will only change the ammonia release rate, which indicates how fast the system will reach the steady-state.

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 waste transfer compatibility assessment 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 the 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 as given in the gas generation study by King and Bryan (1999) and retained gas sampler results in Mahoney et al. (1999). For ammonia, rather than estimating the release rate, the 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 as described above. For the off-normal ventilation condition, which is about 0.5 cfm or lower, an equilibrium prediction of the ammonia concentration is reasonable and conservative.

3.5 TIME TO REACH LOWER FLAMMABILITY LIMIT

For active ventilation system interruptions, the time for the dome space to build up to flammable gas concentrations exceeding the LFL is one of the main concerns of this evaluation. A time-dependent LFL, $LFL_m(t)$ of the mixture can be calculated using the time-dependent gas concentration (Equation 3-6 for insoluble gas or Equation 3-10 for soluble gas) and the Le Chatelier's rule (Equation 3-2) as follows:

$$LFL_m(t) = \frac{100}{\frac{[H_2](t)}{LFL_{H2}} + \frac{[NH_3](t)}{LFL_{NH3}} + \frac{[CH_4](t)}{LFL_{CH4}}} \tag{3-18}$$

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

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

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

$$t = \frac{\ln\left\{\frac{R_g - V_r \cdot C_g(t_0)}{R_g - V_r \cdot C_g(t)}\right\}}{\lambda} \tag{3-19}$$

with λ $= V_r / Vol$

where R_g is the gas release rate (volume/time),
V_r is the barometric breathing rate (volume/time),
$[C_g](t_o)$ is the initial gas concentration at time t_o (ppmv), and
$[C_g](t)$ is the gas concentration at time t (ppmv).

Similarly, for soluble gases, the time to reach a specified gas concentration under a given ventilation condition can be obtained by rewriting Equation 3-12 and is given as follows:

$$t = \frac{\ln\left\{\dfrac{k_2 - k_1 \cdot C_g(t_0)}{k_2 - k_1 \cdot C_g(t)}\right\}}{k_1} \tag{3-20}$$

with $k_1 = [V_r + h \cdot A \cdot K_H \cdot P \cdot v]/[Vol]$ and

$k_2 = [h \cdot A \cdot C_l]/[Vol]$

However, the time to reach a specified flammability limit of the mixture was not calculated explicitly. A customized macro function in EXCEL™[1] using Visual Basic, based on Equation 3-19 for an insoluble gas and 3-20 for a soluble gas, was developed to calculate the time to reach a specific flammability limit.

3.6 THE MINIMUM VENTILATION RATE TO MAINTAIN DOME SPACE BELOW 25% OF THE LFL

Whether the dome space of a tank will reach the specified flammability limit or not is dependent on the competition between the gas release rates and the ventilation rates of the system. For steady state, the flammability limit of the mixture in the dome space can be calculated using Equation 3-2. 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 ventilation 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 ventilation to reach the specified flammability limit. If the dome space ventilation rate is larger than this minimum, then the system will never reach the specified flammability limit.

1 EXCEL™ is a registered trademark of Microsoft, Redmond, WA

4.0 EVALUATIONS OF STEADY-STATE FLAMMABILITY LEVEL

In this section, steady-state gas releases from all 28 DSTs and 149 SSTs are evaluated quantitatively against tank ventilation conditions using the methodology described in Sections 2.0 and 3.0 to see if the resulting flammability level becomes a safety concern.

In Section 4.1, hydrogen generation rates are calculated. Collection of input data and the setup of the EXCEL™ spreadsheet for rate calculations 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 ventilation rate are discussed. Section 4.3 discusses the steady-state gas release rates for the flammability level evaluation. For hydrogen, the gas release rate is the net result of the model-calculated gas generation rate minus the field estimated gas accumulation rate. For ammonia, methane, and nitrous oxide, the gas release rates were extrapolated from steady-state concentrations under normal ventilation rates. For those tanks showing higher predicted steady-state ammonia concentrations (more than 0.5%) under off-normal ventilation conditions and flammability levels exceeding 25% of the LFL in Revision 0, the ammonia concentration has been reanalyzed with the liquid/vapor equilibrium model as described in Section 3.4. Section 4.4 describes the evaluation of flammability levels in the tank dome space for all 177 tanks. The evaluations include: (1) calculation of total flammability level as well as the distribution from each flammable gas under both normal and off-normal ventilation conditions, (2) the time required for the flammable gases concentration in the tank dome space to reach various flammability levels when the normal ventilation system is shut down, and (3) the minimum ventilation rate required to keep the dome space concentration below the specified flammability limit.

Details of the results of the hydrogen generation rate calculations, ammonia mass transport properties and flammability evaluations in the tank dome space for 177 tanks are given in Appendix B, Appendix C, and Appendix D, respectively. A 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 E. In addition, a preliminary uncertainty analysis on both the hydrogen generation rate calculation and the flammability evaluation using Monte Carlo simulation for tank 241-AN-104 is also given in Appendix E.

4.1 HYDROGEN GENERATION RATE MODEL CALCULATIONS

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

An EXCEL™ spreadsheet was set up to calculate hydrogen generation rates for all 177 Hanford DSTs and SSTs. There are four sections in the spreadsheet including an input data section (Section 4.1.1), a derived data section (Section 4.1.2), a calculated rates section (Section 4.1.3), and rate validation section (Section 4.1.4). The spreadsheet was set up to allow for easy upgrades 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 concentrations of TOC, NO_3, NO_2, and Al in the liquid phase; the total heat load in terms of Cs and Sr; liquid and bulk densities; total solids and supernatant tank waste volumes; the weight percent of water for liquid and sludge layers; tank waste temperature, and the tank dome space temperature. The organic species present provide 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 dome space 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). The input data used were based on data available as of October 1999 except for tank 241-SY-101 where input data were based on the grab sample data of April 2000 (Esch 2000) to reflect the status after remediation. Waste tanks were 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 were used to create a distribution, which was assumed to describe the total population of data for a given tank classification. This distribution was then used to provide a range of data including the missing data. In cases where there were insufficient data to create a statistically valid distribution, data from similar groups of tanks were combined to create a distribution of 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 was used.

This methodology of providing values and distributions for missing data was not optimized to provide the "best" waste properties or compositions with respect to waste chemical makeup. This methodology was prepared 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 in Barker et al. (1999) was used to determine that a finer resolution of data over that used for general waste classifications was not statistically justified. As a result, the mean values used in this analysis were 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 calculations for 177 tanks are described in detail in Kufahl et al. (2000) and listed in Table B-1 of Appendix B.

The tank 241-A-105 hydrogen generation rate has not been calculated. As described in Chapter 2 of the FSAR, the steel liner leaked and the tank has been interim stabilized. 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 Derived Data

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 fold. 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 cumbersome task of completing the rate calculations and makes error checking easier and more effective. Details of the derived data are listed in Table B-2 of Appendix B.

4.1.3 *Calculated Hydrogen Generation Rates*

The hydrogen generation rates were calculated for the total tank waste, as well as for different waste layers. The waste layers are the convective layer (supernatant) and the 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 per unit mass or per unit volume are listed in the Table B-3 of Appendix B. The total gas generation rate for a whole tank (in units of "cubic feet per minute" and "liters per day") was calculated by multiplying the unit rates by the total waste volume, and the results are listed in Table B-4. Table 4-1 lists the nine tanks with the highest model-calculated hydrogen generation rate plus the rates for tank 241-SY-101. Note that the updated total hydrogen generation rates for tank 241-SY-101 decreased by a factor of 10 when compared to the previous calculations in Revision 0 of this report.

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	6.98E-04	1.59E-03	6.94E-04	23.4%	53.3%	23.3%	2.98E-03
SY-101 liquid	5.40E-04	1.14E-03	3.41E-04	26.7%	56.4%	16.9%	2.02E-03
SY-101 solid	1.59E-04	4.47E-04	3.53E-04	16.6%	46.6%	36.8%	9.58E-04
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 supernatant and salt cake/sludge layers, respectively.

Generation rates from radiolysis, thermolysis, and corrosion are also listed in Table 4-1 for solid and liquid layers for each tank. Tank 241-A-101 has the largest hydrogen generation rate of 1.5E-2 cfm. 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.

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 at the tank outlet 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. The ventilation rates were for normal ventilation conditions, either passive or active, in conjunction with steady-state gas concentration data to estimate the gas release rates.

Dome space gas composition data were based on analytical data from 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 et al. (1999). The ventilation rates and the steady-state gas concentrations under normal operating conditions, along with waste volumes and dome space volumes for 177 tanks are listed in Table B-1 of Appendix B. For a number of tanks, specifically sludge tanks, dome 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 levels under different ventilation conditions, the steady-state gas release rates were used to calculate the flammable gas concentrations for a given ventilation condition. For hydrogen, the steady-state release rates were calculated by subtracting the gas accumulation rate from the generation rate. The hydrogen generation rates are calculated in Section 4.1 and are listed in Appendix B. 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 CH_4, NH_3, and N_2O were derived from the steady-state concentrations under normal ventilation rates using Equation 3-16. The calculated gas release rates of H_2, NH_3, CH_4, and N_2O are listed in Table D-1 of Appendix D.

For ammonia, however, the above method would largely overestimate the steady-state concentrations under off-normal ventilation conditions for those tanks having relatively large

release rates calculated from the steady-state concentration. For example, for tank 241-SY-101, the steady-state release rate obtained from the dome space concentration of 400 ppm under normal ventilation conditions predicts a steady-state concentration 108% of the LFL for the off-normal ventilation condition. This value is two orders of magnitude larger than the current estimated value of 0.4% of the LFL using the liquid/vapor equilibrium mechanism. In Revision 0 of this report, similar overestimations of ammonia concentration are also reported for tanks 241-AN-102 and 241-AN-107.

As described in Section 3.0, ammonia is very soluble, and the gas release rate is not a constant but governed by the liquid/vapor equilibrium defined by Henry's Law and the mass transport coefficient, h, and the effective transport surface area, A. The ammonia release rate is driven by the gradient between the vapor and liquid phase before reaching equilibrium. Therefore, a greater difference results in a larger release rate. For a closed system, i.e., a zero ventilation rate, the final release rate is zero when the system reaches equilibrium.

For an open system, the system will never reach the equilibrium but a steady-state release condition. At steady-state, the concentration is lower than the equilibrium value, and the larger the ventilation rate, the lower the steady-state concentration of ammonia. For a given system, the release rate at steady-state is also proportional to the ventilation rate. Therefore, if the steady-state release rate obtained for a high ventilation rate (i.e., normal active ventilation) is used as a constant to predict the steady-state concentrations for the off normal low ventilation condition, the ammonia dome space concentration for the off-normal ventilation condition could be greatly overestimated.

Figure 4-1 demonstrates the relationship of the equilibrium value, the steady-state concentration, and the release rate of ammonia under both normal and off-normal conditions for tank 241-SY-101. As shown in Figure 4-1 for the normal ventilation rate of 486 cfm, the steady-state concentration of ammonia is 400 ppm, which is far below the equilibrium value of 3,895 ppm. For an off-normal ventilation rate of 0.18 cfm, the ammonia concentration increased exponentially and takes less than 8 days to reach steady-state with the concentration of 3,882 ppm, which is lower but very close to the equilibrium value. Also, note that the steady-state release rate from 0.19 cfm under normal ventilation conditions of 486 cfm dropped exponentially to 7.6 E-4 cfm for the off-normal ventilation condition of 0.18 cfm.

For many SSTs and some of the less-concentrated ammonia DSTs, the ammonia release rate was too small to contribute significantly to reaching 25% of the LFL even under off-normal ventilation conditions. Therefore, this method of considering ammonia release rates as constants would be a simple method to screen out those tanks having small release rates. This would avoid having to use the liquid/vapor equilibrium method, which requires liquid and dome space ammonia concentration data and more complex calculations.

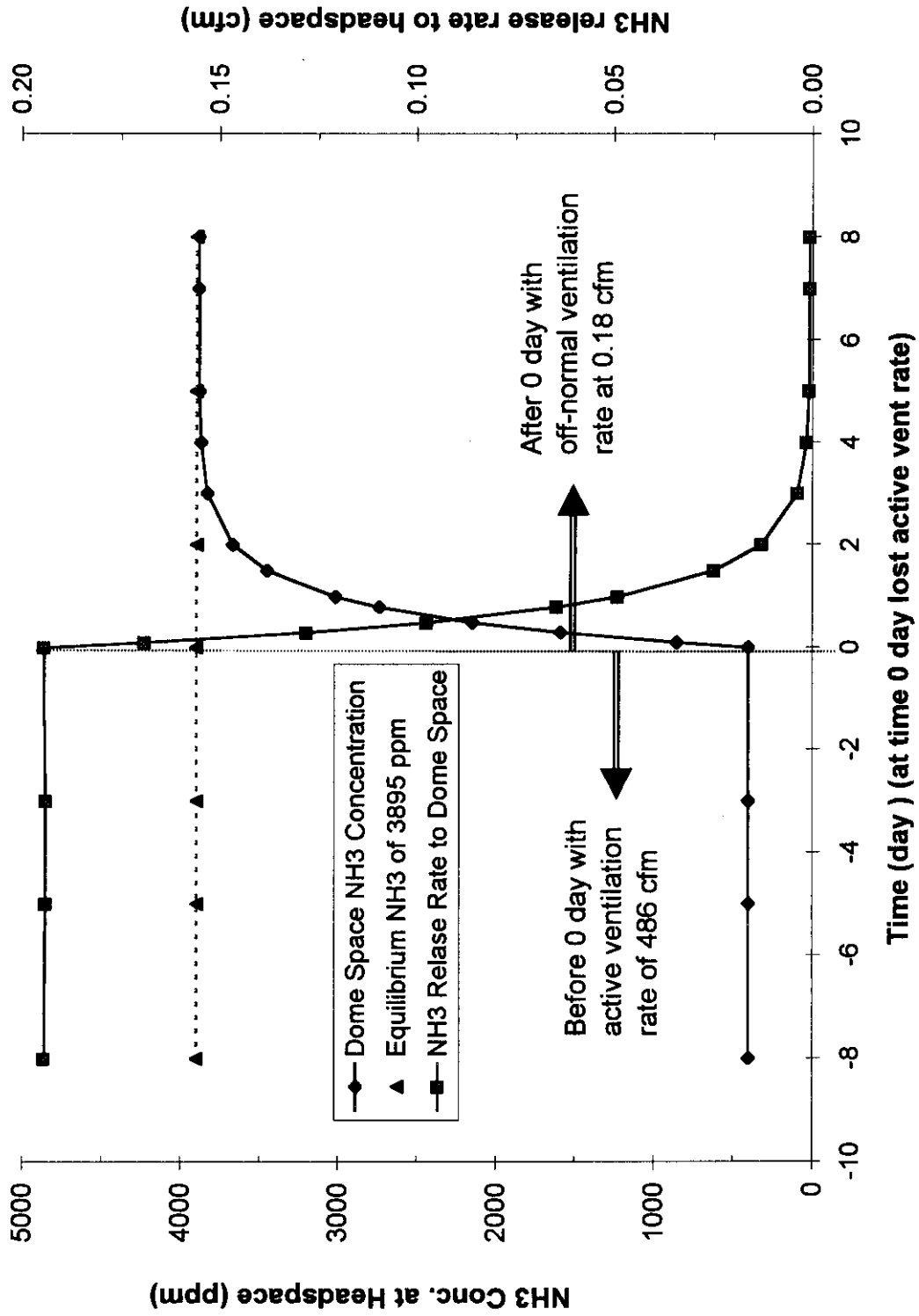


Figure 4-1. Ammonia Concentration and Release Rate for Tank 241-SY-101 Before and After Loss of Active Ventilation

4.4 STEADY-STATE MASS TRANSPORT PROPERTIES "h" AND "A" FOR NH_3

As mentioned in Section 3.0, in the liquid/vapor equilibrium model, it is difficult to estimate the effective area A of the mass transport. As discussed later, the ammonia concentration could be overestimated by two orders of magnitude in the liquid/vapor equilibrium model if 100% of the effective area is used. In this report, the ammonia concentration analysis follows the logic below to perform the dome space ammonia calculations:

(1) The ammonia concentration of all DSTs was analyzed using the liquid/vapor equilibrium model as described in Section 3.0. The mass transport properties, the product of h and A, were obtained by Equation 3-17 from the steady-state concentration under normal conditions. Then, using this product of h and A, the time-dependent ammonia concentration and flammability under off-normal conditions were calculated.

(2) For the SSTs, the ammonia concentrations were first evaluated assuming a constant release rate. If the ammonia concentrations were more than 0.5% and the total flammability was above 20% of the LFL, then the ammonia concentration was reanalyzed with the liquid/vapor equilibrium method as done for the DSTs.

The input data collected included the ammonia concentrations in the liquid and in the dome space under normal ventilation conditions, the waste volume and ionic composition, and the temperatures of the waste and the dome space. Table C-1 of Appendix C gives the liquid concentrations in the DSTs and selected SSTs for the ions used in the calculation of the Hydrogen Generation Rate. The additional ion constituents required are aluminum, carbonate, hydroxide, nitrate, nitrite, and sodium. Concentrations of other constituents required to perform the ammonia calculations are ammonia, chloride, chromium, fluorine, iron, nickel, phosphate, potassium, and sulfate. Other required data include the tank waste density, temperature, and weight percent water. If available, the ion concentration data were obtained from the Best-Basis Inventory (BBI) reports. The BBI database maintains the most current tank waste inventories for 25 chemical and 46 radionuclide components found in the 177 Hanford Site waste tanks. Where tank ion concentrations or waste properties were not available, an average value was used from the sample analysis data contained in the Tank Characterization Database (TCD). The tank waste temperature values were the only figures not taken from the BBI or the TCD. They were obtained from Table 3-2, SACS Database Waste Temperatures (Bingham et al. 2000).

Based on Equation 3-8, the Henry's Law constants were calculated and are listed in Table C-2 of Appendix C. Also included in Table C-2 are the summations of ion concentrations, the Henry's Law constants in pure water, and the correction factors for the calculated Henry's constants K_H for salt solutions. The correction factors were assigned using the tank waste concentrations and temperatures according to the study results of ammonia solubility in high concentration salt solutions (Hedengren et al. 2000). The mass transport properties of the product h and A were calculated using Equation 3-17 and are listed in Table C-3 of Appendix C. Based on the products of h and A, the time-dependent ammonia concentration and flammability under off-normal ventilation conditions were calculated. As mentioned in Section 3.0, the

product of h and A is dependent on waste configuration and physical and chemical properties, particularly the surface area A, which is the effective surface for gas transport from the liquid to vapor phase. For example, if the waste was disturbed or the configuration of the waste surface changed, then both the effective surface area and h could change and the product of h and A would change. Therefore, what has been calculated for the product of h and A in this report only reflects the current ammonia transport status of storage tank waste at steady-state.

As a comparison, Table 4-2 lists the products of h and A both from the field data under normal condition derived values using Equation 3-17 and the calculated h with a 100% tank surface area using the equations listed in Appendix A. For most cases, using 100% of the surface area would overestimate the ammonia concentration by several orders of magnitude, particularly for the SSTs which are covered with crust. The ammonia values in several DSTs are also overestimated by several orders of magnitude. These calculated results suggest that the effective transport surface area is much smaller than originally thought. Even for tanks containing supernatant, a thin crust layer could easily be formed that will limit gas transport, especially when the supernatant is highly concentrated. Note that the values of the product of h and A determine how fast the ammonia will be released to the dome space. The bounding value is the steady-state ammonia concentration in the dome space. Listed in the last column of Table 4-2 are the steady-state ammonia concentrations under off-normal conditions. For all calculated values except tank 241-A-101, the ammonia concentration is less than 7,500 ppm, which contributes less than 5% of the LFL to the total flammability.

Table 4-2. The Calculation of Ammonia Transport Properties

Tanks	$(NH_3)^{ss}$ in Dome Under Normal Vent (ppm)	Liquid $[NH_3]$ in Waste (μg/mL)	Normal Vent Rate in the Dome Space (cfm)	Product h A (cfm) From Field Data at Normal Vent	Product h A (cfm) From Calculated h and 100% A	$(NH_3)^{ss}$ at Off-Normal Vent (ppm)
241-AN-101	11	40	113	2.85E-02	1.02E+00	55
241-AN-102	300	210	119	1.80E-01	2.03E+00	857
241-AN-103	7	345	100	1.33E-03	3.50E+00	2034
241-AN-104	21	246	100	5.92E-03	3.08E+00	2011
241-AN-105	15	210	100	5.02E-03	2.91E+00	1523
241-AN-106	1	210	117	3.99E-04	1.12E+00	123
241-AN-107	400	210	129	3.60E-01	1.94E+00	759
241-AP-101	125	439	108	2.57E-02	1.26E+00	827
241-AP-102	75	439	135	1.83E-02	1.15E+00	728
241-AP-103	1	250	200	5.76E-04	1.48E+00	248
241-AP-104	3	133	71	1.23E-03	1.18E+00	136
241-AP-105	7	324	176	2.79E-03	1.75E+00	800
241-AP-106	5	68	111	6.54E-03	1.11E+00	104
241-AP-107	5	1060	342	1.16E-03	7.14E-01	909
241-AP-108	27	800	129	3.14E-03	8.82E-01	852

Table 4-2. The Calculation of Ammonia Transport Properties

Tanks	$(NH_3)^{\infty}$ in Dome Under Normal Vent (ppm)	Liquid $[NH_3]$ in Waste (μg/mL)	Normal Vent Rate in the Dome Space (cfm)	Product h A (cfm) From Field Data at Normal Vent	Product h A (cfm) From Calculated h and 100% A	$(NH_3)^{\infty}$ at Off-Normal Vent (ppm)
241-AP-108	27	800	129	3.14E-03	8.82E-01	852
241-AW-101	5	10	100	3.92E-02	3.05E+00	89
241-AW-102	3	74	292	7.16E-03	7.74E-01	80
241-AW-103	138	512	134	3.63E-02	7.06E-01	437
241-AW-104	6	169	141	3.64E-03	6.99E-01	142
241-AW-105	43	1010	194	5.97E-03	5.49E-01	625
241-AW-106	28	355	158	8.59E-03	2.06E+00	1164
241-AY-101	5	113	250	7.69E-03	1.55E+00	286
241-AY-102	4	74	250	1.05E-02	1.60E+00	207
241-AZ-101	1	125	150	8.31E-04	2.79E+00	331
241-AZ-102	6	438	112	1.01E-03	1.96E+00	1181
241-SY-101	400	1044	486	1.42E-01	2.09E+00	3870
241-SY-102	12	1150	363	2.67E-03	1.24E+00	1771
241-SY-103	59	1290	116	3.88E-03	3.14E+00	5581
241-A-101	394	531	10	5.17E-03	3.74E+00	8253
241-A-103	261	531	8	2.61E-03	3.21E+00	2922
241-C-103	324	1210	10	1.94E-03	1.88E+00	3159
241-S-101	765	1210	6	2.94E-03	2.59E+00	5817
241-S-102	588	1700	2	5.47E-04	3.01E+00	4312
241-SX-103	31	1800	53	6.11E-04	3.55E+00	4977
241-U-102	651	745	2	1.66E-03	2.08E+00	2157
241-U-103	722	1400	2	9.56E-04	2.47E+00	4582
241-U-105	1936	1600	5	5.64E-03	2.22E+00	6909
241-U-107	448	403	12	1.34E-02	1.98E+00	1380
241-U-108	684	1050	4	1.87E-03	2.57E+00	4345

4.5 FLAMMABILITY EVALUATION AND RESULTS

With the collected ventilation rates and steady-state gas concentrations, the flammable gas concentrations, as expressed as percent of the LFL, in the tank dome space under normal ventilation conditions were calculated using Equation 3-18 and are listed in Table D-1 of Appendix D. The highest observed level is 4% of the LFL. This suggests that the tank dome space of all tanks under current ventilation rates, whether actively or passively ventilated, will not exceed 25% of the LFL.

For off-normal ventilation rates, assuming only barometric breathing rate, $V_{bb,}$, is available (discussed in Section 4.2), the steady-state concentration can be calculated using Equation 3-14 for insoluble gas and using Equation 3-17 for the soluble gas; the results are listed in Table D-2 of Appendix D. In the calculation for the off-normal condition, the initial concentrations are assumed to be the steady-state concentration under normal ventilation conditions and are listed in Table D-1 of Appendix D. As listed in Table D-2, under the off-normal condition, 35 tanks exceed 25% of the LFL when the system reaches steady-state, and 10 tanks reach 100% of the LFL.

Equation 3-18 gives the formula to calculate the flammable gas concentrations at a given time with the aid of a time-dependent gas concentration equation (Equation 3-6 for insoluble gas and Equation 3-12 for soluble gas). Since the "time" variable cannot 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 LFLs in Equation 3-18 are met. The calculated times to reach 25% and 100% of the LFL (time-to-25% LFL and -100% LFL) under the off-normal ventilation condition are listed in Tables D-3 and D-4 of Appendix D, 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 dome space from exceeding 25% of the LFL. Equation 3-18 gives the flammable gas concentration in terms of % of the LFL at steady-state; however, the ventilation rate is embedded in the time-dependent concentration as given in Equations 3-6 and 3-12. No explicit solution was developed to find the minimum ventilation rate in Equation 3-18. For those tanks exceeding the specified flammability level, the minimum ventilation rate can be found by gradually increasing the ventilation rate from zero until a total flammability level of less than the specified 25% or 100% of the 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 Tables C-3 and C-4 for 25% and 100% of the LFL, respectively.

Table 4-3 lists the tanks with time-to-25% of the LFL as less than 600 days for both DSTs and SSTs under the off-normal ventilation condition. Also listed in Table 4-3 are the previously calculated times-to-25% of the LFL, the current calculated time to reach 100% of the LFL, the hydrogen generation rates from current and previous calculations, and the gas concentrations and % of the LFL contribution of the different gases at time-to-25% of the LFL. Tanks 241-A-101 and 241-AN-102 give the shortest time-to-25% of the LFL of 21 and 32 days for SSTs and DSTs, respectively, under the off-normal condition. Overall, there are six tanks from DSTs and four tanks from SSTs that will reach 100% of the LFL. It takes 110 and 180 days to reach 100% of the LFL for tanks 241-A-101 and 241-AN-102, respectively.

Table 4-3. Comparison of Time-to-25% and 100% of the LFL Between Current and Previous Calculations

Tank Name	Time to 25% LFL $t_{25\%}$ (day) (This work)	Time to 25% LFL $t_{25\%}$ (day) (Rev. 0)	Time to 25% LFL $t_{25\%}$ (day) (CN-116&7)	Time to 100% LFL $t_{100\%}$ (day) (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-AN-102	**32**	17	18	180	1.01E-02	1.64E-02	0.62
241-AN-107	**37**	15	11	221	9.07E-03	2.92E-02	0.31
241-AZ-102	**42**	42	27	266	1.06E-02	1.71E-02	0.62
241-AN-105	**56**	54	36	591	4.82E-03	7.40E-03	0.65
241-AY-102	**57**	57	29	545	1.40E-02	1.83E-02	0.77
241-AZ-101	**63**	63	24	1143	8.80E-03	2.01E-02	0.44
241-AW-101	**74**	73	66	not occur	3.93E-03	4.31E-03	0.91
241-AN-104	**101**	92	59	not occur	3.66E-03	5.91E-03	0.62
241-SY-101	**152**	9	7	not occur	2.98E-03	3.65E-02	0.08
241-AN-103	**172**	171	96	not occur	3.17E-03	5.05E-03	0.63
241-SY-103	**263**	168	129	not occur	3.13E-3	5.90E-3	0.53
241-AP-101	**503**	64	217	not occur	1.06E-3	1.85E-3	0.57
241-AP-102	**544**	86	151	not occur	1.15E-03	2.49E-03	0.46
Single-Shell Tanks							
241-A-101	**21**	22	25	110	1.48E-02	1.04E-02	1.41
241-B-204	**36**	36	63	205	2.47E-04	1.75E-04	1.41
241-B-203	**42**	42	57	262	1.91E-04	1.75E-04	1.09
241-SX-105	**55**	55	not occur	460	1.22E-02	1.30E-03	9.41
241-SX-103	**83**	84	not occur	not occur	8.19E-03	1.50E-03	5.46
241-A-103	**96**	91	288	not occur	1.07E-02	4.74E-03	2.25
241-T-204	**140**	140	161	not occur	1.57E-04	1.75E-04	0.90
241-AX-101	**146**	147	not occur	not occur	4.83E-03	6.40E-04	7.55
241-T-203	**178**	180	194	not occur	1.46E-04	1.75E-04	0.84
241-S-101	**232**	179	173	not occur	3.30E-03	4.42E-03	0.75
241-U-103	**287**	240	91	not occur	4.70E-03	4.3E-03	1.09
241-SX-108	not occur	not occur	17	not occur	7.59E-04	6.14E-02	0.01
241-SX-107	not occur	not occur	20	not occur	2.42E-03	5.23E-02	0.05
241-SX-114	not occur	not occur	22	not occur	3.84E-03	4.39E-02	0.09
241-SX-110	not occur	not occur	28	not occur	1.12E-03	3.96E-02	0.03
241-C-106	not occur	not occur	30	not occur	5.57E-04	2.26E-02	0.02
241-SX-111	not occur	not occur	30	not occur	3.94E-03	3.56E-02	0.11
241-C-105	not occur	not occur	35	not occur	7.77E-04	1.92E-02	0.04
241-SX-112	not occur	not occur	36	not occur	1.21E-03	3.04E-02	0.04

4.6 UNCERTAINITY ANALYSIS: TANK 241-AN-104 AS AN EXAMPLE

A Monte-Carlo analysis was performed to investigate the sensitivity of the model presented. Appendix E contains a MathCad™2 model, which performs a preliminary analysis of the model as applied to tank 241-AN-104. The evaluation was limited in scope and since the sensitivity of the results to sample count has not be studied, the results might not be statistically valid. The number of samples was limited to 500. However, some interesting findings are presented. Typically, the characterization data were entered with an estimated uncertainty in the data listed as a standard deviation of 10% of the value. In the case of the waste temperature, a standard deviation of 5 °K, or about 1.6% was used. Because of the exponential relationship between temperature and the 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 an exponential relationship to temperature, the structure of the formula dampens the effect (this is a result of the non-temperature-dependent G_{H2O} term being added to the temperature-dependent G_{org} term). For the total waste in tank 241-AN-104, Table 4-4 summarizes the differences in hydrogen generation rates, in steady-state flammable gas concentrations, time to 25 and 50 % of the LFL, and the required ventilation rates to maintain concentrations below 25 and 100 % of the LFL.

Table 4-4. 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	1.3×10^{-4} cfm
HGR - Thermolysis	1.7×10^{-3} cfm	2.0×10^{-3} cfm	9.7×10^{-4} cfm
HGR - Corrosion	7.2×10^{-4} cfm	7.3×10^{-4} cfm	9.5×10^{-6} cfm
HGR - Total	3.7×10^{-3} cfm	4.0×10^{-3} cfm	9.8×10^{-4} cfm
$[H_2]^{SS}$	0.093 %LFL	0.100 %LFL	0.019 %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	66 %LFL	15 %LFL
$[NH_3]^{SS}$ (loss of ventilation)	1.3 %LFL	1.4 %LFL	0.2 %LFL
$[CH_4]^{SS}$ (loss of ventilation)	4.0 %LFL	2.7 %LFL	0.3 %LFL
Time to reach 25 %LFL	100 days	99 days	6 days
Time to reach 50 %LFL	312 days	300 days	32 days
Min Ventilation Rate to maintain <25 %LFL	0.40 cfm	0.41 cfm	0.02 cfm
Min Ventilation Rate to maintain <100 %LFL	0.095 cfm	0.098cfm	0.022 cfm

Note: nc is not calculated

2 MathCad is a registered trademark of MathSoft Engineering & Education, Inc., Cambridge, Massachusetts.

4.7 DISCUSSION

One of major upgrades of this revision was the incorporation of the liquid/vapor equilibrium model (Hedengren et al. 2000) into the methodology to handle highly soluble ammonia. This model reduces the over conservatism in estimating the ammonia flammability in Revision 0. As shown in Table 4-3, the times to reach 25% of the LFL from this work are in general longer than in Revision 0 of this document. This is mostly due to using a refined model (Hedengren et al. 2000) which predicts smaller dome space ammonia concentrations than previous calculations. Most dramatic changes are seen for tanks 241-AP-101, 241-AP-102, 241-S-101, 241-AN-102, and 241-AN-107, whose times to reach 25% of the LFL increased from 64, 86, 179, 17, and 15 days to 503, 544, 232, 32, and 37 days, respectively. Table D-3, in Appendix D, shows that the ammonia concentrations are reduced from 2.7%, 2.5%, 1.0%, 2.2%, 2.0% to 0.08%, 0.07%, 0.58%, 0.09%, and 0.08% LFL, respectively.

In addition, the update of the status of tank 241-SY-101 having had 6,166 kgal of its waste transferred out and its remaining waste diluted has significantly reduced the overall flammability of its dome space. As shown in Table 4-3, the time to reach 25% of the LFL has increased from 9 to 152 days. The hydrogen generation rate is reduced by a factor of more than 10 from 3.7 E-2 to 3.0 E-3 cubic feet per minute. The dome space ammonia concentration in tank 241-SY-101, increased from 4 ppm (prior transfer data) to 400 ppm (January 2001 data) even though the liquid concentration decreased by a factor of 4 comparing prior to and after the waste being transferred out of the tank. The explanation for this is that the thick crust had greatly reduced the ammonia transport from the waste to the dome space. After the waste had been transferred from tank 241-SY-101, the crust layer was substantially removed and the effective area A of mass transport increased; therefore, the concentration in the dome space increased even though the concentration of the ammonia in the liquid decreased. Some thin crust has re-formed in tank 241-SY-101. Breaks in this crust periodically appear.

Note that the dome space ammonia concentration in tank 241-SY-101 steadily increased from 50 ppm in July 2000 to 400 ppm in January 2001, while the hydrogen concentration remained the same. This may also be explained as the effective area of mass transport increased gradually. Calculations show that the effective area could increase from 1.5% to 7% of the total tank waste surface are when the dome space concentration increased from 100 to 400 ppm. This effective area of 1.5% and 7% is roughly 70 and 300 square feet, respectively, and is consistent with the estimated liquid pond of 10 feet (Johnson et al. 2000) and 20 feet or more diameter (Conner 2001), respectively, observed on the surface in the corresponding time period. Calculations also indicated that most of the calculated single-shell tanks had effective surface areas as small as several tenths of one percent of the total tank waste surface. Caution should be taken in using the results of the calculated product of h and A in Table C-3 of Appendix C because the accuracy is limited by the accuracy of the input data. Whether these data such as dome space ammonia concentration, ventilation rate, and liquid concentration are collected at the same time also introduces uncertainty. Tank 241-SY-101 is an example that shows the model calculations agree reasonably with field observations since the input data are accurate and are taken in the same timeframe.

Another issue is that it seems that the area of liquid surface in tank 241-SY-101 is continuously changing and, therefore, the ammonia transport rate will change accordingly. Calculations show that the steady-state dome space ammonia concentration under normal ventilation conditions would reach 2,573 ppm if the effective area were 100% for a given liquid ammonia concentration of 1,040 μg/mL. Using this concentration, the equilibrium vapor concentration of 3,895 ppm is calculated. For the scenario of the waste surface being fully open with 100% effective mass transport area, the total flammability is calculated to be 1.73% under normal ventilation conditions, and the total mass transport product of h and A is 2.09 cfm. Therefore, the calculated time to reach 25% of the LFL under the off-normal ventilation condition would become 151 days rather than 152 days predicted by the previous methods.

Hydrogen generation rates are very sensitive to temperature and are temperature-dependent exponentially for both the thermolysis rate and the radiolysis rate. The temperature used in the calculation is an average value available from the thermocouple tree in a given tank. This method is reasonable for most tanks, where temperature gradients are not too large (about a 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 to 140 °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 calculations and field estimated data show that the current model calculations, using averaged bulk-waste temperatures, still overestimate the observed generation rates; therefore, 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. A linear fit of the available temperature data was conducted to extrapolate the average temperature for the tank waste. Details of the analysis are 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 SSTs 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 the same waste group. The liquid composition data are used to estimate the gas generation rate from the interstitial liquid portion of the solid layer. The liquid fraction is estimated based on the weight percent water data of the solid layer. 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% of the LFL between the current work and the previous calculation notes, 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 based on the tank-waste composition and condition. Based on additional gas generation data, that model was further refined to the revised rate equation model (Hu 2000), 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; therefore, the radiolysis rates were previously overestimated. 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 and reduced heat loads due to the decay of radionuclides. Also, the organic reactants are consumed as time goes on. Therefore, in general for DSTs, it is expected that current hydrogen generation rates would be lower than the previously calculated values. As shown in Table 4-3, the ratios between the current and previous generation rates are all less than one, and current rates are reduced about 40% for most tanks compared to the previous calculations. The calculation for tank 241-SY-101 waste was updated to reflect the waste transferred out between December 1999 and February 2000. Note that the hydrogen generation rate is 2.98 E-3 cfm, which is one tenth of the rate prior to the waste transfer as shown in Revision 0 of this report.

For the flammability evaluation, the major difference between current and previous calculations (CN-116 and CN-117) is that previously the time-to 25% of the 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% of the LFL. The previous 2% assumption was based on the highest ammonia and methane concentration observed in the tank dome space. The current model considers all three fuels, hydrogen, ammonia, and methane, as a function of time for the off-normal ventilation condition.

For SSTs, 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 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 dome space concentration is a function of the ventilation rate. It is rare to find both pieces of data measured at the same time. Because of the lack of measured data, CN-116 used the best-estimated or conservative bounding values to calculate the hydrogen generation rates for many tanks; therefore, the uncertainty in the gas generation rate could be relatively high. For example tanks 241-SX-107, 241-SX-108, 241-SX-110, 241-SX-111, 241-SX-112, and 241-SX-114 have high ventilation rates (about 300 to 400 cfm) and were all assigned a bounding value of 140 ppm for hydrogen concentration. Therefore, the resulting time-to-25% of the LFL calculation results ranged from 17 to 36 days as summarized in Table 4-3. This resulted in a large conservatism being built into these calculations, because the calculated release rates were the same size or up to two times the generation rate from tank 241-SY-101 as reported in CN-117. 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 dome space 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% of the LFL based on CN-116 reported generation rates, but will reach 25% of the LFL in 55 and 83 days, respectively, in the current model calculation. In addition, note that tanks,

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

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5.0 SUMMARY AND CONCLUSIONS

Hydrogen generation rates are calculated for 177 SSTs and DSTs using a rate equation model and tank waste data. For some tanks, which do not have complete information, a waste grouping method was used to obtain missing data. Flammable gas concentrations, in terms of % of the LFL in the tank dome space, are evaluated under both normal and off-normal conditions for all 177 tanks. For normal ventilation conditions, all tanks are well below 25% of the LFL with the highest flammable gas concentration level at 4% of the LFL in tank 241-U-105. Under off-normal conditions, the shortest time to reach 25 % of the LFL is 21 days for SST 241-A-101 and 32 days for DST 241-AN-102.

Calculated hydrogen generation rates for DSTs ranged from 1.4 E-2 to 2.7 E-4 cfm with the highest rate found in tank 241-AY-102. For SSTs the rate ranged from 1.5 E-2 to 4.0 E-5 cfm with tank 241-A-101 having the highest rate. For most DSTs, the tank data are sample based. For quite a few SSTs, the tanks were stabilized and no liquid samples were available. The waste grouping method was used to generate default values for missing tank waste data using a Monte Carlo 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. For the 25 % of the LFL and 100 % of the 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. Therefore, the LFL values of the fuel in air used in Equation 3-10 were valid throughout the calculation. Overall, the calculations under off-normal conditions show that 35 tanks will reach 25% of the LFL and 10 tanks will reach 100% of the LFL when the tanks reach steady-state.

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APPENDIX A

Equations to Calculate the Mass Transport Coefficient h for Soluble Gas

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As described in Hedengren et al. (2000), the overall mass transport coefficient for steady-state can be written in terms of the mass transport coefficient in vapor phase h_g and in liquid h_l as following,

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

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

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

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

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

Listed above in the last column are the typical values used in the calculation of h.

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APPENDIX B

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

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Table B-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

Table B-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

Table B-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

Table B-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	6.20E+03	9.56E+04	1.52E+05	1.34E+04	1.11E+01	1.86E+02	1.36	3685	59%	33	30
SY-101 liquid	6.20E+03	9.56E+04	1.52E+05	1.34E+04	2.80E+00	1.97E+02	1.33	2966	61%	32	30
SY-101 solid	6.20E+03	9.56E+04	1.52E+05	1.34E+04	4.19E+01	1.44E+02	1.49	719	53%	37	30
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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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	353.4	5.02E+06	97%	11358	9.53E-04	4.78E+03	2.45	2.08	0.48	1.03	0.005	0.028
SY-101 liquid	284.5	3.95E+06	100%	5587	9.51E-04	3.75E+03	2.45	2.08	0.48	1.03	0.005	0.026
SY-101 solid	68.9	1.07E+06	87%	5771	9.61E-04	1.03E+03	2.45	2.08	0.48	1.03	0.005	0.033
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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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	2.30E-07	5.14E-07	2.28E-07	9.72E-07	3.62E-09	8.10E-09	3.59E-09	1.53E-08
SY-101 liquid	2.25E-07	4.74E-07	1.43E-07	8.42E-07	3.47E-09	7.30E-09	2.19E-09	1.30E-08
SY-101 solid	2.44E-07	6.84E-07	5.43E-07	1.47E-06	4.21E-09	1.18E-08	9.36E-09	2.54E-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	8.14E-08	9.75E-09	9.77E-08
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	9.39E-09	4.39E-09	1.84E-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	1.78E-08	4.39E-09	2.67E-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

Table B-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	2.49E-08	4.39E-09	3.34E-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	1.44E-09	4.39E-09	8.47E-09
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

Table B-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	3.32E-10	4.39E-09	5.33E-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	2.37E-10	4.39E-09	5.20E-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	1.22E-09	4.39E-09	7.93E-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	3.83E-10	4.39E-09	5.40E-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

Table B-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	4.47E-10	4.39E-09	5.48E-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	1.37E-10	1.65E-08	1.71E-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	1.13E-10	1.65E-08	1.71E-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	1.43E-10	1.65E-08	1.71E-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	5.63E-10	4.39E-09	5.51E-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

Table B-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	5.01E-10	4.39E-09	5.43E-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	8.35E-10	4.39E-09	6.10E-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	8.83E-10	4.39E-09	6.35E-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	2.83E-10	4.39E-09	5.26E-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	7.77E-10	4.39E-09	5.96E-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

Table B-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	4.39E-09	8.45E-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	3.75E-11	4.39E-09	5.00E-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

Table B-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

Table B-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	1.03E-09	4.39E-09	7.86E-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	4.34E-11	4.39E-09	5.73E-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	5.47E-10	4.39E-09	5.61E-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	2.96E-10	4.39E-09	5.28E-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

Table B-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	2.74E-08	4.39E-09	3.92E-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

Table B-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*	*2.55E-09*	*4.39E-09*	*7.96E-09*
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	2.76E-09	4.39E-09	8.20E-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

Table B-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	7.55E-10	4.39E-09	6.08E-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	1.81E-08	4.39E-09	2.59E-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	5.62E-09	4.39E-09	1.30E-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

Table B-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

Table B-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	1.77E-09	4.39E-09	8.74E-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	3.69E-11	4.39E-09	4.61E-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	1.89E-10	4.39E-09	5.13E-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	1.97E-10	4.39E-09	5.14E-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

Table B-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	1.78E-11	4.39E-09	4.94E-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	2.06E-10	1.65E-08	1.72E-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

Table B-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*	*6.10E-10*	*4.39E-09*	*5.69E-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	9.81E-11	4.39E-09	5.74E-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	8.00E-08	8.44E-08
TX-107 liquid	1.78E-07	1.19E-07	2.73E-07	5.70E-07	2.86E-09	1.91E-09	4.39E-09	9.16E-09
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

Table B-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

Table B-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	2.20E-10	4.39E-09	5.17E-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

Table B-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	2.90E-10	4.39E-09	5.27E-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	6.51E-09	4.39E-09	1.58E-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	7.17E-09	4.39E-09	1.80E-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	1.10E-08	4.39E-09	2.90E-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	1.29E-08	4.39E-09	3.05E-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	1.28E-09	4.39E-09	7.44E-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

Table B-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	4.08E-09	4.39E-09	1.19E-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	2.78E-09	4.39E-09	9.81E-09
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	2.60E-10	4.39E-09	5.23E-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	2.15E-10	1.65E-08	1.72E-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	2.16E-10	1.65E-08	1.72E-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	2.01E-10	1.65E-08	1.72E-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

Table B-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	1.99E-10	1.65E-08	1.72E-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

Table B-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

Table B-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

Table B-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

Table B-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	6.98E-04	1.59E-03	6.94E-04	23.4%	53.3%	23.3%	2.98E-03	122
SY-101 liquid	5.40E-04	1.14E-03	3.41E-04	26.7%	56.4%	16.9%	2.02E-03	83
SY-101 solid	1.59E-04	4.47E-04	3.53E-04	16.6%	46.6%	36.8%	9.58E-04	39
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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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

Table B-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 C

Calculations of the Henry's Law Constants and the Mass Transport Products of h and A

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Table C-1 Input Ion Concentration for NH_3 Calculation

Tanks	Na^{+} in liquid (µg/mL)	Al^{+3} in liquid (µg/mL)	Fe^{+3} in liquid (µg/mL)	Cr^{+3} in liquid (µg/mL)	Ni^{+2} in liquid (µg/mL)	K^{+1} in liquid (µg/mL)	OH^{-1} in liquid (µg/mL)	NO_3^{-1} in liquid (µg/mL)	NO_2^{-1} in liquid (µg/mL)	CO_3^{-2} in liquid (µg/mL)	PO_4^{-3} in liquid (µg/mL)	SO_4^{-2} in liquid (µg/mL)	F^{-1} in liquid (µg/mL)	Cl^{-1} in liquid (µg/mL)
241-AN-101	9.29E+04	1.09E+04	6.32E+00	1.21E+02	3.61E+00	2.68E+03	3.08E+04	7.18E+04	4.07E+04	9.65E+03	1.59E+03	1.36E+03	2.89E+02	2.33E+03
241-AN-102	2.27E+05	1.54E+04	4.90E+01	2.97E+02	4.17E+02	2.88E+03	3.23E+03	2.36E+05	9.04E+04	7.00E+04	5.52E+03	1.53E+04	1.91E+03	4.11E+03
241-AN-103	2.85E+05	3.02E+04	3.01E+01	5.66E+02	1.20E+01	1.68E+04	9.93E+04	1.68E+05	1.65E+05	5.80E+03	1.65E+03	1.45E+03	6.60E+02	9.76E+03
241-AN-104	2.56E+05	3.86E+04	3.01E+01	3.36E+02	1.20E+01	6.69E+03	7.09E+04	1.70E+05	1.25E+05	1.07E+04	2.71E+03	3.54E+03	8.19E+01	8.09E+03
241-AN-105	2.46E+05	4.11E+04	2.47E+01	2.22E+02	9.95E+00	6.50E+03	5.86E+04	1.62E+05	1.21E+05	1.18E+04	1.22E+03	2.85E+03	3.06E+02	9.90E+03
241-AN-106	7.56E+04	3.22E+03	1.77E+00	9.91E+01	2.79E+02	5.96E+03	9.93E+04	6.58E+04	1.76E+04	2.18E+04	2.02E+03	5.50E+03	5.11E+03	9.60E+02
241-AN-107	2.03E+05	2.93E+02	1.67E+03	1.72E+02	5.51E+02	1.81E+03	9.93E+04	2.38E+05	6.59E+04	7.55E+04	2.94E+03	8.98E+03	4.18E+03	2.02E+03
241-AP-101	1.29E+05	6.94E+03	2.50E+00	1.43E+02	7.90E+00	3.12E+04	4.94E+04	1.32E+05	4.19E+04	3.23E+04	1.02E+03	4.03E+03	2.90E+03	1.98E+03
241-AP-102	1.02E+05	1.15E+04	3.82E+00	6.19E+02	2.66E+01	1.29E+03	9.09E+03	7.60E+04	3.59E+04	2.66E+04	1.16E+04	4.52E+03	1.68E+02	2.73E+03
241-AP-103	1.81E+05	8.43E+03	3.01E+01	3.72E+02	1.22E+02	1.33E+04	9.51E+03	1.35E+05	1.06E+05	7.55E+04	3.46E+03	4.50E+03	2.09E+03	2.82E+03
241-AP-104	1.36E+05	1.97E+04	1.04E+02	1.37E+03	7.85E+01	2.11E+03	2.26E+03	1.13E+05	6.74E+04	1.93E+04	3.86E+03	3.84E+03	4.15E+02	5.49E+03
241-AP-105	1.90E+05	2.07E+04	3.01E+01	5.13E+02	2.54E+01	1.23E+04	3.35E+04	2.32E+05	1.01E+05	1.12E+05	3.16E+03	6.78E+03	4.74E+03	5.45E+03
241-AP-106	1.22E+05	1.83E+04	1.13E+02	1.57E+03	7.56E+01	3.12E+03	9.01E+03	9.03E+04	6.14E+04	1.88E+04	2.76E+03	3.20E+03	6.71E+02	4.92E+03
241-AP-107	7.97E+04	8.69E+03	1.01E+01	6.55E+02	2.36E+00	1.58E+03	7.28E+03	9.56E+04	2.80E+04	4.55E+03	4.84E+03	2.41E+03	7.22E+02	2.29E+03
241-AP-108	9.03E+04	1.09E+04	1.01E+01	8.21E+02	4.02E+00	2.85E+03	1.39E+04	9.10E+04	3.27E+04	1.27E+04	3.40E+03	2.72E+03	9.70E+02	2.86E+03
241-AW-101	2.53E+05	3.07E+04	1.80E+01	1.12E+02	6.10E+00	4.12E+04	8.63E+04	1.70E+05	1.20E+05	9.20E+03	9.96E+02	1.26E+03	9.62E+02	7.30E+03
241-AW-102	5.68E+04	6.39E+03	6.95E+00	4.81E+02	1.90E+00	1.32E+03	7.45E+03	6.50E+04	2.01E+04	2.31E+03	6.22E+02	1.72E+03	5.42E+02	1.68E+03
241-AW-103	2.46E+04	6.46E+01	5.57E+00	2.53E+01	5.08E+00	1.43E+04	9.62E+03	4.22E+03	1.78E+03	4.70E+03	5.92E+01	6.72E+02	1.68E+04	1.38E+02
241-AW-104	1.74E+04	7.11E+02	1.86E+00	2.20E+00	7.40E-01	1.67E+03	3.55E+03	1.66E+04	5.33E+03	7.25E+03	2.93E+02	6.54E+02	1.32E+02	2.39E+02
241-AW-105	1.49E+04	4.34E+01	4.61E+00	2.12E+00	9.91E-01	1.99E+03	6.12E+03	2.70E+04	1.28E+03	1.62E+03	1.85E+02	3.01E+02	4.81E+02	2.45E+02
241-AW-106	1.77E+05	1.99E+04	2.18E+01	1.47E+03	8.39E+00	5.65E+03	9.80E+03	1.92E+05	6.35E+04	2.84E+04	1.47E+03	5.14E+03	1.23E+03	5.17E+03

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Table C-1 Input Ion Concentration for NH_3 Calculation

Tanks	Na^{+} in liquid (μg/mL)	Al^{+3} in liquid (μg/mL)	Fe^{+3} in liquid (μg/mL)	Cr^{+3} in liquid (μg/mL)	Ni^{+2} in liquid (μg/mL)	K^{+1} in liquid (μg/mL)	OH^{-1} in liquid (μg/mL)	NO_3^{-1} in liquid (μg/mL)	NO_2^{-1} in liquid (μg/mL)	CO_3^{-2} in liquid (μg/mL)	PO_4^{-3} in liquid (μg/mL)	SO_4^{-2} in liquid (μg/mL)	F^{-1} in liquid (μg/mL)	Cl^{-1} in liquid (μg/mL)
241-AY-101	5.19E+04	1.21E+01	1.20E+01	1.05E+02	5.90E+01	7.63E+02	2.29E+02	2.60E+04	3.53E+04	3.44E+04	1.15E+03	5.87E+03	1.74E+02	6.36E+02
241-AY-102	5.40E+04	1.97E+03	1.01E+01	2.91E+01	4.02E+00	3.88E+02	1.44E+03	4.86E+02	7.29E+03	4.87E+04	3.01E+03	2.32E+03	1.72E+02	1.60E+02
241-AZ-101	1.11E+05	8.56E+03	2.24E+01	7.23E+02	8.02E+00	4.76E+03	1.15E+04	7.12E+04	7.26E+04	3.42E+04	1.34E+03	1.50E+04	1.75E+03	1.51E+02
241-AZ-102	5.59E+04	6.68E+02	1.00E+00	7.37E+02	1.75E+00	3.20E+03	1.21E+03	1.85E+04	3.55E+04	3.50E+04	4.97E+02	1.86E+04	1.14E+03	7.66E+01
241-SY-101	1.63E+05	1.34E+04	3.97E+02	5.18E+03	2.02E+02	4.14E+03	2.63E+04	1.52E+05	9.56E+04	3.44E+04	4.94E+03	4.19E+03	5.50E+02	1.11E+04
241-SY-102	9.84E+04	1.44E+04	1.41E+01	2.41E+02	5.04E+01	1.53E+03	1.97E+04	9.20E+04	5.89E+04	1.31E+04	3.48E+03	2.91E+03	1.51E+02	4.64E+03
241-SY-103	2.12E+05	4.14E+04	2.10E+01	3.30E+01	4.90E+01	3.91E+03	2.89E+04	1.79E+05	1.43E+05	3.44E+04	3.12E+03	4.08E+03	3.51E+02	1.16E+04
241-A-101	2.78E+05	5.18E+04	4.29E+01	5.73E+01	1.85E+01	7.42E+03	4.48E+04	2.33E+05	1.65E+05	1.33E+04	5.89E+03	1.40E+03	2.17E+02	9.01E+03
241-A-103	2.20E+05	3.56E+04	1.81E+01	2.96E+02	9.46E+01	5.44E+03	4.48E+04	1.33E+05	1.65E+05	1.33E+04	3.67E+03	1.40E+03	2.17E+02	9.01E+03
241-C-103	3.53E+04	1.16E+01	5.40E+00	7.86E+01	7.85E+01	3.10E+02	4.49E+04	4.30E+03	2.43E+04	2.94E+04	4.59E+03	3.22E+03	1.16E+03	4.05E+02
241-S-101	2.15E+05	2.45E+04	2.01E+01	8.13E+02	8.02E+00	2.36E+03	4.49E+04	1.81E+05	9.40E+04	5.30E+03	3.86E+03	5.65E+03	1.06E+02	7.45E+03
241-S-102	2.36E+05	4.19E+04	4.01E+01	1.08E+02	1.64E+01	3.25E+03	4.10E+04	1.59E+05	1.14E+05	2.01E+04	4.93E+03	4.63E+03	3.50E+02	1.04E+04
241-SX-103	2.37E+05	4.41E+04	3.01E+01	8.36E+01	2.05E+04	4.24E+03	4.15E+04	1.59E+05	1.58E+05	1.28E+04	3.33E+03	2.01E+03	1.01E+02	1.10E+04
241-U-102	2.43E+05	1.80E+04	2.01E+01	2.79E+02	1.26E+02	3.77E+03	2.93E+04	2.45E+05	1.05E+05	4.68E+04	3.80E+03	9.84E+03	1.33E+02	8.82E+03
241-U-103	2.31E+05	4.09E+04	3.01E+01	1.08E+02	1.69E+02	4.83E+03	3.08E+04	1.52E+05	1.37E+05	1.56E+04	7.64E+02	2.68E+03	1.09E+03	1.14E+04
241-U-105	2.27E+05	2.98E+04	3.10E+01	2.01E+02	2.48E+02	3.98E+03	2.09E+04	1.81E+05	1.08E+05	2.78E+04	3.92E+03	8.01E+03	1.31E+03	8.92E+03
241-U-107	2.21E+05	2.64E+04	3.77E+01	5.75E+02	1.72E+01	3.27E+03	3.61E+04	2.27E+05	1.11E+05	2.65E+04	3.44E+03	6.63E+03	1.67E+02	8.99E+03
241-U-108	2.43E+05	3.29E+04	3.33E+01	1.28E+03	3.13E+01	4.01E+03	4.92E+04	1.81E+05	1.30E+05	2.20E+04	3.13E+03	4.23E+03	7.90E+02	8.94E+03
241-AX-101	2.82E+05	5.03E+04	3.01E+01	1.75E+02	1.20E+01	7.42E+03	3.90E+04	2.72E+05	1.73E+05	1.10E+04	6.59E+03	1.54E+03	5.78E+01	8.82E+03
241-B-203	3.12E+04	1.00E+01	1.00E+01	1.62E+02	4.02E+00	5.44E+03	3.90E+04	5.67E+04	1.57E+03	1.09E+04	1.90E+03	5.62E+02	6.04E+03	6.77E+02
241-B-204	2.94E+04	8.35E+00	8.35E+00	1.52E+02	3.35E+00	6.42E+03	3.90E+04	4.82E+04	1.82E+03	1.09E+04	7.14E+02	8.24E+02	6.55E+03	6.22E+02

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Table C-1 Input Ion Concentration for NH_3 Calculation

Tanks	Na^{+} in liquid (µg/mL)	Al^{+3} in liquid (µg/mL)	Fe^{+3} in liquid (µg/mL)	Cr^{+3} in liquid (µg/mL)	Ni^{+2} in liquid (µg/mL)	K^{+1} in liquid (µg/mL)	OH^{-1} in liquid (µg/mL)	NO_3^{-1} in liquid (µg/mL)	NO_2^{-1} in liquid (µg/mL)	CO_3^{-2} in liquid (µg/mL)	PO_4^{-3} in liquid (µg/mL)	SO_4^{-2} in liquid (µg/mL)	F^{-1} in liquid (µg/mL)	Cl^{-1} in liquid (µg/mL)
241-S-103	2.28E+05	3.20E+04	3.01E+01	2.69E+02	1.20E+01	3.90E+03	3.65E+04	2.16E+05	1.47E+05	2.21E+04	3.57E+03	5.10E+03	2.56E+02	1.33E+04
241-S-106	2.44E+05	3.85E+04	3.01E+01	9.41E+03	1.20E+01	1.84E+03	5.49E+04	2.40E+05	1.09E+05	1.58E+04	6.38E+03	5.73E+03	1.40E+02	1.11E+04
241-S-111	2.19E+05	2.91E+04	2.01E+01	4.06E+03	8.02E+00	1.64E+03	4.73E+04	1.90E+05	7.05E+04	1.28E+04	1.02E+04	4.32E+03	1.05E+02	6.39E+03
241-SX-101	2.42E+05	7.56E+04	3.56E+01	1.21E+04	3.44E+04	2.52E+03	4.87E+04	1.05E+05	7.80E+04	8.05E+03	5.18E+03	1.83E+03	7.14E+01	1.67E+04
241-SX-102	2.35E+05	4.56E+04	3.65E+01	2.77E+03	1.45E+01	3.55E+03	5.01E+04	1.58E+05	1.51E+05	8.80E+03	3.49E+03	3.33E+03	7.80E+01	1.02E+04
241-SX-104	2.50E+05	3.56E+04	3.38E+01	9.39E+02	1.35E+01	2.88E+03	3.42E+04	2.91E+05	1.17E+05	2.48E+04	1.27E+04	3.90E+03	1.87E+02	8.23E+03
241-SX-105	2.36E+05	4.41E+04	3.01E+01	3.38E+02	1.20E+01	3.38E+03	4.09E+04	1.65E+05	1.43E+05	1.41E+04	3.27E+03	4.20E+03	1.04E+02	9.01E+03
241-SX-106	2.45E+05	2.59E+04	3.01E+01	1.30E+02	1.20E+01	3.89E+03	3.31E+04	2.10E+05	1.32E+05	2.56E+04	3.52E+03	7.20E+03	3.11E+02	1.17E+04
241-SX-108	2.27E+05	1.54E+04	4.90E+01	2.97E+02	4.17E+02	2.88E+03	4.14E+04	2.36E+05	9.04E+04	7.00E+04	5.66E+03	1.53E+04	1.91E+03	4.11E+03
241-T-110	3.70E+04	5.00E+00	5.00E+00	3.46E+01	2.00E+00	3.27E+02	5.11E+03	1.83E+04	5.90E+01	7.00E+04	1.49E+03	4.36E+03	4.22E+03	9.58E+02
241-T-203	4.12E+04	5.05E+00	5.05E+00	4.26E+01	2.02E+00	8.39E+03	5.11E+03	7.37E+04	3.53E+02	7.00E+04	1.90E+03	4.69E+02	7.02E+03	7.07E+02
241-U-106	2.23E+05	1.20E+04	3.93E+01	4.96E+02	5.22E+02	1.89E+03	5.11E+03	2.52E+05	9.90E+04	4.73E+04	3.84E+03	8.64E+03	3.32E+02	5.46E+03
241-U-109	2.28E+05	2.92E+04	1.00E+02	2.61E+03	4.55E+01	3.33E+03	4.42E+04	1.85E+05	1.28E+05	1.87E+04	3.37E+03	5.17E+03	3.96E+02	8.69E+03

Author [illegible] Date 2-22-01 Checked by D C Hedengren Date 2/23/01

Table C-2 Calculations of Henry's Law Constant by Schumpe Model

Tanks	(NH_3)ss in dome (ppm)	Liquid NH_3 (µg/mL)	wt% H_2O in liquid (%)	Spg in Liquid (g/ml)	Waste Volume (kL)	Head space T(°C)	Waste T(°C)	Sum (Ci)	Sum (Ci*Hi)	$K_H°$ in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-AN-101	11	4.00E+01	70	1.15	606	18	18	8.64	0.82	86.11	1.25	41.96
241-AN-102	300	2.10E+02	48	1.43	4013	29	31	18.10	1.69	46.94	2.03	14.36
241-AN-103	7	3.45E+02	49	1.49	3627	28	38	26.53	2.54	34.01	2.30	4.25
241-AN-104	21	2.46E+02	51	1.40	3986	29	36	22.85	2.24	37.50	2.30	6.17
241-AN-105	15	2.10E+02	50	1.42	4263	28	34	21.62	2.15	40.39	2.26	7.15
241-AN-106	1	2.10E+02	76	1.20	148	18	17	11.59	1.04	88.51	1.38	40.30
241-AN-107	400	2.10E+02	50	1.37	3952	26	29	21.70	1.89	50.67	2.26	16.24
241-AP-101	125	4.39E+02	58	1.31	4221	19	19	13.43	1.22	81.52	1.41	30.97
241-AP-102	75	4.39E+02	75	1.20	4134	20	20	8.15	0.82	77.21	1.23	35.13
241-AP-103	1	2.50E+02	80	1.31	1079	16	16	15.11	1.46	96.18	1.40	24.73
241-AP-104	3	1.33E+02	97	1.29	91	15	15	10.73	1.06	98.90	1.33	37.70
241-AP-105	7	3.24E+02	62	1.35	2896	26	19	19.62	1.84	79.34	1.95	19.84
241-AP-106	5	6.75E+01	94	1.25	352	19	18	9.95	0.99	86.11	1.31	34.54
241-AP-107	5	1.06E+03	87	1.21	3695	17	14	6.67	0.60	101.71	1.17	61.92
241-AP-108	27	8.00E+02	81	1.25	1397	19	16	7.83	0.74	93.55	1.21	49.38
241-AW-101	5	1.00E+01	49	1.47	4263	16	34	24.06	2.31	40.39	2.26	6.46
241-AW-102	3	7.43E+01	88	1.15	303	26	21	4.81	0.44	75.16	1.10	51.68
241-AW-103	138	5.12E+02	93	1.02	1931	27	17	3.09	0.30	88.51	1.10	68.43
241-AW-104	6	1.69E+02	82	1.06	4236	25	21	1.56	0.15	73.16	1.10	68.40
241-AW-105	43	1.01E+03	93	1.02	1624	33	16	1.59	0.12	93.55	1.10	92.16
241-AW-106	28	3.55E+02	59	1.38	1791	33	32	14.42	1.34	44.63	1.60	16.10

Author [illegible] Date 2-22-01 Checked by DC Wedengren Date 2/23/01

Table C-2 Calculations of Henry's Law Constant by Schumpe Model

Tanks	(NH_3)ss in dome (ppm)	Liquid NH_3 (μg/mL)	wt% H_2O in liquid (%)	Spg in Liquid (g/ml)	Waste Volume (kL)	Head space T(°C)	Waste T(°C)	Sum (Ci)	Sum (Ci*Hi)	$K_H°$ in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-AY-101	5	1.13E+02	84	1.09	583	30	38	4.15	0.42	34.01	1.00	20.48
241-AY-102	4	7.37E+01	92	1.12	2355	21	37	3.56	0.43	35.71	1.00	19.65
241-AZ-101	1	1.25E+02	72	1.22	3199	27	51	9.52	0.94	19.43	1.67	10.69
241-AZ-102	6	4.38E+02	84	1.14	3524	19	46	4.54	0.47	24.40	1.00	13.53
241-SY-101	400	1.04E+03	61	1.33	3685	30.00	32.0	14.89	1.37	43.96	1.63	15.79
241-SY-102	12	1.15E+03	75	1.23	2317	15	22	9.20	0.87	69.34	1.28	32.86
241-SY-103	59	1.29E+03	49	1.47	2817	16	31	19.55	1.93	45.77	2.25	10.57
241-A-101	394	5.31E+02	55	1.49	3608	36	60	24.74	2.42	13.69	3.28	2.61
241-A-103	261	5.31E+02	75	1.48	1404	36	58	19.95	1.98	14.96	3.28	4.70
241-C-103	324	1.21E+03	86	1.08	750	38	43	5.43	0.53	27.01	1.17	16.99
241-S-101	765	1.21E+03	63	1.36	1616	31	43	18.34	1.73	26.82	2.27	8.66
241-S-102	588	1.70E+03	50	1.39	1946	27	39	20.10	2.03	32.41	2.31	6.54
241-SX-103	31	1.80E+03	47	1.47	2400	31	62	21.45	2.17	12.84	3.28	3.10
241-U-102	651	7.45E+02	48	1.38	1420	24	28	20.47	1.88	53.34	2.26	15.39
241-U-103	722	1.40E+03	49	1.41	1772	25	28	19.59	1.97	51.99	2.26	11.13
241-U-105	1936	1.60E+03	69	1.46	1582	25	30	18.50	1.80	48.15	2.10	12.29
241-U-107	448	4.03E+02	58	1.41	1545	23	24	19.69	1.82	62.37	2.00	16.58
241-U-108	684	1.05E+03	50	1.40	1772	24	28	21.29	2.06	51.99	2.26	10.70
241-AX-101	41	4.10E+03	48	1.49	2832	29	49	25.28	2.42	20.79	2.57	3.32
241-B-203	5	1.00E+02	89	1.17	193	12	12	5.28	0.44	115.89	1.00	76.38
241-B-204	5	1.00E+02	89	1.05	189	14	13	5.11	0.43	107.29	1.00	70.65

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Table C-2 Calculations of Henry's Law Constant by Schumpe Model

Tanks	(NH_3)ss in dome (ppm)	Liquid NH_3 (μg/mL)	wt% H_2O in liquid (%)	Spg in Liquid (g/ml)	Waste Volume (kL)	Head space T(°C)	Waste T(°C)	Sum (Ci)	Sum (Ci*Hi)	K_H^o in water (mole/L-atm)	K_H in solns' correction factor	K_H in solns' (mole/L-atm)
241-S-103	149	1.41E+03	50	1.45	939	23	28	20.88	1.96	53.20	2.26	13.35
241-S-106	14	2.40E+02	51	1.46	1613	20	25	22.44	2.12	62.01	2.26	12.86
241-S-111	120	1.50E+03	52	1.40	2044	23	28	18.67	1.79	51.99	2.24	14.83
241-SX-101	4	1.32E+02	49	1.46	1696	38	52	21.14	2.37	19.00	2.57	2.14
241-SX-102	5	1.37E+03	48	1.45	1946	33	55	21.34	2.13	16.63	3.28	4.30
241-SX-104	5	7.93E+02	51	1.39	1768	29	46	22.36	2.07	23.85	2.57	6.23
241-SX-105	27	1.21E+03	43	1.47	2411	34	63	20.74	2.07	12.06	3.28	3.31
241-SX-106	177	2.50E+03	46	1.42	1601	26	37	20.81	1.96	35.71	2.31	9.06
241-SX-108	5	1.30E+03	47.2	1.43	329	53	72	20.35	1.88	8.86	4.04	4.48
241-T-110	107	1.50E+03	87	1.17	1465	16	17	3.69	0.41	90.99	1.00	53.35
241-T-203	5	1.00E+02	85	1.17	132	15	17	5.08	0.47	89.83	1.00	53.34
241-U-106	940	1.05E+03	49	1.36	856	24	26	17.81	1.60	57.66	2.01	21.04
241-U-109	5	1.10E+03	52	1.47	1760	23	26	20.17	1.93	57.66	2.26	14.45

Author [illegible] Date 2/22/01 Checked by D C Hedengren Date 2/23/01

Table C-3 Calculation of Mass Transport Product of h and A from Normal Ventilation Condition and Prediction for Off-Normal Condition

Tanks	Normal Vent Q (cfm)	Headspace Volume V (ft3)	Equiv (NH_3)ss in Liquid	Product hA from Normal Condition (cfm)	Normal Steady-State Release Rate (cfm)	Off-Normal Barometric Vent Q (cfm)	Off-normal const. k_1 (min^{-1})	Off-normal const. k_2 (mole/L-min)	(NH3)ss at off-Normal Vent (ppm)	Off-Normal Steady-State Release Rate	Time t to reach steady state (day)
241-AN-101	113	166,700	0.00047	2.85E-02	1.28E-03	0.52	1.74E-04	4.02E-10	55	2.86E-05	49
241-AN-102	119	46,387	0.00431	1.80E-01	3.57E-02	0.14	1.38E-03	4.77E-08	857	1.24E-04	5
241-AN-103	100	60,023	0.00003	1.33E-03	6.65E-04	0.19	5.46E-06	4.49E-10	2034	3.82E-04	976
241-AN-104	100	47,323	0.00013	5.92E-03	2.10E-03	0.15	2.23E-05	1.81E-09	2011	2.97E-04	250
241-AN-105	100	37,564	0.00011	5.02E-03	1.51E-03	0.12	2.67E-05	1.65E-09	1523	1.79E-04	271
241-AN-106	117	182,875	0.00004	3.99E-04	1.17E-04	0.57	5.22E-06	2.69E-11	123	7.02E-05	200
241-AN-107	129	48,526	0.00649	3.60E-01	5.16E-02	0.15	2.96E-03	9.15E-08	759	1.15E-04	1.4
241-AP-101	108	39,035	0.00387	2.57E-02	1.35E-02	0.12	4.92E-04	1.70E-08	827	1.01E-04	13
241-AP-102	135	42,109	0.00264	1.83E-02	1.02E-02	0.13	3.69E-04	1.12E-08	728	9.57E-05	13
241-AP-103	200	149,990	0.00002	5.76E-04	2.00E-04	0.47	5.38E-06	5.64E-11	248	1.16E-04	822
241-AP-104	71	184,881	0.00012	1.23E-03	2.23E-04	0.58	9.04E-06	5.19E-11	136	7.83E-05	433
241-AP-105	176	85,823	0.00015	2.79E-03	1.29E-03	0.27	1.89E-05	6.18E-10	800	2.15E-04	281
241-AP-106	111	175,657	0.00018	6.54E-03	5.92E-04	0.55	3.39E-05	1.48E-10	104	5.72E-05	96
241-AP-107	342	57,616	0.00031	1.16E-03	1.71E-03	0.18	3.28E-05	1.25E-09	909	1.64E-04	151
241-AP-108	129	138,761	0.00131	3.14E-03	3.43E-03	0.43	2.99E-05	1.06E-09	852	3.69E-04	188
241-AW-101	100	37,564	0.00003	3.92E-02	5.15E-04	0.12	1.63E-04	6.13E-10	89	1.05E-05	22
241-AW-102	292	177,394	0.00013	7.16E-03	7.44E-04	0.55	5.44E-05	1.76E-10	80	4.41E-05	95
241-AW-103	134	119,912	0.00942	3.63E-02	1.85E-02	0.37	5.13E-04	9.10E-09	437	1.64E-04	13
241-AW-104	141	38,500	0.00041	3.64E-03	8.46E-04	0.12	1.61E-04	9.37E-10	142	1.71E-05	25
241-AW-105	194	130,740	0.00394	5.97E-03	8.30E-03	0.41	1.09E-04	2.71E-09	625	2.55E-04	43
241-AW-106	158	124,858	0.00045	8.59E-03	4.40E-03	0.39	3.09E-05	1.43E-09	1164	4.54E-04	184

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Table C-3 Calculation of Mass Transport Product of h and A from Normal Ventilation Condition and Prediction for Off-Normal Condition

Tanks	Normal Vent Q (cfm)	Headspace Volume V (ft3)	Equiv (NH_3)ss in Liquid	Product hA from Normal Condition (cfm)	Normal Steady-State Release Rate (cfm)	Off-Normal Barometric Vent Q (cfm)	Off-normal const. k_1 (min^{-1})	Off-normal const. k_2 (mole/L-min)	(NH3)ss at off-Normal Vent (ppm)	Off-Normal Steady-State Release Rate	Time t to reach steady state (day)
241-AY-101	250	167,502	0.00010	7.69E-03	1.25E-03	0.52	2.65E-05	3.05E-10	286	1.50E-04	188
241-AY-102	250	104,939	0.00008	1.05E-02	1.07E-03	0.33	5.04E-05	4.31E-10	207	6.78E-05	129
241-AZ-101	150	75,129	0.00001	8.31E-04	1.50E-04	0.23	6.04E-06	8.12E-11	331	7.77E-05	680
241-AZ-102	112	63,632	0.00007	1.01E-03	6.19E-04	0.20	8.26E-06	4.07E-10	1181	2.35E-04	681
241-SY-101	486	57834	0.00632	1.42E-01	1.94E-01	0.18	9.68E-04	1.51E-07	3870	6.99E-04	8
241-SY-102	363	106,276	0.00038	2.67E-03	4.24E-03	0.33	2.26E-05	1.70E-09	1771	5.88E-04	256
241-SY-103	116	88,630	0.00063	3.88E-03	6.92E-03	0.28	1.41E-05	3.32E-09	5581	1.55E-03	487
241-A-101	10	48,793	0.00103	5.17E-03	3.94E-03	0.15	1.01E-05	3.30E-09	8253	1.26E-03	709
241-A-103	8	126,596	0.00122	2.61E-03	1.98E-03	0.40	5.58E-06	6.44E-10	2922	1.16E-03	1058
241-C-103	10	87,026	0.00550	1.94E-03	3.24E-03	0.27	1.28E-05	1.58E-09	3159	8.59E-04	470
241-S-101	6	83,283	0.00662	2.94E-03	4.72E-03	0.26	1.07E-05	2.51E-09	5817	1.51E-03	720
241-S-102	2	71,653	0.00384	5.47E-04	1.29E-03	0.22	4.35E-06	7.62E-10	4312	9.66E-04	1450
241-SX-103	53	88,363	0.00009	6.11E-04	1.61E-03	0.28	3.66E-06	7.30E-10	4977	1.37E-03	1660
241-U-102	2	63,365	0.01002	1.66E-03	1.37E-03	0.20	1.30E-05	1.15E-09	2157	4.27E-04	432
241-U-103	2	50,932	0.00804	9.56E-04	1.73E-03	0.16	8.24E-06	1.54E-09	4582	7.29E-04	838
241-U-105	5	57,616	0.02379	5.64E-03	9.68E-03	0.18	3.26E-05	9.19E-09	6909	1.24E-03	199
241-U-107	12	58,953	0.00743	1.34E-02	5.27E-03	0.18	9.45E-05	5.37E-09	1380	2.54E-04	52
241-U-108	4	50,932	0.00732	1.87E-03	2.47E-03	0.16	1.27E-05	2.26E-09	4345	6.92E-04	538
241-AX-101	10	80,208	0.00014	6.96E-05	4.15E-04	0.25	3.20E-06	2.09E-10	1618	4.06E-04	1668
241-B-203	0.28	1,069	0.00038	1.10E-05	1.41E-06	0.003	2.15E-05	6.03E-11	66	2.20E-07	187
241-B-204	0.27	1,203	0.00035	1.05E-05	1.36E-06	0.004	1.76E-05	5.10E-11	68	2.57E-07	171

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Table C-3 Calculation of Mass Transport Product of h and A from Normal Ventilation Condition and Prediction for Off-Normal Condition

Tanks	Normal Vent Q (cfm)	Headspace Volume V (ft3)	Equiv (NH_3)ss in Liquid	Product hA from Normal Condition (cfm)	Normal Steady-State Release Rate (cfm)	Off-Normal Barometric Vent Q (cfm)	Off-normal const. k_1 (min^{-1})	Off-normal const. k_2 (mole/L-min)	(NH3)ss at off-Normal Vent (ppm)	Off-Normal Steady-State Release Rate	Time t to reach steady state (day)
241-S-103	15	107,212	0.00198	1.16E-03	2.28E-03	0.34	6.63E-06	8.95E-10	3281	1.10E-03	921
241-S-106	9	83,417	0.00018	3.78E-04	1.27E-04	0.26	4.53E-06	6.38E-11	340	8.85E-05	1549
241-S-111	5	68,177	0.00178	3.09E-04	6.49E-04	0.21	4.76E-06	4.00E-10	2041	4.35E-04	1316
241-SX-101	40	113,228	0.00001	7.62E-04	1.51E-04	0.35	3.49E-06	5.22E-11	381	1.35E-04	1206
241-SX-102	40	104,405	0.00002	9.91E-05	2.00E-04	0.33	3.23E-06	7.63E-11	594	1.94E-04	1696
241-SX-104	30	110,688	0.00003	1.30E-04	1.50E-04	0.35	3.31E-06	5.48E-11	410	1.42E-04	1360
241-SX-105	40	87,962	0.00009	6.11E-04	1.09E-03	0.27	3.71E-06	4.94E-10	3358	9.23E-04	1789
241-SX-106	39	116,570	0.00160	1.93E-03	6.86E-03	0.36	6.80E-06	2.43E-09	8752	3.19E-03	962
241-SX-108	455	161,486	0.00002	1.11E-03	2.28E-03	0.50	3.95E-06	5.27E-10	3565	1.80E-03	1463
241-T-110	7	61,761	0.00570	3.83E-04	7.48E-04	0.19	1.10E-05	5.47E-10	1181	2.28E-04	573
241-T-203	6	3,208	0.00027	2.28E-04	3.02E-05	0.01	9.27E-05	4.18E-10	106	1.07E-06	36
241-U-106	1	83,283	0.01977	1.20E-03	1.22E-03	0.26	1.05E-05	8.88E-10	2058	5.36E-04	521
241-U-109	4	51,333	0.00007	1.37E-05	2.14E-05	0.16	3.22E-06	1.72E-11	130	2.08E-05	1423

APPENDIX D

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

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

Tank 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)	Steady state Flammability at Normal Condition LFL(%)	Model 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	1.917E-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	3.192E-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	2.048E-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	1.950E-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	2.200E-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	1.175E-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	6.289E-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	3.358E-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	3.289E-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	8.584E-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	7.228E-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	2.304E-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	2.801E-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	2.939E-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	1.111E-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	1.556E-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	2.409E-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	4.700E-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	1.031E-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	3.953E-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	1.425E-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	1.419E-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	3.611E-04	2.50E-03

Table D-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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	7.787E-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	8.579E-04	1.12E-03
241-SY-101	0.0004	0.0200	0.0001	0.0005	974	57,834	461.0	0.14%	2.98E-03	9.22E-02	3.581E-04	2.46E-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	1.546E-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	3.150E-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

Table D-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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	0.0005	0.0007	0.0105	51	1,069	0.3	0.24%	1.91E-04	1.41E-06	1.89E-06	2.95E-05
241-B-204	0.0086	0.0005	0.0007	0.0103	50	1,203	0.3	0.23%	2.47E-04	1.36E-06	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

Table D-1 *Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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

Table D-1 *Steady-State Gas Concentrations, Release Rates and Flammability Levels* Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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	0.0005	0.0002	0.0007	467	110,688	30	0.03%	4.60E-03	1.50E-04	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

Table D-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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

Table D-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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

Table D-1 Steady-State Gas Concentrations, Release Rates and Flammability Levels Under Normal Ventilation Conditions (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)	Steady state Flammability at Normal Condition LFL(%)	Model 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	0.0005	0.0010	0.0499	465	51,333	4.3	0.99%	1.14E-03	2.14E-05	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

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

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-AN-101	0.52	0.08	0.005	0.37	0.23	1.96	0.04	7.36	9.36
241-AN-102	0.14	6.98	0.086	0.22	4.35	174.43	0.57	4.40	179.40
241-AN-103	0.19	1.69	0.203	0.11	0.35	42.26	1.36	2.18	45.80
241-AN-104	0.15	2.47	0.201	0.13	0.48	61.86	1.34	2.64	65.84
241-AN-105	0.12	4.11	0.152	0.19	1.09	102.67	1.02	3.75	107.44
241-AN-106	0.57	0.05	0.012	0.00	0.04	1.24	0.08	0.04	1.37
241-AN-107	0.15	5.98	0.076	0.41	4.51	149.56	0.51	8.29	158.36
241-AP-101	0.12	0.87	0.083	0.28	5.44	21.76	0.55	5.51	27.81
241-AP-102	0.13	0.87	0.073	0.25	4.94	21.83	0.49	5.00	27.31
241-AP-103	0.47	0.10	0.025	0.02	0.36	2.54	0.17	0.37	3.07
241-AP-104	0.58	0.05	0.014	0.00	0.02	1.16	0.09	0.03	1.27
241-AP-105	0.27	0.29	0.080	0.09	1.70	7.27	0.53	1.72	9.53
241-AP-106	0.55	0.06	0.010	0.01	0.10	1.38	0.07	0.10	1.55
241-AP-107	0.18	0.40	0.091	0.16	3.23	9.89	0.61	3.27	13.76
241-AP-108	0.43	0.10	0.085	0.03	0.51	2.55	0.57	0.51	3.63
241-AW-101	0.12	3.35	0.009	0.13	0.62	83.76	0.06	2.65	86.46
241-AW-102	0.55	0.06	0.008	0.00	0.09	1.44	0.05	0.09	1.58
241-AW-103	0.37	0.18	0.044	0.13	0.33	4.43	0.29	2.51	7.23
241-AW-104	0.12	0.94	0.014	0.86	1.08	23.48	0.09	17.14	40.72
241-AW-105	0.41	0.11	0.063	0.10	0.44	2.84	0.42	1.94	5.19
241-AW-106	0.39	0.25	0.116	0.04	0.72	6.26	0.78	0.73	7.77
241-AY-101	0.52	0.38	0.029	0.03	0.42	9.43	0.19	0.54	10.16
241-AY-102	0.33	4.28	0.021	0.11	0.76	107.04	0.14	2.20	109.38

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-AZ-101	0.23	3.75	0.033	0.33	0.64	93.73	0.22	6.63	100.58
241-AZ-102	0.20	5.34	0.118	0.43	0.56	133.41	0.79	8.63	142.82
241-SY-101	0.18	1.65	0.387	0.20	1.36	41.22	2.58	3.96	47.76
241-SY-102	0.33	0.19	0.177	0.47	0.59	4.87	1.18	9.31	15.37
241-SY-103	0.28	1.13	0.558	0.11	0.68	28.27	3.72	2.27	34.26
241-A-101	0.15	9.68	0.825	0.04	0.88	241.90	5.50	0.72	248.12
241-A-102	0.53	0.14	0.36	0.00	0.32	3.52	2.41	0.05	5.98
241-A-103	0.40	2.69	0.292	0.01	0.56	67.31	1.95	0.20	69.46
241-A-104	0.54	0.92	0.01	0.00	0.07	22.88	0.06	0.10	23.04
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	7.25	3.67	0.46	11.39
241-AX-101	0.25	1.93	0.47	0.02	0.07	48.17	3.12	0.47	51.76
241-AX-102	0.55	0.12	0.10	0.00	0.15	3.06	0.67	0.03	3.76
241-AX-103	0.52	0.32	0.20	0.01	0.11	7.88	1.31	0.19	9.39
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	7.82	0.21	0.22	8.26
241-B-102	0.34	0.16	0.01	0.00	0.13	4.03	0.06	0.06	4.15
241-B-103	0.33	0.18	0.02	0.01	0.13	4.43	0.12	0.11	4.66
241-B-104	0.20	0.90	0.02	0.17	2.66	22.54	0.12	3.41	26.07
241-B-105	0.29	0.26	0.03	0.01	0.22	6.50	0.19	0.23	6.92
241-B-106	0.31	0.31	0.01	0.04	0.55	7.78	0.08	0.71	8.56
241-B-107	0.29	0.31	0.05	0.02	0.04	7.80	0.34	0.35	8.49
241-B-108	0.32	0.19	0.08	0.01	0.19	4.83	0.51	0.19	5.53
241-B-109	0.30	0.29	0.10	0.01	0.27	7.36	0.64	0.27	8.27
241-B-110	0.25	0.31	0.14	0.09	1.39	7.66	0.93	1.78	10.37

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-B-111	0.26	0.31	0.03	0.08	1.23	7.84	0.23	1.58	9.65
241-B-112	0.34	0.16	0.06	0.01	0.14	4.03	0.42	0.18	4.62
241-B-201	0.01	0.99	0.28	0.21	3.32	24.65	1.86	4.26	30.78
241-B-202	0.01	0.91	0.14	0.19	0.92	22.79	0.96	3.72	27.46
241-B-203	0.003	5.71	0.04	0.06	0.88	142.87	0.28	1.13	144.29
241-B-204	0.004	6.58	0.04	0.05	0.74	164.47	0.24	0.95	165.66
241-BX-101	0.34	0.17	0.10	0.01	0.18	4.21	0.69	0.24	5.13
241-BX-102	0.31	0.19	0.01	0.03	0.04	4.81	0.04	0.56	5.41
241-BX-103	0.33	0.18	0.19	0.02	0.17	4.55	1.28	0.40	6.24
241-BX-104	0.31	0.21	0.59	0.03	0.36	5.30	3.93	0.58	9.81
241-BX-105	0.33	0.17	0.37	0.01	0.29	4.24	2.45	0.28	6.96
241-BX-106	0.34	0.16	0.10	0.01	0.09	4.12	0.64	0.21	4.96
241-BX-107	0.21	0.39	0.27	0.01	0.04	9.86	1.81	0.26	11.94
241-BX-108	0.34	0.16	0.05	0.01	0.11	3.94	0.33	0.14	4.41
241-BX-109	0.27	0.27	0.05	0.06	1.01	6.74	0.34	1.30	8.37
241-BX-110	0.27	0.28	0.16	0.02	0.04	7.05	1.09	0.41	8.56
241-BX-111	0.29	0.23	0.15	0.00	0.04	5.74	1.01	0.08	6.83
241-BX-112	0.29	0.23	0.30	0.05	0.83	5.80	1.98	1.06	8.85
241-BY-101	0.28	0.36	0.15	0.02	0.14	8.95	1.00	0.49	10.45
241-BY-102	0.32	0.24	0.38	0.01	0.04	6.07	2.51	0.17	8.75
241-BY-103	0.27	0.38	0.15	0.01	0.09	9.43	1.02	0.20	10.65
241-BY-104	0.30	0.61	0.66	0.02	0.63	15.33	4.37	0.36	20.05
241-BY-105	0.23	0.51	0.58	0.03	0.53	12.79	3.87	0.61	17.26
241-BY-106	0.20	1.24	0.23	0.01	0.38	30.91	1.52	0.29	32.72

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-BY-107	0.33	0.28	1.00	0.02	1.13	7.08	6.67	0.32	14.06
241-BY-108	0.34	0.50	1.00	0.02	1.09	12.62	6.67	0.30	19.59
241-BY-109	0.32	0.26	0.21	0.01	0.05	6.48	1.38	0.20	8.06
241-BY-110	0.27	0.47	1.00	0.02	0.50	11.63	6.67	0.32	18.62
241-BY-111	0.25	0.39	0.14	0.01	0.20	9.80	0.95	0.13	10.88
241-BY-112	0.32	0.26	0.27	0.01	0.17	6.56	1.80	0.11	8.47
241-C-101	0.32	0.21	0.11	0.01	0.72	5.33	0.74	0.27	6.33
241-C-102	0.22	0.64	0.99	0.04	0.75	15.89	6.59	0.88	23.36
241-C-103	0.27	0.90	0.3159	0.06	2.71	22.41	2.11	1.16	25.68
241-C-104	0.23	0.48	1.00	0.12	1.83	11.96	6.67	2.35	20.98
241-C-105	0.30	0.26	0.43	0.04	0.94	6.51	2.89	0.83	10.24
241-C-106	0.31	0.18	0.14	0.03	0.21	4.49	0.94	0.64	6.07
241-C-107	0.25	0.59	0.03	0.00	0.04	14.77	0.20	0.09	15.05
241-C-108	0.33	0.18	0.01	0.00	0.38	4.60	0.04	0.01	4.65
241-C-109	0.33	0.20	0.04	0.00	1.45	5.06	0.26	0.07	5.39
241-C-110	0.28	0.24	0.35	0.09	0.04	6.07	2.31	1.75	10.13
241-C-111	0.33	0.21	0.01	0.00	0.11	5.25	0.06	0.02	5.33
241-C-112	0.31	0.30	0.08	0.00	1.93	7.40	0.54	0.07	8.01
241-C-201	0.02	0.18	0.02	0.01	0.12	4.51	0.11	0.15	4.78
241-C-202	0.02	0.17	0.01	0.00	0.06	4.13	0.07	0.08	4.27
241-C-203	0.02	0.26	0.14	0.02	0.32	6.45	0.96	0.41	7.81
241-C-204	0.02	0.20	0.01	0.01	0.18	4.92	0.06	0.24	5.22
241-S-101	0.26	1.28	0.5817	0.02	0.47	31.92	3.88	0.34	36.13

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-S-102	0.22	1.13	0.4312	0.01	0.39	28.29	2.87	0.16	31.33
241-S-103	0.34	0.29	0.68	0.02	0.62	7.25	4.53	0.42	12.20
241-S-104	0.32	0.36	0.04	0.08	1.30	9.07	0.30	1.67	11.04
241-S-105	0.25	0.40	0.24	0.02	0.05	10.08	1.61	0.31	12.00
241-S-106	0.26	0.45	0.05	0.06	0.02	11.18	0.32	1.13	12.63
241-S-107	0.28	0.39	0.28	0.02	0.29	9.72	1.88	0.32	11.91
241-S-108	0.25	0.37	0.07	0.00	0.01	9.26	0.47	0.06	9.80
241-S-109	0.23	0.48	0.08	0.60	0.07	11.98	0.51	12.07	24.56
241-S-110	0.28	0.55	0.55	0.02	0.15	13.77	3.66	0.38	17.81
241-S-111	0.21	0.52	0.30	0.01	0.05	13.01	2.03	0.14	15.18
241-S-112	0.22	0.70	0.16	0.00	0.01	17.55	1.06	0.10	18.71
241-SX-101	0.35	0.37	0.04	0.02	0.08	9.37	0.28	0.37	10.02
241-SX-102	0.33	0.94	0.00	0.02	0.07	23.52	0.00	0.49	24.01
241-SX-103	0.28	2.97	0.4977	0.09	0.20	74.18	3.32	1.72	79.22
241-SX-104	0.35	1.33	0.04	0.02	0.06	33.28	0.29	0.38	33.94
241-SX-105	0.27	4.45	0.40	0.03	0.12	111.28	2.65	0.54	114.46
241-SX-106	0.36	0.40	1.00	0.03	0.25	9.99	5.83	0.59	16.41
241-SX-107	0.50	0.49	0.14	0.02	0.30	12.18	0.90	0.39	13.47
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	19.09	0.77	0.17	20.03
241-SX-110	0.52	0.22	0.08	0.01	0.17	5.42	0.52	0.22	6.16
241-SX-111	0.49	0.80	0.16	0.02	0.36	20.10	1.07	0.46	21.63
241-SX-112	0.50	0.24	0.14	0.02	0.31	6.12	0.94	0.40	7.46

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-SX-113	0.53	0.11	0.04	0.01	0.08	2.73	0.25	0.11	3.10
241-SX-114	0.47	0.83	0.25	0.04	0.56	20.65	1.68	0.72	23.04
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	0.24	0.05	0.01	0.11	5.89	0.32	0.18	6.39
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	4.21	0.07	0.14	4.42
241-T-104	0.22	0.37	0.33	0.01	0.02	9.15	2.23	0.25	11.62
241-T-105	0.31	0.20	0.21	0.03	0.45	4.99	1.40	0.58	6.97
241-T-106	0.35	0.15	0.20	0.01	0.09	3.84	1.35	0.11	5.30
241-T-107	0.28	0.24	0.28	0.05	0.09	6.03	1.85	1.04	8.92
241-T-108	0.34	0.18	0.04	0.00	0.08	4.47	0.28	0.08	4.83
241-T-109	0.33	0.18	0.01	0.01	0.10	4.48	0.07	0.11	4.66
241-T-110	0.19	0.46	0.39	0.01	0.05	11.40	2.58	0.18	14.16
241-T-111	0.17	0.54	0.80	0.21	0.05	13.42	5.35	4.18	22.94
241-T-112	0.33	0.17	0.06	0.02	0.29	4.35	0.41	0.38	5.14
241-T-201	0.01	0.99	0.06	0.21	3.32	24.86	0.37	4.26	29.50
241-T-202	0.02	0.65	0.10	0.12	1.90	16.20	0.67	2.44	19.31
241-T-203	0.01	1.46	0.00	0.32	5.01	36.49	0.00	6.43	42.92
241-T-204	0.01	1.79	0.10	0.40	6.22	44.77	0.66	7.98	53.42
241-TX-101	0.40	0.20	0.02	0.02	0.09	5.07	0.16	0.40	5.63
241-TX-1019	0.35	0.22	0.56	0.01	0.18	5.62	3.71	0.13	9.46
241-TX-102	0.37	0.19	0.20	0.01	0.16	4.69	1.34	0.12	6.15

Table D-2 *Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)*

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-TX-103	0.41	0.15	0.02	0.01	0.04	3.75	0.16	0.10	4.01
241-TX-104	0.18	0.64	0.15	0.01	0.10	16.07	1.03	0.22	17.31
241-TX-105	0.30	0.32	0.60	0.02	0.12	7.97	3.99	0.32	12.28
241-TX-106	0.42	0.14	0.34	0.00	0.05	3.44	2.25	0.05	5.74
241-TX-107	0.38	0.17	0.06	0.00	0.05	4.22	0.39	0.05	4.65
241-TX-108	0.28	0.34	1.00	0.11	1.69	8.40	6.67	2.17	17.24
241-TX-110	0.24	0.41	1.00	0.01	0.37	10.25	6.67	0.17	17.09
241-TX-111	0.28	0.32	1.00	0.01	0.60	7.92	6.67	0.13	14.72
241-TX-112	0.17	0.68	0.47	0.03	0.21	17.11	3.13	0.55	20.79
241-TX-113	0.18	0.63	0.11	0.02	0.25	15.69	0.72	0.38	16.79
241-TX-114	0.21	0.47	0.90	0.01	0.22	11.78	5.99	0.23	18.00
241-TX-115	0.20	0.52	0.07	0.01	0.23	12.92	0.46	0.23	13.61
241-TX-116	0.17	0.66	0.02	0.02	0.09	16.40	0.17	0.42	16.99
241-TX-117	0.18	0.62	0.05	0.01	0.18	15.43	0.34	0.21	15.98
241-TX-118	0.31	0.29	0.11	0.07	0.06	7.20	0.76	1.40	9.35
241-TY-101	0.39	0.16	0.01	0.00	0.08	4.01	0.09	0.04	4.14
241-TY-102	0.41	0.14	0.01	0.00	0.11	3.61	0.05	0.09	3.74
241-TY-103	0.37	0.18	0.10	0.03	0.44	4.52	0.67	0.66	5.85
241-TY-104	0.42	0.15	0.19	0.01	0.31	3.86	1.25	0.20	5.31
241-TY-105	0.34	0.22	0.01	0.05	0.10	5.61	0.03	0.93	6.57
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	0.17	0.20	0.01	0.10	4.13	1.36	0.13	5.62
241-U-102	0.20	0.80	0.2157	0.01	0.85	20.02	1.44	0.25	21.71

Table D-2 Steady-State Gas Concentrations and Flammability Levels Under Off-Normal Ventilation Conditions (8 Sheets)

Tank Name	Off-Normal Ventilation Rate $(Vr)_{bb}$ (cfm)	Steady State Hydrogen Concen. $[H_2]$ (%)	Steady State Ammonia Concen. $[NH_3]$ (%)	Steady State Methane Concen. $[CH_4]$ (%)	Steady State N_2O Concen. $[N_2O]$ (%)	Steady State Hydrogen Flammability (%)	Steady State Ammonia Flammibility (%)	Steady State Methane Flammability (%)	Steady State Total Flammability (%)
241-U-103	0.16	1.17	0.4582	0.02	1.15	29.37	3.05	0.42	32.85
241-U-104	0.30	0.34	0.00	0.01	0.20	8.46	0.01	0.26	8.73
241-U-105	0.18	0.94	0.6909	0.11	7.72	23.62	4.61	2.18	30.40
241-U-106	0.26	0.69	0.47	0.03	0.28	17.27	3.13	0.52	20.92
241-U-107	0.18	0.52	0.1380	0.06	3.69	12.94	0.92	1.21	15.08
241-U-108	0.16	0.94	0.4345	0.02	1.10	23.56	2.90	0.50	26.95
241-U-109	0.16	0.71	0.01	0.03	1.33	17.73	0.09	0.55	18.37
241-U-110	0.28	0.37	0.15	0.06	0.96	9.20	1.02	1.24	11.45
241-U-111	0.22	0.52	0.59	0.01	0.28	13.10	3.90	0.21	17.21
241-U-112	0.33	0.17	0.12	0.01	0.08	4.23	0.77	0.27	5.27
241-U-201	0.02	0.22	0.14	0.02	0.32	5.55	0.96	0.41	6.92
241-U-202	0.02	0.22	0.14	0.02	0.32	5.56	0.96	0.41	6.92
241-U-203	0.02	0.19	0.01	0.01	0.18	4.65	0.05	0.24	4.94
241-U-204	0.02	0.18	0.01	0.01	0.18	4.61	0.04	0.24	4.88

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	32	1.08	0.94	0.09	0.03	0.59	23.48	0.57	0.60
241-AN-103	172	0.35	0.91	0.15	0.06	0.19	22.80	1.01	1.18
241-AN-104	101	0.41	0.91	0.19	0.05	0.18	22.63	1.29	0.97
241-AN-105	56	0.53	0.92	0.13	0.04	0.24	22.97	0.90	0.84
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	37	1.00	0.92	0.08	0.06	0.70	22.99	0.51	1.28
241-AP-101	503	0.14	0.78	0.08	0.25	4.87	19.51	0.55	4.93
241-AP-102	544	0.15	0.80	0.07	0.23	4.51	19.95	0.49	4.57
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	74	0.41	0.96	0.01	0.04	0.18	23.92	0.06	0.75
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	209	0.20	0.58	0.01	0.52	0.66	14.41	0.09	10.45
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	1.47	0.97	0.02	0.03	0.17	24.28	0.14	0.50

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	0.97	0.93	0.01	0.08	0.16	23.22	0.09	1.65
241-AZ-102	42	1.17	0.93	0.05	0.07	0.10	23.15	0.31	1.50
241-SY-101	152	0.37	0.82	0.39	0.10	0.67	20.43	2.58	1.96
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	265	0.40	0.79	0.56	0.08	0.47	19.71	3.70	1.59
241-A-101	21	1.60	0.90	0.25	0.00	0.09	22.43	1.65	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	96	1.13	0.97	0.06	0.00	0.21	24.37	0.40	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	146	0.53	0.93	0.23	0.01	0.04	23.25	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	694	0.21	0.86	0.02	0.17	2.55	21.62	0.11	3.31
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

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	371	0.02	0.80	0.23	0.17	2.70	20.03	1.51	3.49
241-B-202	535	0.01	0.83	0.13	0.17	0.84	20.74	0.87	3.41
241-B-203	42	0.02	0.99	0.01	0.01	0.16	24.74	0.05	0.21
241-B-204	36	0.03	0.99	0.01	0.01	0.12	24.80	0.04	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	318	0.27	0.94	0.18	0.01	0.29	23.61	1.17	0.22

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	769	0.29	0.87	0.32	0.06	2.63	21.77	2.11	1.12
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	232	0.40	0.84	0.57	0.01	0.31	20.98	3.78	0.22

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	334	0.29	0.89	0.39	0.01	0.31	22.28	2.57	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	83	0.90	0.93	0.18	0.03	0.06	23.14	1.19	0.54
241-SX-104	296	0.48	0.98	0.03	0.01	0.04	24.51	0.21	0.28
241-SX-105	55	1.28	0.97	0.09	0.01	0.03	24.29	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

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	417	0.02	0.84	0.05	0.18	2.81	21.07	0.32	3.62
241-T-202	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-T-203	178	0.02	0.85	0.00	0.18	2.82	21.37	0.00	3.63
241-T-204	140	0.02	0.84	0.05	0.19	2.90	20.96	0.31	3.75
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

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	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

Table D-3 Gas Concentrations, Time to Reach 25% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	287	0.22	0.87	0.45	0.02	0.85	21.68	2.97	0.32
241-U-104	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-U-105	323	0.23	0.75	0.69	0.08	5.98	18.70	4.61	1.69
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	548	0.18	0.87	0.43	0.02	1.01	21.64	2.90	0.46
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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	180	0.26	3.88	0.09	0.12	2.42	96.88	0.57	2.45
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	591	0.13	3.82	0.15	0.17	1.01	95.50	1.02	3.49
241-AN-106	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-AN-107	221	0.24	3.77	0.08	0.26	2.84	94.26	0.51	5.23
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	545	0.36	3.91	0.02	0.10	0.70	97.84	0.14	2.01

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	1143	0.24	3.73	0.03	0.33	0.64	93.18	0.22	6.59
241-AZ-102	266	0.28	3.73	0.11	0.30	0.39	93.17	0.75	6.03
241-SY-101	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-102	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-SY-103	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur	not occur
241-A-101	110	0.38	3.79	0.67	0.01	0.35	94.86	4.45	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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	262	0.005	3.96	0.03	0.04	0.61	99.01	0.20	0.81
241-B-204	205	0.006	3.97	0.02	0.03	0.45	99.27	0.15	0.58
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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation Conditions (8 Sheets)

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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	460	0.31	3.90	0.31	0.02	0.11	97.43	2.05	0.47
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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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	#REF!	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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation Conditions (8 Sheets)

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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

Table D-4 Gas Concentrations, Time to Reach 100% of the LFL and Flammability Distribution Among Gases Under Off-Normal Ventilation 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 E

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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Written By: SA Barker Date: 2/8/01

CH2MHILL
Hanford Group, Inc.

SA Barker

Hydrogen Generation Rate Calculations

Single-Point Calculation - Calculation Note RPP-5926

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 Kufahl 2000, except where noted

$$[TOC] := \begin{pmatrix} 3110 \\ 3110 \\ 3110 \\ 3110 \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_2] := \begin{pmatrix} 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \\ 1.25 \cdot 10^5 \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad Ci := 1.61 \cdot 10^{-2} \cdot \frac{BTU}{hr}$$

$$[Al] := \begin{pmatrix} 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \\ 3.86 \cdot 10^4 \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL} \qquad [NO_3] := \begin{pmatrix} 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \\ 1.70 \cdot 10^5 \end{pmatrix} \cdot \frac{\mu \cdot gm}{mL}$$

$$[137Cs] := \begin{pmatrix} 4.67 \cdot 10^2 \\ 3.84 \cdot 10^{-12} \\ 5.38 \cdot 10^2 \\ 3.83 \cdot 10^2 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr] := \begin{pmatrix} 1.70 \cdot 10^1 \\ 3.91 \cdot 10^{-12} \\ 7.31 \cdot 10^{-2} \\ 3.7 \cdot 10^1 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$$

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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)

$class_{waste} :=$ "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

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

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

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

Written By: SA Barker Date: 2/8/01

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

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

Ammonia Diffusion Information

$k_{2_NH3} := 1.81 \cdot 10^{-9} \cdot \frac{mol}{L \cdot min}$ $V_m := 24.79 \cdot \frac{L}{mol}$

$h_{A_NH3} := 5.92 \cdot 10^{-3} \cdot cfm$ $[NH3_{liq}] := \frac{2.46 \cdot 10^2 \cdot \frac{\mu \cdot gm}{mL}}{17.037 \cdot \frac{gm}{mol}}$ $[NH3_{liq}] = 0.014 \frac{mol}{L}$

$K_H := 6.18 \cdot \frac{mol}{L \cdot atm}$ $P := 1 \cdot atm$

$k_{1_NH3} := \frac{vent_rate_{bb} + (h_{A_NH3} \cdot K_H \cdot P \cdot V_m)}{vol_{head}}$ $k_{1_NH3} = 2.229 \times 10^{-5} min^{-1}$

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)

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

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

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

Reactivity coefficient (0.7 for DSTs, 0.4 for SSts) (Hu, 2000 - eqn 4-8)

$$r_f = 0.700$$

Calculate the Weight Fraction of Liquid in the Waste

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

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

Check units on input data

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$Temp_{waste_2} = 308.930\,K$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$HGR_{radv} = \begin{pmatrix} 1.7952 \\ 1.2175 \times 10^{-13} \\ 1.1120 \\ 0.6839 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_scf} := HGR_{radv} \cdot \frac{273.15 \cdot K}{Temp_{vap}}$$

$$HGR_{radv} = \begin{pmatrix} 1.247 \times 10^{-3} \\ 8.455 \times 10^{-17} \\ 7.723 \times 10^{-4} \\ 4.750 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{radv_scf} = \begin{pmatrix} 1.622 \\ 1.100 \times 10^{-13} \\ 1.005 \\ 0.618 \end{pmatrix} \frac{ft^3}{day}$$

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

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)

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

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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

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

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

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

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

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

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

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

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Total Hydrogen Generation Rate

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

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

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

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

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

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

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

At Headspace Temp...

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

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

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

At Standard conditions...

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)

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

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

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

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

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

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

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

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

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

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

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

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

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

$$NH3_1000_day := \left[\frac{k_{2_NH3}}{k_{1_NH3}} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left(-1 \cdot \frac{k_{1_NH3}}{\frac{1}{day}} \cdot 1000\right)\right] \cdot V_m$$

$$NH3_1000_day = 2.013 \times 10^{3}\,ppm$$

$$[NH3_{ss_bb}] := NH3_1000_day \qquad [NH3_{ss_bb}] = 0.201\,\%$$

$$[NH3_{ss_bb}] = 1.342\,\%LFL_{NH3}$$

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

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

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

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

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

$$[Conc_mix_{ss_bb}] = 65.160\,\%LFL$$

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)

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

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

Calculate the composition of all components at time 't'

Special Calculation for Ammonia (Soluble Gas)

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

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

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$$conc(t,i) := \begin{cases} Conc_{in_i}\cdot\left[1 - e^{(-\lambda_i\cdot t)}\right] + Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right] & \text{if } i < 2 \\ Conc_{in_i}\cdot\left[1 - e^{(-\lambda_i\cdot t)}\right] + Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right] & \text{if } i > 2 \\ \left[\frac{k_{2_NH3}}{k_{1_NH3}} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left(-1\cdot\frac{k_{1_NH3}}{\frac{1}{day}}\cdot\frac{t}{day}\right)\right]\cdot V_m & \text{otherwise} \end{cases}$$

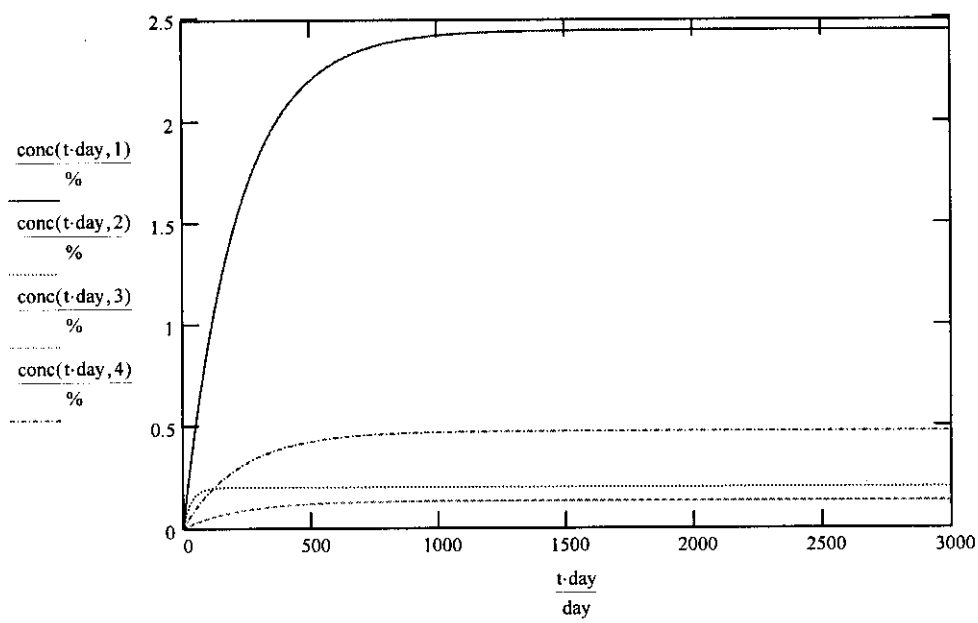
$conc(0\cdot sec,1) = 3.710\times 10^{-3}\%$ $\quad conc(1000\cdot day,1) = 2.423\%$ $\quad conc(1000\cdot day,1) = 60.578\%LFL_{H2}$

$conc(0\cdot sec,2) = 2.100\times 10^{-3}\%$ $\quad conc(1000\cdot day,2) = 0.201\%$ $\quad conc(1000\cdot day,2) = 1.342\%LFL_{NH3}$

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

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

$t := 0, 10 .. 3000$



Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

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

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

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$LFL_{mix}(1000000 \cdot day) = 153.469\,\%$

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

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

$temp_{25} = 100.460\ day$

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

$Time_{1_25\%LFL} = 100.460\ day$

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

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

$temp_{50} = 311.578\ day$

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

$Time_{1_50\%LFL} = 311.578\ day$

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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

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

$temp_{75} = 405.331\ day$

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

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

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

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

$temp_{100} = 131.106\ day$

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

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

Written By: SA Barker Date: 2/8/01

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

$$Conc_vr(V,i) := \begin{cases} \dfrac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right] & \text{if } i<2 \\ \dfrac{Rate_{rel_i}\cdot 100\cdot\%}{Rate_{rel_i}+V}\cdot\left[1-e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right]+Conc_{init_i}\cdot\left[e^{\left(-\frac{V+Rate_{rel_i}}{vol_{head}}\cdot 10^9\cdot day\right)}\right] & \text{if } i>2 \\ \left[\dfrac{k_{2_NH3}}{\frac{V+(h_{A_NH3}\cdot K_H\cdot P\cdot V_m)}{vol_{head}}}+\left(\dfrac{[NH3_{ss}]}{V_m}-\dfrac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left[-1\cdot\dfrac{\frac{V+(h_{A_NH3}\cdot K_H\cdot P\cdot V_m)}{vol_{head}}}{\frac{1}{day}}\cdot 10^9\right]\right]\cdot V_m & \text{otherwise} \end{cases}$$

ventilation Rate to keep concentration less than 25 %LFL

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

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

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

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

$temp_{25} = 0.400567\,cfm$

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

$vent_rate_{1_25\%LFL} = 0.402\,cfm$

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

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

$temp_{50} = 0.194844\,cfm$

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

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$vent_rate_{1_50\%LFL} = 0.196\,cfm$

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

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

$temp_{75} = 0.127702\,cfm$

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

$vent_rate_{1_75\%LFL} = 0.129\,cfm$

ventilation Rate to keep concentration less than 100 %LFL

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

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

$temp_{1000} := -5 \cdot cfm$ Initial Value in case solution cannot be found

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

$temp_{100} = 0.094478\,cfm$

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

$vent_rate_{1_100\%LFL} = 0.095\,cfm$

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Summary Section

Input Data

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

Tank_id = "241-AN-104" $\quad class_{waste}$ = "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 $\quad$ vent_rate = 100.000 cfm $\quad vent_rate_{bb} = 0.148$ cfm

AN Tank farm: Tank Data

$diam_{tank} = 75.000$ ft $\quad ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592\times10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix}$ in $\quad$ estimation of waste depth

Dome-Space Compositions

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

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

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

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

$[NH3_{ss}] = 0.014\%LFL_{NH3}$ $\qquad$ $[NH3_{ss_bb}] = 1.342\%LFL_{NH3}$

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

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

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

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

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Flammable Gas Concentrations after Loss of Ventilation at Selected Time Periods

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

$conc_{mix}(10 \cdot day) = 3.345\,\%LFL$

$conc_{mix}(100 \cdot day) = 24.914\,\%LFL$

$conc_{mix}(10^9 \cdot day) = 65.160\,\%LFL$

Time to Reach Various LFL Levels

$Time_{1_25\%LFL} = 100.460\ day$

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

$Time_{1_50\%LFL} = 311.578\ day$

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

Minimum Ventilation Rates to Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL} = 0.402\ cfm$

$vent_rate_{1_75\%LFL} = 0.129\ cfm$

$vent_rate_{1_50\%LFL} = 0.196\ cfm$

$vent_rate_{1_100\%LFL} = 0.095\ cfm$

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SA Barker

Hydrogen Generation Rate Calculations

Monte Carlo Analysis - Calculation Note RPP-5926

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 := "241-AN-104"

Set Monte Carlo sampling parameters:

NSamples := 500 number of individual samples to collect

SSize := 50 number of data points in each sample

Input waste property data

...The following data is from Kufahl 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...

$$[137Cs_m] := \begin{pmatrix} 4.67 \cdot 10^2 \\ 10^{-18} \\ 5.38 \cdot 10^2 \\ 3.83 \cdot 10^2 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [137Cs_{sd}] := \begin{pmatrix} 4.67 \cdot 10^1 \\ 10^{-19} \\ 5.38 \cdot 10^1 \\ 3.83 \cdot 10^1 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$$

$$[90Sr_m] := \begin{pmatrix} 1.70 \cdot 10^1 \\ 10^{-18} \\ 7.31 \cdot 10^{-2} \\ 3.7 \cdot 10^1 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm} \qquad [90Sr_{sd}] := \begin{pmatrix} 1.70 \cdot 10^0 \\ 10^{-19} \\ 7.31 \cdot 10^{-3} \\ 3.7 \cdot 10^0 \end{pmatrix} \cdot \frac{\mu \cdot Ci}{gm}$$

$$\rho_{waste_m} := \begin{pmatrix} 1.48 \\ 1.39 \\ 1.40 \\ 1.59 \end{pmatrix} \cdot \frac{gm}{mL} \qquad \rho_{waste_sd} := \begin{pmatrix} 0.1 \\ 0.1 \\ 0.1 \\ 0.1 \end{pmatrix} \cdot \frac{gm}{mL}$$

$$vol_{waste_m} := \begin{pmatrix} 3986 \\ 10^{-9} \\ 2286 \\ 1700 \end{pmatrix} \cdot kilo \cdot L \qquad vol_{waste_sd} := \begin{pmatrix} 200 \\ 10^{-10} \\ 114 \\ 170 \end{pmatrix} \cdot kilo \cdot L$$

$$F_{H2O_m} := \begin{pmatrix} 48.7 \\ 45.0 \\ 50.9 \\ 45.8 \end{pmatrix} \cdot \% \qquad F_{H2O_sd} := \begin{pmatrix} 48.7 \\ 45.0 \\ 50.9 \\ 45.8 \end{pmatrix} \cdot 0.10 \cdot \%$$

$$F_{liquid_m} := \begin{pmatrix} 96 \\ 89 \\ 100 \\ 90 \end{pmatrix} \cdot \% \qquad F_{liquid_sd} := \begin{pmatrix} 9.6 \\ 8.9 \\ 1 \\ 9.0 \end{pmatrix} \cdot \%$$

$Temp_{vap_m} := 302.372 \cdot K$ $Temp_{vap_sd} := 4 \cdot K$ From (Bingham 2000)

$$Temp_{waste_m} := \begin{pmatrix} 308.93 \\ 308.93 \\ 308.93 \\ 308.93 \end{pmatrix} \cdot K \qquad Temp_{waste_sd} := \begin{pmatrix} 5 \\ 5 \\ 5 \\ 5 \end{pmatrix} \cdot K$$

$class_{waste} :=$ "dst"

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

$$HeatLoad_{137Cs_90Sr_m} := \begin{pmatrix} 1.372 \cdot 10^4 \\ 10^{-18} \\ 8.160 \cdot 10^3 \\ 5.554 \cdot 10^3 \end{pmatrix} \cdot watt \qquad HeatLoad_{137Cs_90Sr_sd} := \begin{pmatrix} 1 \cdot 10^3 \\ 10^{-19} \\ 1 \cdot 10^2 \\ 1 \cdot 10^2 \end{pmatrix} \cdot watt$$

$vol_{tank} := (1407) \cdot kilo \cdot gal$ 43.5790

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

$$vent_rate_{bb} := .0045 \cdot \left(vol_{tank} - vol_{waste_m_1}\right) \cdot \frac{1}{day}$$

$vent_rate_{bb} = 0.148\,cfm$

AN Tank farm: Tank Data

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

$$ht_{tank} := \frac{vol_{waste_m}}{2754 \cdot \frac{gal}{in}}$$ estimation of waste depth

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

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

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

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

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

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

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

$vol_{head_m} = 4.813 \times 10^4\ ft^3$ $\qquad$ $vol_{head_sd} = 7.027 \times 10^3\ ft^3$

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

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

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

$$mass_{waste_m_i} = \begin{pmatrix} 5.889\times10^6 \\ 1.392\times10^{-6} \\ 3.213\times10^6 \\ 2.706\times10^6 \end{pmatrix} kg \qquad mass_{waste_sd_i} = \begin{pmatrix} 4.886\times10^5 \\ 1.750\times10^{-7} \\ 2.696\times10^5 \\ 3.178\times10^5 \end{pmatrix} kg$$

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

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

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

Ammonia Diffusion Information

$k_{2_NH3} := 1.81\cdot10^{-9}\cdot\frac{mol}{L\cdot min}$ $\qquad$ $V_m := 24.79\cdot\frac{L}{mol}$

$h_{A_NH3} := 5.92\cdot10^{-3}\cdot cfm$ $\qquad$ $[NH3_{liq_m}] := \frac{2.23\cdot10^2\cdot\frac{\mu\cdot gm}{mL}}{17.037\cdot\frac{gm}{mol}}$ $\qquad$ $[NH3_{liq_m}] = 0.013\frac{mol}{L}$

$P := 1\cdot atm$

$[NH3_{liq_sd}] := \frac{0.174\cdot10^2\cdot\frac{\mu\cdot gm}{mL}}{17.037\cdot\frac{gm}{mol}}$ $\qquad$ $[NH3_{liq_sd}] = 1.021\times10^{-3}\frac{mol}{L}$

$K_H := 6.18\cdot\frac{mol}{L\cdot atm}$

$k_{1_NH3_k} := \frac{vent_rate_{bb} + \left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{vol_{head_k}}$ $\qquad$ $k_{1_NH3_nbr_k} := \frac{vent_rate + \left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{vol_{head_k}}$

Gas Concentrations at LFL

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

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

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

End of Input Data

Calculations

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

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

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

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

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

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

Reactivity coefficient (0.7 for DSTs, 0.4 for SSts) (Hu, 2000 - eqn 4-8)

$r_f = 0.700$

Calculate the Weight Fraction of Liquid in the Waste

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

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

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

$$W_{H2O_m_i} = \begin{pmatrix} 2.885 \times 10^{6} \\ 6.263 \times 10^{-7} \\ 1.641 \times 10^{6} \\ 1.247 \times 10^{6} \end{pmatrix} kg \qquad W_{H2O_sd_i} = \begin{pmatrix} 3.767 \times 10^{5} \\ 1.029 \times 10^{-7} \\ 2.126 \times 10^{5} \\ 1.907 \times 10^{5} \end{pmatrix} kg$$

Check units on input data

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

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

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

$[TOC_{wt\%_m}] = 0.221$ $\qquad$ $[TOC_{wt\%_sd}] = 0.027$

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

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

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

$[Al_{wt\%_m}] = 2.754$ $\qquad$ $[Al_{wt\%_sd}] = 0.317$

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

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

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

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

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

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

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

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

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

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

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

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

$i := 1..4$

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

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

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

$$HGR_{therm_m} = \begin{pmatrix} 5.462 \times 10^{-7} \\ 5.127 \times 10^{-7} \\ 5.843 \times 10^{-7} \\ 5.339 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day} \qquad HGR_{therm_sd} = \begin{pmatrix} 3.410 \times 10^{-7} \\ 3.033 \times 10^{-7} \\ 3.564 \times 10^{-7} \\ 3.713 \times 10^{-7} \end{pmatrix} \frac{g_mol}{kg \cdot day}$$

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

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

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

$$HGR_{thermv_m} = \begin{pmatrix} 2.909 \\ 6.279 \times 10^{-13} \\ 1.641 \\ 1.268 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{thermv_scf_i} := HGR_{thermv_m_i} \cdot \frac{273.15 \cdot K}{Temp_{vap_m}}$$

$$HGR_{thermv_m} = \begin{pmatrix} 2.020 \times 10^{-3} \\ 4.360 \times 10^{-16} \\ 1.140 \times 10^{-3} \\ 8.804 \times 10^{-4} \end{pmatrix} cfm \qquad HGR_{thermv_scf} = \begin{pmatrix} 2.628 \\ 5.672 \times 10^{-13} \\ 1.482 \\ 1.145 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{thermv_scf} = \begin{pmatrix} 1.825 \times 10^{-3} \\ 3.939 \times 10^{-16} \\ 1.029 \times 10^{-3} \\ 7.953 \times 10^{-4} \end{pmatrix} cfm$$

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

$Temp_{waste_m_2} = 308.907\,K$

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

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

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

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

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

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

$[NO_{3_molar_m}] = 2.740 \frac{g_mol}{L}$ $\qquad$ $[NO_{3_molar_sd}] = 0.279 \frac{g_mol}{L}$

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

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

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

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

$[NO_{2_molar_m}] = 2.702 \frac{g_mol}{L}$ $\qquad$ $[NO_{2_molar_sd}] = 0.272 \frac{g_mol}{L}$

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

$HeatLoad_{137Cs_90Sr_md_i} := mean(HeatLoad_{137Cs_90Sr_i})$

$$HeatLoad_{137Cs_90Sr_md_i} = \begin{pmatrix} 2.904 \times 10^{12} \\ 2.113 \times 10^{-10} \\ 1.729 \times 10^{12} \\ 1.176 \times 10^{12} \end{pmatrix} \mu \cdot Ci$$

$$HeatLoad_{137Cs_90Sr_sdd_i} := Stdev\left(HeatLoad_{137Cs_90Sr_i}\right)$$

$$HeatLoad_{137Cs_90Sr_sdd_i} = \begin{pmatrix} 2.053 \times 10^{11} \\ 0.000 \\ 2.194 \times 10^{10} \\ 1.998 \times 10^{10} \end{pmatrix} \mu \cdot Ci$$

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

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

$$HeatLoad_{m_i} = \begin{pmatrix} 4.654 \times 10^{-6} \\ 1.432 \times 10^{-15} \\ 5.080 \times 10^{-6} \\ 4.100 \times 10^{-6} \end{pmatrix} \frac{watt}{kg}$$

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

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

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

$$G_{org_m_i} = \begin{pmatrix} 0.013 \\ 0.013 \\ 0.013 \\ 0.013 \end{pmatrix} \frac{molecules}{100 \cdot eV} \qquad G_{org_sd_i} = \begin{pmatrix} 3.851 \times 10^{-3} \\ 3.752 \times 10^{-3} \\ 3.899 \times 10^{-3} \\ 4.337 \times 10^{-3} \end{pmatrix} \frac{molecules}{100 \cdot eV}$$

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

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

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

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

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

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

$$HGR_{rad_m} = \begin{pmatrix} 2.754\times 10^{-7} \\ 7.984\times 10^{-17} \\ 3.193\times 10^{-7} \\ 2.315\times 10^{-7} \end{pmatrix}\frac{ft^3}{kg\cdot day} \qquad HGR_{rad_sd} = \begin{pmatrix} 2.633\times 10^{-8} \\ 0.000 \\ 2.449\times 10^{-9} \\ 2.732\times 10^{-8} \end{pmatrix}\frac{g_mol}{kg\cdot day}$$

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

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

$$HGR_{radv_m} = \begin{pmatrix} 1.7941 \\ 1.2305\times 10^{-22} \\ 1.1357 \\ 0.6934 \end{pmatrix}\frac{ft^3}{day} \qquad HGR_{radv_sd} = \begin{pmatrix} 0.1925 \\ 0.0000 \\ 0.0958 \\ 0.1048 \end{pmatrix}\frac{ft^3}{day}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.246\times 10^{-3} \\ 8.545\times 10^{-26} \\ 7.887\times 10^{-4} \\ 4.815\times 10^{-4} \end{pmatrix} cfm$$

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

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

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.621 \\ 1.112 \times 10^{-22} \\ 1.026 \\ 0.626 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{radv_scf_sd} = \begin{pmatrix} 0.174 \\ 0.000 \\ 0.087 \\ 0.095 \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{radv_scf_m} = \begin{pmatrix} 1.125 \times 10^{-3} \\ 7.719 \times 10^{-26} \\ 7.125 \times 10^{-4} \\ 4.350 \times 10^{-4} \end{pmatrix} cfm$$

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

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

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

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

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

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

$$HGR_{corr_m_i} := mean\left(HGR_{corr_i}\right) \qquad HGR_{corr_sd_i} := Stdev\left(HGR_{corr_i}\right)$$

$$HGR_{corr_m} = \begin{pmatrix} 1.0448 \\ 1.6501 \times 10^{-13} \\ 0.3772 \\ 0.6676 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_sd} = \begin{pmatrix} 0.0136 \\ 0.0000 \\ 4.9252 \times 10^{-3} \\ 8.7164 \times 10^{-3} \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.636 \times 10^{-4} \end{pmatrix} cfm$$

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

$$HGR_{corr_scf_m_i} := mean\left(HGR_{corr_scf_i}\right) \qquad HGR_{corr_scf_sd_i} := Stdev\left(HGR_{corr_scf_i}\right)$$

$$HGR_{corr_scf_m} = \begin{pmatrix} 0.944 \\ 1.491 \times 10^{-13} \\ 0.341 \\ 0.603 \end{pmatrix} \frac{ft^3}{day} \qquad HGR_{corr_scf_sd} = \begin{pmatrix} 0.012 \\ 0.000 \\ 4.449 \times 10^{-3} \\ 7.874 \times 10^{-3} \end{pmatrix} \frac{ft^3}{day}$$

$$HGR_{corr_scf_m} = \begin{pmatrix} 6.554 \times 10^{-4} \\ 1.035 \times 10^{-16} \\ 2.366 \times 10^{-4} \\ 4.188 \times 10^{-4} \end{pmatrix} cfm$$

Total Hydrogen Generation Rate

$$mass_{waste_m} = \begin{pmatrix} 5.889 \times 10^{6} \\ 1.392 \times 10^{-6} \\ 3.213 \times 10^{6} \\ 2.706 \times 10^{6} \end{pmatrix} kg$$

$$HGR_{thermv_m} = \begin{pmatrix} 2.020 \times 10^{-3} \\ 4.360 \times 10^{-16} \\ 1.140 \times 10^{-3} \\ 8.804 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{radv_m} = \begin{pmatrix} 1.246 \times 10^{-3} \\ 8.545 \times 10^{-26} \\ 7.887 \times 10^{-4} \\ 4.815 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.636 \times 10^{-4} \end{pmatrix} cfm$$

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

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

$$HGR_m = \begin{pmatrix} 3.991 \times 10^{-3} \\ 5.506 \times 10^{-16} \\ 2.190 \times 10^{-3} \\ 1.826 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{sd} = \begin{pmatrix} 9.829 \times 10^{-4} \\ 0.000 \\ 7.065 \times 10^{-4} \\ 6.419 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_m = \begin{pmatrix} 162.755 \\ 2.245 \times 10^{-11} \\ 89.308 \\ 74.438 \end{pmatrix} \frac{L}{day}$$

At Headspace Temp...

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

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

$$HGR_{stp_m} = \begin{pmatrix} 3.606 \times 10^{-3} \\ 4.974 \times 10^{-16} \\ 1.979 \times 10^{-3} \\ 1.649 \times 10^{-3} \end{pmatrix} cfm \qquad HGR_{stp_sd} = \begin{pmatrix} 8.879 \times 10^{-4} \\ 0.000 \\ 6.382 \times 10^{-4} \\ 5.799 \times 10^{-4} \end{pmatrix} cfm$$

$$HGR_{stp_m} = \begin{pmatrix} 5.192 \\ 7.163 \times 10^{-13} \\ 2.849 \\ 2.375 \end{pmatrix} \frac{ft^3}{day}$$

At Standard conditions...

Steady-State Hydrogen Concentration (assuming normal ventilation rate)

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

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

$$[H2_{ss_m}] = 3.991 \times 10^{-3}\% \qquad [H2_{ss_sd}] = 9.828 \times 10^{-4}\%$$

$$[H2_{ss_m}] = 0.100\%LFL_{H2} \qquad [H2_{ss_sd}] = 0.025\%LFL_{H2}$$

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

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

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

$[H2_{ss_bb_m}] = 2.624\%$ $\qquad$ $[H2_{ss_bb_sd}] = 0.625\%$

$[H2_{ss_bb_m}] = 65.600\%LFL_{H2}$ $\qquad$ $[H2_{ss_bb_sd}] = 15.615\%LFL_{H2}$

Gas release Rate (independent of ventilation rate)

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

$rate_{H2_rel} = 1.996\,cfm$ $\qquad$ $rate_{H2_rel_bb} = 1.996\,cfm$

Calculate Release Rates of Ammonia, Methane, and Nitrous Oxide at Normal ventilation Rate (assuming no gas retention)

$$[NH_3] := (rnorm(NSamples, [NH_{3_m}], [NH_{3_sd}]))$$

$$RR_{NH3} := \overrightarrow{\left(\frac{[NH_3] \cdot vent_rate}{1 - [NH_3]}\right)}$$

$RR_{NH3_m} := mean(RR_{NH3})$ $\qquad$ $RR_{NH3_sd} := Stdev(RR_{NH3})$

$RR_{NH3_m} = 2.107 \times 10^{-3}\,cfm$ $\qquad$ $RR_{NH3_sd} = 2.054 \times 10^{-4}\,cfm$

$$[CH_4] := (rnorm(NSamples, [CH_{4_m}], [CH_{4_sd}]))$$

$$RR_{CH4} := \overrightarrow{\left(\frac{[CH_4] \cdot vent_rate}{1 - [CH_4]}\right)}$$

$RR_{CH4_m} := mean(RR_{CH4})$ $\qquad$ $RR_{CH4_sd} := Stdev(RR_{CH4})$

$RR_{CH4_m} = 2.006 \times 10^{-4}\,cfm$ $\qquad$ $RR_{CH4_sd} = 2.043 \times 10^{-5}\,cfm$

$$[N2O] := (rnorm(NSamples, [N2O_m], [N2O_{sd}]))$$

$$RR_{N2O} := \overrightarrow{\left(\frac{[N2O] \cdot vent_rate}{1 - [N2O]}\right)}$$

$RR_{N2O_m} := mean(RR_{N2O})$ $RR_{N2O_sd} := Stdev(RR_{N2O})$

$RR_{N2O_m} = 6.952 \times 10^{-4}\,cfm$ $RR_{N2O_sd} = 6.879 \times 10^{-5}\,cfm$

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

$[NH3_{ss_m}] := \frac{RR_{NH3_m}}{RR_{NH3_m} + vent_rate}$ $[NH3_{ss_m}] = 2.107 \times 10^{-3}\%$

$[NH3_{ss_sd}] := [NH3_{ss_m}] \cdot \frac{17.4}{223}$ $[NH3_{ss_m}] = 0.014\%LFL_{NH3}$

$[NH3_{ss}] := (rnorm(NSamples, [NH3_{ss_m}], [NH3_{ss_sd}]))$

$[CH4_{ss_m}] := \frac{RR_{CH4_m}}{RR_{CH4_m} + vent_rate}$ $[CH4_{ss_m}] = 2.006 \times 10^{-4}\%$

$[N2O_{ss_m}] := \frac{RR_{N2O_m}}{RR_{N2O_m} + vent_rate}$ $[N2O_{ss_m}] = 6.951 \times 10^{-4}\%$

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

$$NH3_1000_day_k := \left[\frac{k_{2_NH3}}{k_{1_NH3_k}} + \left[\frac{([NH3_{ss}])_k}{V_m} - \frac{k_{2_NH3}}{k_{1_NH3_k}}\right]\exp\left(-1 \cdot \frac{k_{1_NH3_k}}{\frac{1}{day}} \cdot 1000\right)\right] \cdot V_m$$

$NH3_1000_day_1 = 2.145 \times 10^{3}\,ppm$

$[NH3_{ss_bb}] := NH3_1000_day$

$[NH3_{ss_bb_m}] := mean([NH3_{ss_bb}])$ $[NH3_{ss_bb_sd}] := Stdev([NH3_{ss_bb}])$

$[NH3_{ss_bb_m}] = 0.205\%$ $[NH3_{ss_bb_sd}] = 0.030\%$

$[NH3_{ss_bb_m}] = 1.365\%LFL_{NH3}$ $[NH3_{ss_bb_sd}] = 0.199\%LFL_{NH3}$

$[CH4_{ss_bb}] := \frac{\overrightarrow{RR_{CH4}}}{RR_{CH4} + vent_rate_{bb}}$

$[CH4_{ss_bb_m}] := mean([CH4_{ss_bb}])$ $[CH4_{ss_bb_sd}] := Stdev([CH4_{ss_bb}])$

$[CH4_{ss_bb_m}] = 0.135\%$ $\qquad$ $[CH4_{ss_bb_sd}] = 0.014\%$

$[CH4_{ss_bb_m}] = 2.710\%LFL_{CH4}$ $\qquad$ $[CH4_{ss_bb_sd}] = 0.276\%LFL_{CH4}$

$$[N2O_{ss_bb}] := \overrightarrow{\frac{RR_{N2O}}{RR_{N2O} + vent_rate_{bb}}}$$

$[N2O_{ss_bb_m}] := mean([N2O_{ss_bb}])$ $\qquad$ $[N2O_{ss_bb_sd}] := Stdev([N2O_{ss_bb}])$

$[N2O_{ss_bb_m}] = 0.468\%$ $\qquad$ $[N2O_{ss_bb_sd}] = 0.046\%$

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

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

$[Conc_mix_{ss_bb_m}] := mean([Conc_mix_{ss_bb}])$

$[Conc_mix_{ss_bb_m}] = 69.674\%LFL$

$[Conc_mix_{ss_bb_sd}] := Stdev([Conc_mix_{ss_bb}])$

$[Conc_mix_{ss_bb_sd}] = 15.602\%LFL$

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

$$GR := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad GR = \begin{pmatrix} \{500,1\} \\ \{500,1\} \\ \{500,1\} \\ \{500,1\} \end{pmatrix} cfm$$

Generation Rate

$$GR_m := \begin{pmatrix} HGR_{m_1} \\ RR_{NH3_m} \\ RR_{CH4_m} \\ RR_{N2O_m} \end{pmatrix} \qquad GR_m = \begin{pmatrix} 3.991 \times 10^{-3} \\ 2.107 \times 10^{-3} \\ 2.006 \times 10^{-4} \\ 6.952 \times 10^{-4} \end{pmatrix} cfm$$

$$Rate_{rel} := \begin{pmatrix} HGR_1 \\ RR_{NH3} \\ RR_{CH4} \\ RR_{N2O} \end{pmatrix} \qquad Rate_{rel} = \begin{pmatrix} \{500,1\} \\ \{500,1\} \\ \{500,1\} \\ \{500,1\} \end{pmatrix} cfm$$

Release Rate
(Assume no retention)

$$Conc_{init} := \begin{pmatrix} [H2_{ss_m}] \\ [NH3_{ss_m}] \\ [CH4_{ss_m}] \\ [N2O_{ss_m}] \end{pmatrix} \qquad Conc_{init} = \begin{pmatrix} 3.991 \times 10^{-3} \\ 2.107 \times 10^{-3} \\ 2.006 \times 10^{-4} \\ 6.951 \times 10^{-4} \end{pmatrix} \%$$

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

Calculate the composition of all components at time 't'

... Insoluble Gas Relationship

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

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

...With New Ammonia Relationship (as Soluble Gas)

$$conc(t,i) := \begin{cases} \overrightarrow{\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]} & \text{if } i < 2 \\ \overrightarrow{\left[Conc_{in_i} \cdot \left[1 - e^{(-\lambda_i \cdot t)}\right] + Conc_{init_i} \cdot \left[e^{(-\lambda_i \cdot t)}\right]\right]} & \text{if } i > 2 \\ \overrightarrow{\left[\frac{k_{2_NH3}}{k_{1_NH3}} + \left(\frac{[NH3_{ss}]}{V_m} - \frac{k_{2_NH3}}{k_{1_NH3}}\right) \exp\left(-1 \cdot \frac{k_{1_NH3}}{\frac{1}{day}} \cdot \frac{t}{day}\right)\right]} \cdot V_m & \text{otherwise} \end{cases}$$

...With New Ammonia Relationship (as Soluble Gas)

$$conc_m(t,i) := mean\left(\left|\begin{array}{ll} \overrightarrow{\left[Conc_{in_i}\cdot\left[1-e^{(-\lambda_i\cdot t)}\right]+Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right]\right]} & \text{if } i<2 \\ \overrightarrow{\left[Conc_{in_i}\cdot\left[1-e^{(-\lambda_i\cdot t)}\right]+Conc_{init_i}\cdot\left[e^{(-\lambda_i\cdot t)}\right]\right]} & \text{if } i>2 \\ \overrightarrow{\left[\frac{k_{2_NH3}}{k_{1_NH3}}+\left(\frac{[NH3_{ss}]}{V_m}-\frac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left(-1\cdot\frac{k_{1_NH3}}{\frac{1}{day}}\cdot\frac{t}{day}\right)\right]}\cdot V_m & \text{otherwise} \end{array}\right.\right)$$

...With New Ammonia Relationship (as Soluble Gas)

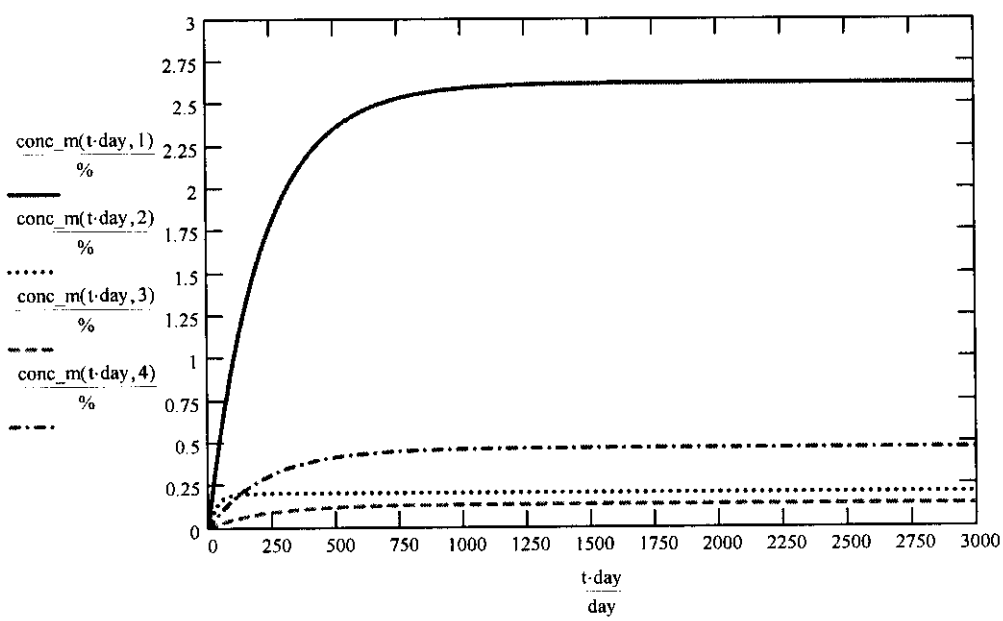
$conc_m(0\cdot sec,1) = 3.991\times10^{-3}\%$ $\quad conc_m(1000\cdot day,1) = 2.593\%$ $\quad conc_m(1000\cdot day,1) = 64.828\%LFL_{H2}$

$conc_m(0\cdot sec,2) = 2.104\times10^{-3}\%$ $\quad conc_m(1000\cdot day,2) = 0.205\%$ $\quad conc_m(1000\cdot day,2) = 1.365\%LFL_{NH3}$

$conc_m(0\cdot sec,3) = 2.006\times10^{-4}\%$ $\quad conc_m(1000\cdot day,3) = 0.134\%$ $\quad conc_m(1000\cdot day,3) = 2.674\%LFL_{CH4}$

$conc_m(0\cdot sec,4) = 6.951\times10^{-4}\%$ $\quad conc_m(1000\cdot day,4) = 0.462\%$

$t := 0,30..3000$



Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

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

$LFL_{mix_m}(z) := mean(LFL_{mix}(z))$

$LFL_{mix_sd}(z) := Stdev(LFL_{mix}(z))$

$LFL_{mix_m}(0 \cdot day) = 8.488 \times 10^4\,\%$

$LFL_{mix_sd}(0 \cdot day) = 836.379\,\%$

$LFL_{mix_m}(1000000 \cdot day) = 149.796\,\%$

$LFL_{mix_sd}(1000000 \cdot day) = 29.308\,\%$

Calculate the time to reach various fractions of the LFL

time to reach 25 %LFL

$TOL := .00001$

$$fm(z,ll) := \frac{\left(\frac{1}{LFL_{mix_m}(z)}\right)}{\%LFL} - ll$$

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

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

$tlfl := 25$

$z := 10 \cdot day$ Initial Guess

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

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

$temp_{25} = 91.877\,day$

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

$temp_{25_m} := Re(root(fm(zm,tlfl),zm))$

$temp_{25_m} = 98.541\,day$

$Time_{1_25\%LFL_m} := if([Conc_mix_{ss_bb_m}] > 25\%, if(temp_{25_m} < 0 \cdot day, 0 \cdot day, temp_{25_m}), 10^9 \cdot day)$

$Time_{1_25\%LFL_m} = 98.541\ day$

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

$Time_{1_25\%LFL_sd} = 5.681\ day$

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

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

$temp_{50} = 271.253\ day$

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

$temp_{50_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{50_m} = 300.463\ day$

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

$Time_{1_50\%LFL_m} = 300.463\ day$

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

$Time_{1_50\%LFL_sd} = 32.068\ day$

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

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

$temp_{75} = 542.444\ day$

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

$temp_{75_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{75_m} = 436.238\ day$

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

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

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

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

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*

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

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!

$temp_{100} = 152.811\ day$

$zm := 10 \cdot day$ Initial Guess

$temp_{100_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{100_m} := Re(root(fm(zm, tlfl), zm))$

$temp_{100_m} = 135.485\ day$

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

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

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

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

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

$$\mathrm{Conc_vr}(V,i) := \begin{cases} \left[\dfrac{\mathrm{Rate}_{\mathrm{rel}_i}\cdot 100\cdot\%}{\mathrm{Rate}_{\mathrm{rel}_i}+V}\cdot\left[1-e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]+\mathrm{Conc}_{\mathrm{init}_i}\cdot\left[e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]\right] & \text{if } i<2 \\ \left[\dfrac{\mathrm{Rate}_{\mathrm{rel}_i}\cdot 100\cdot\%}{\mathrm{Rate}_{\mathrm{rel}_i}+V}\cdot\left[1-e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]+\mathrm{Conc}_{\mathrm{init}_i}\cdot\left[e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]\right] & \text{if } i>2 \\ \left[\left[\dfrac{k_{2_NH3}}{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{\mathrm{vol}_{\mathrm{head}}}}+\left(\dfrac{[NH3_{ss}]}{V_m}-\dfrac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left[-1\cdot\dfrac{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{\mathrm{vol}_{\mathrm{head}}}}{\frac{1}{\mathrm{day}}}\cdot 10^9\right]\right]\cdot V_m\right] & \text{otherwise} \end{cases}$$

$$\mathrm{Conc_vr_m}(V,i) := \mathrm{mean}\left(\begin{cases} \left[\dfrac{\mathrm{Rate}_{\mathrm{rel}_i}\cdot 100\cdot\%}{\mathrm{Rate}_{\mathrm{rel}_i}+V}\cdot\left[1-e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]+\mathrm{Conc}_{\mathrm{init}_i}\cdot\left[e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]\right] & \text{if } i<2 \\ \left[\dfrac{\mathrm{Rate}_{\mathrm{rel}_i}\cdot 100\cdot\%}{\mathrm{Rate}_{\mathrm{rel}_i}+V}\cdot\left[1-e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]+\mathrm{Conc}_{\mathrm{init}_i}\cdot\left[e^{\left(-\frac{V+\mathrm{Rate}_{\mathrm{rel}_i}}{\mathrm{vol}_{\mathrm{head}}}\cdot 10^9\cdot\mathrm{day}\right)}\right]\right] & \text{if } i>2 \\ \left[\left[\dfrac{k_{2_NH3}}{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{\mathrm{vol}_{\mathrm{head}}}}+\left(\dfrac{[NH3_{ss}]}{V_m}-\dfrac{k_{2_NH3}}{k_{1_NH3}}\right)\exp\left[-1\cdot\dfrac{\frac{V+\left(h_{A_NH3}\cdot K_H\cdot P\cdot V_m\right)}{\mathrm{vol}_{\mathrm{head}}}}{\frac{1}{\mathrm{day}}}\cdot 10^9\right]\right]\cdot V_m\right] & \text{otherwise} \end{cases}\right).$$

Calculate Steady-State Flammable Gas Concentration at Normal Operating Conditions

$$\mathrm{LFL}_{\mathrm{mix_vr}}(v) := \frac{1}{\dfrac{\mathrm{Conc_vr}(v,1)}{\mathrm{LFL}_{H2}}+\dfrac{\mathrm{Conc_vr}(v,2)}{\mathrm{LFL}_{NH3}}+\dfrac{\mathrm{Conc_vr}(v,3)}{\mathrm{LFL}_{CH4}}}$$

$\mathrm{LFL}_{\mathrm{mix_vr_m}}(z) := \mathrm{mean}\left(\mathrm{LFL}_{\mathrm{mix_vr}}(z)\right)$

$\mathrm{LFL}_{\mathrm{mix_vr_sd}}(z) := \mathrm{Stdev}\left(\mathrm{LFL}_{\mathrm{mix_vr}}(z)\right)$

$\mathrm{LFL}_{\mathrm{mix_vr_m}}(0.148\cdot\mathrm{cfm}) = 149.904\,\%$

$\mathrm{LFL}_{\mathrm{mix_vr_sd}}(0.148\cdot\mathrm{cfm}) = 29.329\,\%$

$\mathrm{LFL}_{\mathrm{mix_vr_m}}(1\cdot\mathrm{cfm}) = 939.041\,\%$

$\mathrm{LFL}_{\mathrm{mix_vr_sd}}(1\cdot\mathrm{cfm}) = 178.880\,\%$

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

$temp_{25} := root(f2(z,tlfl),z)$

$temp_{25} = 0.429832\,cfm$

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

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

$temp_{25_m} := root(f2m(zm,tlfl),zm)$

$temp_{25_m} = 0.411261\,cfm$

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

$vent_rate_{1_25\%LFL_m} = 0.412\,cfm$

$vent_rate_{1_25\%LFL_sd} := if(temp_{25} < 0\cdot cfm, 0\cdot cfm, f2_sd(temp_{25},tlfl)\cdot temp_{25})$

$vent_rate_{1_25\%LFL_sd} = 0.024\,cfm$

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

$temp_{50} := root(f2(z, tlfl), z)$

$temp_{50} = 0.209030\,cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{50_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{50_m} := root(f2m(zm, tlfl), zm)$

$temp_{50_m} = 0.199885\,cfm$

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

$vent_rate_{1_50\%LFL_m} = 0.201\,cfm$

$vent_rate_{1_50\%LFL_sd} := if(temp_{50} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{50}, tlfl) \cdot temp_{50})$

$vent_rate_{1_50\%LFL_sd} = 0.023\,cfm$

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

$temp_{75} := root(f2(z, tlfl), z)$

$temp_{75} = 0.136928\,cfm$

$zm := .001 \cdot cfm$ Initial Guess $temp_{75_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{75_m} := root(f2m(zm, tlfl), zm)$

$temp_{75_m} = 0.130956\,cfm$

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

$vent_rate_{1_75\%LFL_m} = 0.132\,cfm$

$vent_rate_{1_75\%LFL_sd} := if(temp_{75} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{75}, tlfl) \cdot temp_{75})$

$vent_rate_{1_75\%LFL_sd} = 0.023\,cfm$

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

$temp_{100} := root(f2(z, tlfl), z)$

$temp_{100} = 0.101243\,cfm$

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

$temp_{100_m} := -5 \cdot day$ Initial Value in case solution cannot be found

$temp_{100_m} := root(f2m(zm, tlfl), zm)$

$temp_{100_m} = 0.096863\,cfm$

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

$vent_rate_{1_100\%LFL_m} = 0.098\,cfm$

$vent_rate_{1_100\%LFL_sd} := if(temp_{100} < 0 \cdot cfm, 0 \cdot cfm, f2_sd(temp_{100}, tlfl) \cdot temp_{100})$

$vent_rate_{1_100\%LFL_sd} = 0.022\,cfm$

Summary Section

Input Data

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

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

$[TOC_m] = 3.110 \times 10^3 \frac{\mu \cdot gm}{mL}$ $\quad [NO_{3_m}] = 1.700 \times 10^5 \frac{\mu \cdot gm}{mL}$ $\quad [NO_{2_m}] = 1.250 \times 10^5 \frac{\mu \cdot gm}{mL}$

$[Al_m] = 3.860 \times 10^4 \frac{\mu \cdot gm}{mL}$ $\quad [137Cs_m] = \begin{pmatrix} 467.000 \\ 1.000 \times 10^{-18} \\ 538.000 \\ 383.000 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$ $\quad [90Sr_m] = \begin{pmatrix} 17.000 \\ 1.000 \times 10^{-18} \\ 0.073 \\ 37.000 \end{pmatrix} \frac{\mu \cdot Ci}{gm}$

$vol_{waste_m} = \begin{pmatrix} 1.408 \times 10^5 \\ 3.531 \times 10^{-8} \\ 8.073 \times 10^4 \\ 6.003 \times 10^4 \end{pmatrix} ft^3$ $\quad \rho_{waste_m} = \begin{pmatrix} 1.480 \\ 1.390 \\ 1.400 \\ 1.590 \end{pmatrix} \frac{gm}{mL}$ $\quad Temp_{waste_m} = \begin{pmatrix} 308.868 \\ 308.907 \\ 308.988 \\ 308.989 \end{pmatrix} K$

$F_{H2O_m} = \begin{pmatrix} 48.700 \\ 45.000 \\ 50.900 \\ 45.800 \end{pmatrix} \%$ $\quad HeatLoad_{137Cs_90Sr_m} = \begin{pmatrix} 1.372 \times 10^4 \\ 1.000 \times 10^{-18} \\ 8.160 \times 10^3 \\ 5.554 \times 10^3 \end{pmatrix} watt$ $\quad Temp_{vap_m} = 302.372\ K$

$vol_{tank} = 1.407 \times 10^3\ kilo \cdot gal$ $\quad vent_rate = 100.000\ cfm$ $\quad vent_rate_{bb} = 0.148\ cfm$

AN Tank farm: Tank Data

$diam_{tank} = 75.000\ ft$ $\quad ht_{tank} = \begin{pmatrix} 382.349 \\ 9.592 \times 10^{-11} \\ 219.280 \\ 163.069 \end{pmatrix} in$ estimation of waste depth

Dome-Space Compositions

$[CH_{4_m}] = 2.000 \times 10^{-4}\%$ $\quad [N2O_m] = 7.000 \times 10^{-4}\%$ $\quad [NH_{3_m}] = 2.100 \times 10^{-3}\%$

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...

$$HGR_{thermv_m} = \begin{pmatrix} 2.020 \times 10^{-3} \\ 4.360 \times 10^{-16} \\ 1.140 \times 10^{-3} \\ 8.804 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{thermv_sd} = \begin{pmatrix} 9.691 \times 10^{-4} \\ 0.000 \\ 6.969 \times 10^{-4} \\ 6.235 \times 10^{-4} \end{pmatrix} \text{cfm}$$

$$HGR_{radv_m} = \begin{pmatrix} 1.246 \times 10^{-3} \\ 8.545 \times 10^{-26} \\ 7.887 \times 10^{-4} \\ 4.815 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{radv_sd} = \begin{pmatrix} 1.337 \times 10^{-4} \\ 0.000 \\ 6.653 \times 10^{-5} \\ 7.278 \times 10^{-5} \end{pmatrix} \text{cfm}$$

$$HGR_{corr_m} = \begin{pmatrix} 7.255 \times 10^{-4} \\ 1.146 \times 10^{-16} \\ 2.619 \times 10^{-4} \\ 4.636 \times 10^{-4} \end{pmatrix} \text{cfm} \qquad HGR_{corr_sd} = \begin{pmatrix} 9.473 \times 10^{-6} \\ 0.000 \\ 3.420 \times 10^{-6} \\ 6.053 \times 10^{-6} \end{pmatrix} \text{cfm}$$

Overall Hydrogen Generation Rate...

at the headspace conditions... **at standard conditions (273.15°K)...**

$$HGR_m = \begin{pmatrix} 3.991 \times 10^{-3} \\ 5.506 \times 10^{-16} \\ 2.190 \times 10^{-3} \\ 1.826 \times 10^{-3} \end{pmatrix} \text{cfm} \qquad HGR_{stp_m} = \begin{pmatrix} 3.606 \times 10^{-3} \\ 4.974 \times 10^{-16} \\ 1.979 \times 10^{-3} \\ 1.649 \times 10^{-3} \end{pmatrix} \text{cfm}$$

$$HGR_m = \begin{pmatrix} 5.748 \\ 7.929 \times 10^{-13} \\ 3.154 \\ 2.629 \end{pmatrix} \frac{\text{ft}^3}{\text{day}} \qquad HGR_{stp_m} = \begin{pmatrix} 5.192 \\ 7.163 \times 10^{-13} \\ 2.849 \\ 2.375 \end{pmatrix} \frac{\text{ft}^3}{\text{day}}$$

Steady-State Compositions

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

$[H2_{ss_m}] = 0.100\,\%LFL_{H2}$ $[H2_{ss_bb_m}] = 65.600\,\%LFL_{H2}$

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

$[NH3_{ss_m}] = 0.014\,\%LFL_{NH3}$ $[NH3_{ss_bb_m}] = 1.365\,\%LFL_{NH3}$

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

$[CH4_{ss_m}] = 4.013 \times 10^{-3}\,\%LFL_{CH4}$ $[CH4_{ss_bb_m}] = 2.710\,\%LFL_{CH4}$

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

$[N2O_{ss_m}] = 6.951 \times 10^{-4}\,\%$ $[N2O_{ss_bb_m}] = 0.468\,\%$

Flammable Gas Concentrations after Loss of Ventilation at Selected Time Periods

$conc_{mix_m}(0 \cdot day)$ $conc_{mix_m}(10 \cdot day) = 3.401\,\%LFL$

$conc_{mix_m}(100 \cdot day) = 25.278\,\%LFL$ $conc_{mix_m}(489.445 \cdot day) = 59.546\,\%LFL$

$conc_{mix_m}(10^9 \cdot day) = 66.758\,\%LFL$

Time to Reach Various LFL Levels after Loss of Ventilation

$Time_{1_25\%LFL_m} = 98.541\ day$ $Time_{1_75\%LFL_m} = 1.000 \times 10^9\ day$

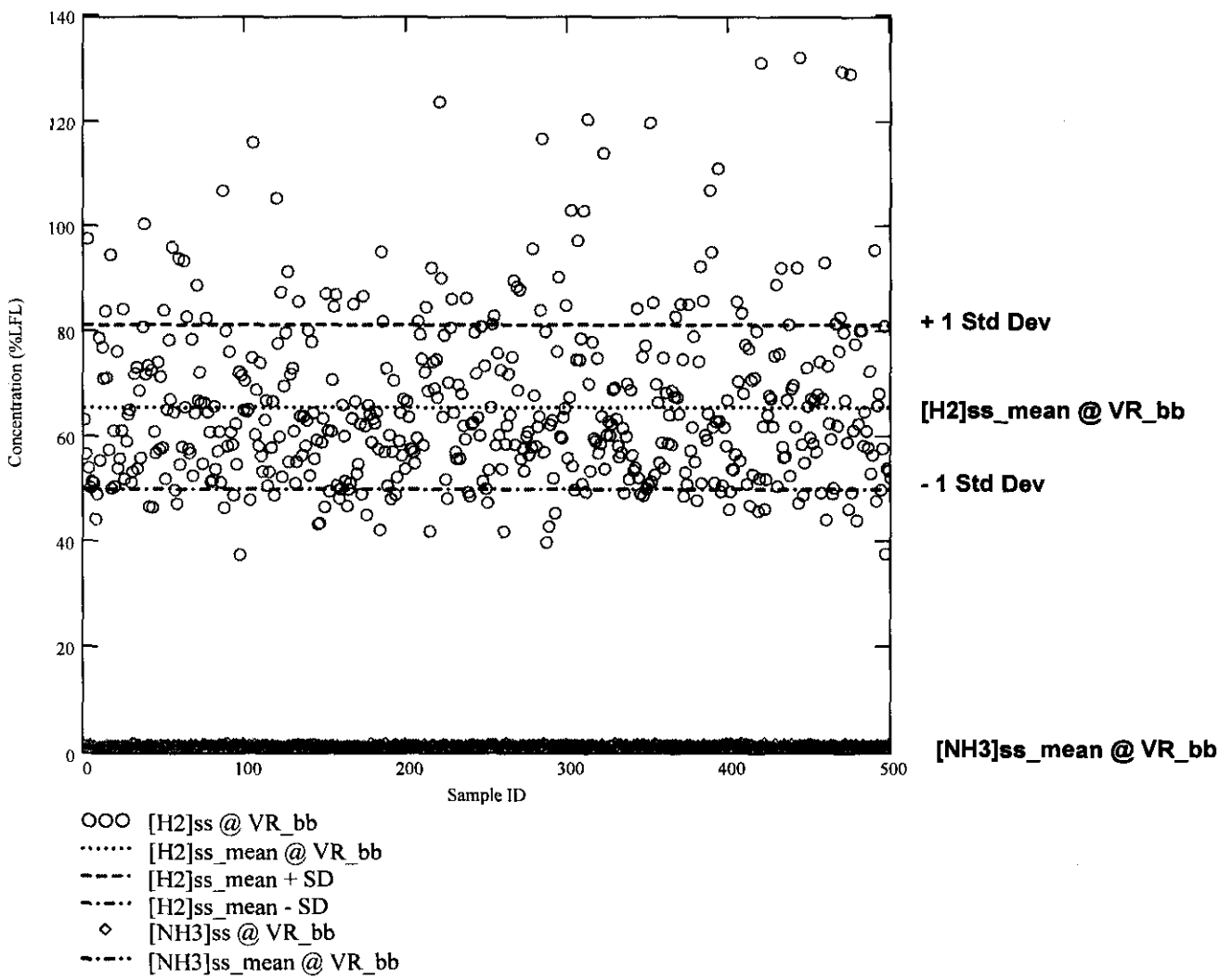
$Time_{1_50\%LFL_m} = 300.463\ day$ $Time_{1_100\%LFL_m} = 1.000 \times 10^9\ day$

Minimum Ventilation Rates to Keep Headspace Composition Below Selected LFLs

$vent_rate_{1_25\%LFL_m} = 0.412\,cfm$ $vent_rate_{1_75\%LFL_m} = 0.132\,cfm$

$vent_rate_{1_50\%LFL_m} = 0.201\,cfm$ $vent_rate_{1_100\%LFL_m} = 0.098\,cfm$

Relationship of sampled [H2] & [NH3] to their means with loss of ventilation



Written By:_____Date: _____

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