Dispersion Analysis

Draft Report

Robin Energy Storage, LLC Project

Kenosha, Wisconsin

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List of Acronyms and Definitions

Acronym	Definition
Ah	Amp hour
AHJ	Authority Having Jurisdiction
BMS	Battery Management System
BSS	Battery Storage System
CGA	Compressed Gas Association
EPA	Environmental Protection Agency
ERPG-2	The maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action.
ERPG-3	The maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects
ESS	Energy Storage Systems
GWh	Gigawatt hour (equal to 1,000 MWhs)
HVAC	Heating Ventilation and Air Conditioning
IDLH	Immediately Dangerous to Life and Health: developed by National Institute for Occupational Safety and Health (NIOSH)
IEEE	Institute of Electrical and Electronics Engineers
kWh	Kilowatt hour
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
LFP	Lithium Ion Phosphate
MWhr	Megawatt hour (equal to 1,000 kWh)
NCA	Lithium Nickel Cobalt Aluminum
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NRTL	OSHAs Nationally Recognized Testing Laboratory
OEHHA	Office of Environmental Health Hazard Assessment
ppm	Parts Per Million
REL	Reference Exposure Level
SCADA	Supervisory Control and Data Acquisition
SDS	Safety Data Sheet
SOC	State of Charge
TCP	Transmission Control Protocol
Thermal Runaway	During the thermal runaway, the battery temperature increases due to exothermic reactions. In turn, the increased temperature accelerates those degradation reactions and the system destabilizes, potentially releasing flammable and toxic gases.
SFPE	Society of Fire Protection Engineers
UL	Underwriters Laboratory
USDOT	U.S. Department of Transportation
Whr	Watt hour

Executive Summary

Robin Energy Storage, LLC proposes to install a battery storage system with a capacity of 200 MW in Kenosha County, Wisconsin (Project). The Project would provide additional capacity to the electrical grid during periods when electrical sources are not generating power or when there is a need for additional power. The Project would provide increased electrical reliability and stability to the local grid.

This report is an update to a previous report (November 2024) that examined the potential impacts of the project using a different battery manufacturer. Since that time, the battery arrangement has changes as well as the proposed battery manufacturer (although not the battery type – LFP). This report examines the potential upset and malfunction scenario impacts for the Project that could result in impacts to nearby receptors from toxic and flammable gas releases, using LG technology and battery equipment that, while similar in battery types (both use LFP) to the previous manufacturer, have slightly different results for the UL testing.

The Project would not cause any impacts from toxic gas or flammable gas releases during normal operations (operations include battery storage and planned and unplanned maintenance activities).

The Project would utilize LG JF2 battery containers. UL9540A requires testing of the individual cells, groups of cells (modules) and the entire "unit". As part of the UL9540A cell level testing, an individual cell is subject to external heating until it undergoes thermal runaway. The off gassed flammable and toxic compounds are measured, and the total volume of materials released are also measured. The cell level testing produced thermal runaway in the cell and generated toxic and flammable gases. The results of the cell level testing, as well as other applicable studies, are used to conservatively estimate the flammable and toxic impacts of the entire container thermal runaway scenario where it is assumed as a worst case that all cells in the container thermal off gas at the same time.

Project emissions to the air would consist of off gassed and combustion products due to a battery cell malfunction under the reasonable worst-case scenario. Inhalation is the main pathway by which toxic air pollutants could potentially cause public health impacts.

Flammable material impacts could be produced by vapor cloud deflagrations or explosions for the reasonable worst-case scenario, or from thermal exposure to fires.

Public health impacts from toxic pollutants associated with the reasonable worst-case battery cell malfunction would not impact populated areas and would be less than significant.

Smoke levels above 1 - 10% in the air would displace oxygen and could produce impacts, as well as increased toxicity of the smoke could cause impacts. Levels below 1% are assumed to not produce impacts over the short term. The ground-level distance for smoke impacts would not impact any off-site receptors.

The off-gassed materials could generate a flammable vapor cloud and may produce a flammable gas mixture that could result in deflagration impacts (flammable vapor and flame effects or

overpressure). Distances for the LFL and the ½ LFL would not extend outside of the Project site boundaries and would not impact any offsite receptors.

Heat flux levels would not extend outside of the Project site boundaries if a thermal scenario were to occur at one of the containers located at the closest area to the site boundary. Although no fire or explosions occurred during the UL9540A tests, indicating the remote possibility of fires, other manufactures of LFP-type batteries have produced fires during their equipment testing using more "destructive" tests. Even if a fire were to occur, impacts would not extend outside of the site boundaries and the slow scenario development time would allow for response activities to occur before peak impacts are realized.

1.0 Introduction

Robin Energy Storage, LLC proposes to install a battery storage system with a capacity of 200 MW in Kenosha County, Wisconsin (Project). The Project would provide additional capacity to the electrical grid during periods when electrical sources are not generating power or when there is a need for additional power. The Project would provide increased electrical reliability and stability to the local grid.

This report is an update to a previous report (November 2024) that examined the potential impacts of the project using a different battery manufacturer. Since that time, the battery arrangement has changes as well as the proposed battery manufacturer (although not the battery type – LFP). This report examines the potential upset and malfunction scenario impacts for the Project that could result in impacts to nearby receptors from toxic and flammable gas releases, using LG technology and battery equipment that, while similar in battery types (both use LFP) to the previous manufacturer, have slightly different results for the UL testing.

Battery energy storage systems convert electrical energy into a chemically stored form that can later be converted back into electrical energy when needed. The first U.S. battery storage system listed in the Federal Energy Information Administration (EIA) database was a 40 MW system in Alaska in 2003. As of June 2024, the United States has 19,929 MW of total battery storage capacity (EIA 2024a) at 641 installations.

Lithium-ion batteries were introduced commercially by Sony in 1991 for use primarily in consumer products, and they since have become the most widely used battery technology for grid-scale energy storage. Lithium-ion batteries are scalable. The majority of U.S. utility-scale BESSs use lithium-ion batteries (EIA 2024b).

The project proposes the use of LG battery systems. The LG JF2 are the most recent design of the LG series. The LG units have undergone UL9540A testing at this time. The results of the UL9540A testing for the unit demonstrate that with heating, the LFP battery modules produced off gassing but no fires, resulting in minimal thermal radiation. Cell level testing demonstrates a range of flammable and toxic chemicals are produced due to cell off gassing and this information is available from the testing reports and used in this analysis.

2.0 Assessment Methodology

There will be no emissions from the battery systems associated with the Project during normal operations (battery storage and planned and unplanned maintenance).

However, in the unlikely event of a battery cell malfunction, such as a thermal runaway reaction or external impact scenario, the Project could emit air pollutants to the atmosphere. For these types of battery cell malfunctions, air pollutant emissions could be generated due to elevated temperatures within a single storage cell or group of storage cells caused by a runaway reaction. When Li-ion batteries are mistreated with high over-temperature, a strong overcharge or suffer damage, they can transit into a so-called “thermal runaway”. During the thermal runaway, the battery temperature increases due to exothermic reactions. In turn, the increased temperature accelerates degradation reactions, and the system destabilizes. At the end of the thermal runaway,

battery temperatures higher than 1,000 °C can be reached and flammable and toxic gases can be released (Golubkov 2015). A thermal runaway event would be considered a worst-case event and is addressed in further detail below.

This analysis is limited to a reasonable worst-case scenario. A catastrophic scenario, such as an airplane impact, runaway vehicle impact, runaway train impact, could cause multiple units to be destroyed simultaneously, causing substantial emissions associated with a large-scale fire. A reasonable worst-case scenario is more limited in scope, defined as a control system failure or a puncture of a module, similar to that conducted as part of the UL1973 testing, which could cause a runaway reaction in a group of cells or an entire unit. Generally, a reasonable worst-case scenario is more appropriate for a planning scenario as any development project could produce substantial fires and cause impacts to neighboring facilities under a catastrophic scenario.

The Project will be equipped with monitoring and control systems that will prevent and/or control battery cell malfunctions, including ventilation systems to maintain flammability below 25 percent. However, to determine an unlikely, but reasonable worst-case public health impacts for this analysis, it is assumed that these control systems, including the ventilation systems, fail and do not control the battery cell malfunction.

Different manufacturers have developed various studies examining the potential scenarios related to battery malfunctions, although most of these studies are proprietary. Some studies have been independently performed for agencies, including by Det Norske Veritas (DNVGL 2017) conducted for the New York State Energy Research & Development Authority (NYSERDA) and Consolidated Edison. Other studies include Anderson 2013, Blum 2016, Larsson 2017, Trucot 2021, Hynynen 2023 and Bugryniec 2024 where batteries were exposed to heat sources and off-gases were measured.

Different battery cell malfunctions could produce emissions. These include: (1) an elevated temperature situation due to a runaway reaction with no combustion (off gassing with no combustion); (2) combustion of the battery and off gassed materials due to an elevated temperature situation from a runaway. For the LG batteries, only the first, pre-combustion scenario occurred during the UL9540A testing. Emissions would occur both during the pre-combustion phase and during the combustion phase. During the pre-combustion phase, the off gassed materials would contain flammable and toxic materials. During the combustion phase, most of the off gassed materials would be combusted and hence would contain only low levels of flammable gasses. The off gassed toxics would also be combusted, but a different array of toxic combustion products, mostly from the combustion of the plastics used in the units, would be produced. In addition, during combustion, the heat of combustion would produce substantial plume buoyancy, thereby causing the materials to rise into the air. As the downwind, ground-level impacts could be greater during the pre-combustion phase, both phases are examined in this analysis.

2.1 UL9540A Testing

The Project would utilize LG JF2 units. UL9540A requires testing of the individual cells, groups of cells (modules) and the entire “unit”. As part of the UL9540A cell level testing, an individual

cell is subject to external heating until it undergoes thermal runaway. The off gassed flammable and toxic compounds are measured, and the total volume of materials released are also measured. The cell level testing produced thermal runaway in the cell and generated toxic and flammable gases. The results of the cell level testing are used to estimate the flammable and toxic impacts of the entire container scenario where it is assumed as a worst case that all cells in the unit thermal off gas at the same time.

An entire unit was also tested as part of the UL9540A unit testing. Under this unit level UL9540A testing, a group of cells in a module was forced into thermal runaway in a unit and the resulting tendency for the thermal runaway to spread to the entire unit was assessed.

The UL9540A tests require that the battery arrangements are forced into thermal runaway by inserting heaters into the batteries and forcing the temperature of the system to be elevated, thereby producing thermal runaway. For the units, the unit level test is primarily performed to examine the ability of the units to maintain containment and prevent the spread of a fire or thermal runaway scenario to adjacent areas of the units or to adjacent units.

The unit level UL9540A testing indicated that only a subset of the cells within the module area heated went into thermal runaway and the thermal runaway did not spread to neighboring units and module stacks. Some toxic and flammable gasses were observed but no flames were produced during the UL9540A unit level testing. This is similar to UL9540A testing on other manufacturers that used LFP-type batteries. The amount of heat given off by an LFP battery is substantially less than that produced by other lithium-ion battery types, and therefore it is harder to generate a full unit thermal runaway scenario, or a fire scenario. No flying debris, fires or explosive discharge of gases occurred during the UL9540A tests.

The difficulty in generating a full unit-level thermal runaway is a benefit in using the LFP battery type.

2.2 Toxic Pollutants

Toxic pollutants emitted from battery malfunctions are partially dependent on the battery type. For lithium-ion batteries used by LG, UL9540A testing indicates that only limited range of toxic pollutants are generated, as shown in Table 1 below. Note that none of the more toxic materials, such as hydrofluoric acid (HF), hydrogen chloride (HCL) nor hydrogen cyanide (HCN), were tested for during UL9540A testing for the LG cells.

Other pollutants may be associated with thermal offgassing that were not specifically tested for in the UL9540A testing. Other studies have indicated that HF, NCH, HCL or other toxic materials could occur. Therefore, other manufacturers proprietary testing and other studies are utilized to estimate a conservative range of toxic pollutants that could be produced. These are also listed in Table 1.

Table 1 Toxic Pollutants from Battery Malfunctions: UL9540A Testing and Other Studies

Pollutant	OEHHA Reference Exposure Level (REL), µg/m3 / (ppm)	IDLH (Immediately Dangerous to Life and Health)	ERPG-3 (Emergency Response Planning Guidelines)	ERPG-2 (Emergency Response Planning Guidelines)
Benzene	27/0.09	500 ppm	1,000 ppm	150 ppm
Carbon monoxide (CO)	23,000/26.7	1,200 ppm	500 ppm	350 ppm
Hydrogen Fluoride (HF)	240/0.2	30 ppm	50 ppm	20 ppm
Hydrogen Cyanide (HCN)	340/0.4	50 ppm	25 ppm	10 ppm
Hydrogen Chloride (HCL)	2100/3.2	50 ppm	150 ppm	20 ppm
Toluene	37,000/140	500 ppm	1,000 ppm	300 ppm
Xylene	22,000/5.1	900 ppm	2500 ppm	920 ppm

Source: LG UL testing reports. Note for Xylene, AEGL levels are used as there are no ERPG for xylenes. Also included are other manufacturers proprietary testing and other studies (Trucot 2021, EPRI 2022, Hynynen 2023 and Bugryniec 2024)

Generally, the battery cell will start to off-gas if the internal temperature exceeds 120 °C (DNVGL 2017). Note in the UL9540A testing, offgassing started at 129 °C.

The battery type proposed for this project, LFP, has demonstrated superior performance in terms of preventing thermal runaway, because the oxygen bond is harder to break and thus lower flammability (NFPA 2017). This is demonstrated in the relatively low thermal activity shown in the UL9540A testing unit level results associated with the unit.

Hydrogen Fluoride, Hydrogen Chloride and Hydrogen Cyanide Emissions

Testing for this group of pollutants sometimes is conducted as part of manufacturing testing. Other studies on a range of battery types has also been conducted (Trucot 2021, EPRI 2022, Hynynen 2023 and Bugryniec 2024). In order to be conservative on the potential range of toxic emissions that could occur, both the UL testing and other studies are utilized to estimate the upper range of toxic material concentrations that could occur in the off gassed material. Note that some of this testing is for off gassed materials while some testing is associated with combustion gases. DNVGL (2017) indicates that HF, HCN and HCL generally occur due to the presence of plastics. This could explain why very little toxics are seen in UL9540A cell-level testing, as opposed to module or unit level testing, as less plastic is present in the individual cells as opposed to an entire module/unit. UL9540A testing and other studies are discussed below.

UL9540A Toxic Testing: not all manufacturers test for HF, HCN and HCL during cell levels testing as the UL9540A cell level tests for LG only used "*Cell vent gas composition determined using Gas Chromatography*" which would not be sufficient to identify HF, HCN and HCL (this would require FTIR instruments). For module/unit level proprietary testing, as it is not required as part of the UL9540A testing, only a few manufacturers test for these toxins during UL9540A module/unit testing. The manufacturers proprietary testing indicates that levels could be elevated

as high as HF-up to 500 ppm, HCL-up to 1000ppm, and HCN-up to 1600ppm. This testing was for module/units. For cell level testing, only HF has been detected at below 2 ppm.

Other Studies: Other studies have addressed potential HF, HCN and HCL concentrations from a range of different battery types and configurations (Trucot 2021, EPRI 2022, Hynynen 2023 and Bugryniec 2024) including electric vehicle fires (Trucot 2021, Hynynen 2023); batteries such as button, cylinder, laptops, EV modules, EVs (Bugryniec 2024); and modeling of impacts (EPRI 2022). Concentrations of HF in these studies range from 3800ppm to 10,000ppm; HCN of 200ppm and HCL of 6000ppm.

Although these studies and battery types/configurations are not the same as the utility-scale installation proposed in this study, they do provide range of potential toxics that could occur from battery configurations which may have higher plastic contents and are considered a very conservative upper range of toxic emissions from modules/units during off gassing or fire situations.

Table 2 UL9540A Testing and Other Studies Results

Study	Description	Results
Anderson 2015	Exposure of battery to heat source, offgasses tested.	HF: 30-50ppm POF3: 1-2ppm
Blum 2016	Modules tested with heat exposure until thermal runaways. 100kwh unit	HF: 100 ppm
Bugryniec 2024	Review of gas emissions from lithium-ion battery thermal runaway failure, examined button, cylinder, laptops, EV modules, EVs. Range based on total volume emitted and total HF emitted Fig 3 and 8, and total CO emitted Fig 11	HF- range 3800ppm - 10,000ppm
DNVGL 2017	Measured characteristics of a wide range of battery types and failures	HF in plastics can be higher than battery fire. HF generally less than 200ppm
EPRI 2022	Air Modeling Simulations of Battery Energy Storage System Fires	Assumed 1% HF
Hynynen 2023	Combustion gases from large scale electric vehicle tests, Figure 6	3 mg/g HF max (0.3%), 6mg/g HCL max (0.6%)
Larsson 2017	External propane burner to heat batteries, measured toxic gasses. Examined different battery types	HF: up to 145-220 ppm
Trucot 2021	Car fires, Table 5 (Car 4 - the only electric car)	HF 0.23%, HCN 0.02%, HCL 0.30%

Table 2 UL9540A Testing and Other Studies Results

Study	Description	Results
5 different manufacturers	Proprietary data on UL battery tests. Various battery types.	Up to 244 L gas per cell at HF-up to 500 ppm HCL-up to 1000ppm HCN-up to 1600ppm Benzene- 0.06% Toluene-up to 3600ppm PH3-1.0ppm

Source: See references.

2.3 Flammable Components and Flammability

Flammable components are also emitted during a battery malfunction. Based upon the UL9540A study and other studies, the flammable components that could be emitted include those listed in Table 3.

Table 3 Flammable Components from Battery Off-gassing: UL9540A Study

Component	Lower Flammability Limit (LFL), vol%
Acetylene (C_2H_2)	2.3
Benzene (C_6H_6)	1.2
C4 (total, Butanes etc)	1.8
C5 (Total, Pentanes etc)	1.4
C6 (Total, benzene, etc)	1.2
C7 (Total, Toluene, etc)	1.0
Carbon monoxide (CO)	10.9
Dimethyl Carbonate ($C_3H_6O_3$)	4.2
Ethane (C_2H_6)	2.4
Ethylene/Ethene (C_2H_4)	2.4
Ethyl Methyl Carbonate ($C_4H_8O_3$)	2.1
Hydrogen (H_2)	4.0
Methane (CH_4)	4.4
Propane (C_3H_8)	1.7
Propene (C_3H_6)	1.8

Source: LG Test Reports

Depending on the combination of these flammable materials, the off gases could have varying degrees of flammability.

The UL9540A testing provided information on the composition of battery off-gassing. These are shown below:

Table 4 LG Manufacturer Battery Off-gassing Primary Flammable Components

Component	Mole Percent
Carbon monoxide (CO)	10.0
Hydrogen (H_2)	59.3
Methane (CH_4)	3.68
Acetylene (C_2H_2)	0.16
Ethylene (C_2H_4)	2.53
Ethane (C_2H_6)	0.53
Propane (C_3H_8)	0.12
Propene (C_3H_6)	0.26
C4	0.40
C5	0.12
C6	0.39
Benzene (C_6H_6)	0.09
Toluene (C_7H_8)	0.01
Xylene (C_8H_{10})	0.01

Note: based on LG proprietary testing for single cell level testing. Other components, such as nitrogen and carbon dioxide, are also produced but are not shown due to not being flammable. These are the components in the UL9540A Cell Level Testing and are estimates of the pre-combustion off gassed materials.
Source: LG Test Reports

The Compressed Gas Association (CGA) Publication P-23 provides algorithms for estimating the level of flammability of gas mixtures. The application of this technique to the off-gassed materials as provided by the manufacturer as part of the testing (shown in Table 3) indicates that the released vapor/gas would be flammable, with a Q value of over 11.7 (this exceeds the Q value flammability limit of 1.0, established by the CGA, indicating the materials is flammable (CGA 2015) with an estimated lower flammability limit of about 5.47 percent.

2.4 Modeling

In order to estimate the impacts of the off-gassing from toxic and flammable emissions, a modeling approach was used. The Canary© model (Canary 2024) was run to examine the downwind distance to the toxic IDLH and the flammable and explosive levels that could occur under the release scenario situations. The IDLH is the level specified as a concern in NFPA 855 and was therefore used in this analysis to assess toxic impacts.

The Canary© model is a computerized model developed by Quest Consulting to estimate the thermodynamic properties of gas mixtures and estimate impact distances of thermal exposure, explosions, vapor clouds and toxic effects.

For flammable deflagration impacts, the Canary© model was used to determine the distances that flammable vapor clouds (assessed to the LFL level) could travel with a resulting battery malfunction scenario under different meteorological conditions. The LFL distance is the distance at which potential flammable cloud deflagration could generate burn impacts on persons located within the LFL cloud. The ½ LFL distance is used to estimate the distance that a person located

immediately adjacent to the LFL cloud could experience thermal radiation effect. The Canary© model was also used to examine explosion impacts to 1 psi overpressure associated with ignition of the flammable vapor cloud.

Although a fire did not develop as part of the UL9540A testing, it is still possible that a fire could develop under severe enough circumstances. A fire would produce higher thermal impacts. For thermal impacts due to a fire, the other manufactures testing that exhibited fires are utilized to estimate the worst-case distances to different heat flux values.

In order to examine the range of potential impacts, modeling with the AERMOD model is also presented. Some jurisdictions have begun utilizing AERMOD (SDC 2025). The AERMOD model performs dispersion analysis, similar to the Canary model discussed above, but conducts the analysis with actual meteorological data, in this case, 5 years' worth of data. This presents a range of potential impacts that might be expected for that specific location. The AERMOD model is set up with a grid spacing of 25 meters and assumes a flat terrain to be conservative. Regulatory default options are utilized.

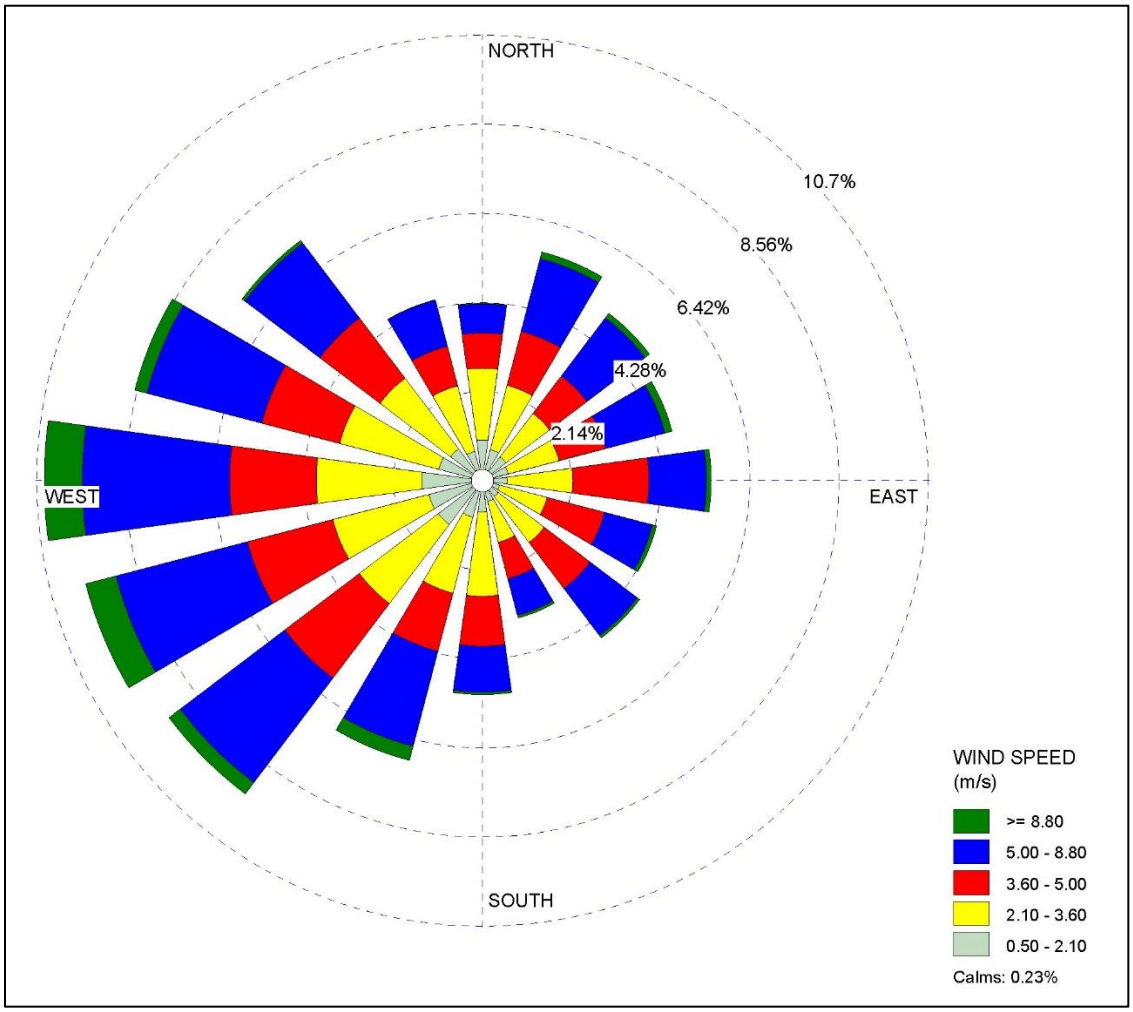
Modeling assumptions are listed below.

- Temperature of release: 27 degC;
- Area of release cabinet top vents: 2 vents totaling 2 ft2;
- Height of release: 9.5 feet;
- Time of cabinet thermal offgassing: 192 minutes;
- Ambient temperature/humidity: 77 deg F and 70% humidity;
- Terrain: 0.04 meter mixing height;
- Meteorological conditions: 1.5 m/s (3.3 mph) and F stability

2.5 Meteorological Data

Meteorological data was analyzed for the Kenosha area based on the year 2016-2020 obtained from the Wisconsin Department of Natural Resources. The data indicates that about 0.2% of wind periods were below 0.5 m/s and were considered "calm" periods, with an estimated 95% of wind period generating wind speeds of above 1.5 m/s. The wind rose are shown in Figure 1 below.

Figure 1 Met Data



Note: bars show direct wind is coming from.
Source: Wisconsin Department of Natural Resources, years 2016-2020 for Kenosha

3.0 Environmental Consequences

The consequences associated with battery malfunctions are discussed below based on the methodology presented above.

3.1 Exposure Assessment

Project emissions to the air would consist of off gassed and combustion products due to a battery cell malfunction under the reasonable worst-case scenario. Inhalation is the main pathway by which toxic air pollutants could potentially cause public health impacts.

Flammable material impacts could be produced by vapor cloud deflagrations or explosions for the reasonable worst-case scenario, or from thermal exposure to fires.

3.2 Significance Criteria

For toxic impacts, limiting IDLH to areas onsite or away from high density areas offsite would produce less than significant hazards, as indicated in NFPA 855 B.3.2. High density areas are defined as residential, commercial areas or schools. For toxic impacts, impacts offsite into high density populated areas may require additional analysis in order to determine significance utilizing a quantitative risk assessment (QRA).

Flammable impacts are less than significant if vapor cloud fires, explosions or thermal impacts do not impact high density areas.

3.3 Toxic Impacts

Potential human health impacts associated with the Project stem from exposure to air emissions from the battery cell malfunction reasonable worst-case scenario discussed above. The reasonable worst-case scenario would involve the battery malfunctions associated with off-gassing or combustion. The battery manufacturer provided information on primary and toxic pollutants from the battery malfunction, and that information was utilized for the analysis.

Toxic levels for CO and hydrocarbons utilize the UL9540A cell levels testing offgassing. The HF, HCN and HCL utilize the maximum levels identified in either UL testing or other studies (HF 10,000ppm, HCN 1600ppm, HCL 3000ppm, see Section 2.2).

Detailed calculations are provided in Attachment A.

Because the emissions would occur over a short period of time, only the public health impacts associated with acute exposure to short term releases were analyzed for the reasonable worst-case battery cell malfunction. No longer-term chronic or carcinogenic impacts are produced as no emissions are associated with normal, long-term operations.

Modeling conducted utilizing the Canary© software indicated that the plume centerline rises due to the elevated temperature of the off-gassed materials. However, as the exact elevations of the plume could vary with varying meteorological conditions and the influence of structures causing downwash, the plume centerline concentrations were used to determine impacts.

The acute impact distances for the reasonable worst-case battery cell malfunction scenarios are provided in Table 5, and detailed calculations can be found in Attachment A. Public health impacts from toxic pollutants associated with the reasonable worst-case battery cell malfunction would not impact populated areas and would be less than significant.

Table 5 Modeling Toxic Materials Results

Pollutant	IDLH Downwind Distance, feet
Benzene	1
Carbon monoxide (CO)	49
Hydrogen Fluoride (HF)*	135
Hydrogen Cyanide (HCN)	24
Hydrogen Chloride (HCL)	64
Toluene	*Concentrations are below levels of concern*
Xylene	*Concentrations are below levels of concern*

Notes: based on Canary© modeling, assuming EPA worst-case meteorology of F stability and 3.3 mph (1.5 m/s) wind speeds.
* Even though HF was not identified during UL testing for the LG battery, it has occurred in some other testing for these battery types.

3.4 Combustion Smoke Impacts

Combustion products can include a number of components that can be toxic: particles, vapors, toxic gases. Fire can also reduce oxygen levels, either by consuming the oxygen, or by displacing it with other gases.

The UL9540A testing did not identify fires as a result of the thermal runaway scenario in any of the tests. However, fire could occur and have occurred in other manufacturers testing. Therefore, these other manufactures tests are used in this analysis to indicate the range of potential impacts from smoke and fire thermal impacts.

The dispersion and downwind impacts of smoke are highly complex due to the influence of the flame and fire-induced turbulence as well as the effect of structures and meteorological parameters. Impacts during the combustion phase are estimated based on the smoke release rate for the from other manufacturers. Smoke generation during a fire is complex, as a wide range of materials in the unit would be consumed by the fire, including electronic components and plastics. During the a unit fire, there could be a wide range of fire conditions, flame lengths, wind effects producing a wide range of ground level exposures near the unit. Use of previous testing were utilized in this analysis to ensure a worst-case analysis is provided. Smoke generation from other manufacturers testing are estimated to be worst case for a complete unit fire for the LFP batteries.

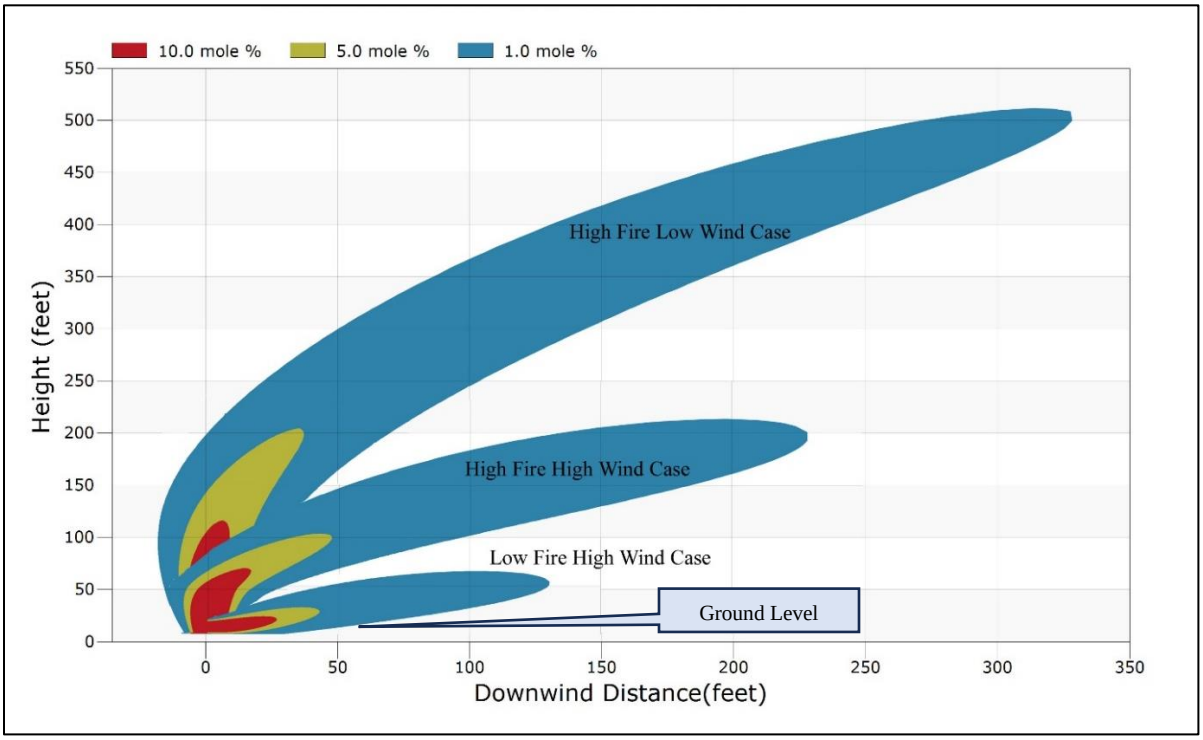
In order to address a range of potential smoke impacts, both a high fire case and a lower fire case were modeled. The high fire case assumed a high level of smoke flow based on the testing. The lower fire case was assumed to be 10% of the high fire case in terms of smoke flow. Both a high wind (10 mph) and a low wind case were modeled, with the low wind speed at 3.3 mph. The higher wind generally produced higher ground level impacts, but with additional dispersion and air mixing, reduces the downwind distances to impacts.

During the combustion phase, substantial temperature and buoyancy effect are produced by the open flame. Based on studies that involve the testing of a range of materials (Heskested 1994), in

combination with smoke release rates and smoke generation rates, the flow of combustion products was estimated and then used in the CANARY© model to estimate the downwind impacts due to dispersion. Fire temperatures were assumed to be 1650 °F as per temperatures measured during testing.

Smoke levels above 1 - 10% in the air would displace oxygen and could produce impacts, as well as increased toxicity of the smoke could cause impacts. Levels below 1% are assumed to not produce impacts over the short term. CANARY© modeling estimated that the smoke concentrations would be as high as 1% concentrations as far as 328 feet from the fire, although this plume would be substantially elevated (up to 500 feet). Peak near-ground-level impacts could be realized as far as 60 feet from the units as per CANARY© modeling results. Figure 2 shows the horizontal profile of the combustion products plume for both the high fire case and lower fire case along with the range of wind speeds. The ground-level distance for smoke impacts would not extend outside of the Project site boundaries and would not impact any off-site receptors. Therefore, impacts would be less than significant.

Figure 2 Combustion Products Downwind Impacts



Notes: Analysis using the Canary© model windy (10 mph) meteorological conditions.
Nearest residential receptor is located 330 feet away from the closest battery unit. Impacts would not reach the closest residential receptor.

3.5 Flammable Vapor and Deflagration Impacts

The off-gassed materials could generate a flammable vapor cloud and may produce a flammable gas mixture (see above) that could result in deflagration impacts (flammable vapor and flame

effects or overpressure). The CANARY© computer model was utilized to estimate the distance that the flammable vapor cloud could reach (see Attachment A for the CANARY© model outputs and assumptions). The lower flammability limit (LFL) and the ½ LFL were used as an estimate of the potential impacts from deflagration and flammable vapors. Distances for the LFL and the ½ LFL were estimated to be extending to 16-27 feet. This distance would not extend outside of the Project site boundaries and would not impact any offsite receptors. Therefore, impacts would be less than significant.

Deflagration can also produce overpressure impacts. Explosion distances to a 1 psi overpressure assumed a high level of material reactivity (due to the presence of hydrogen) and a high obstacle density (due to the location of multiple cabinets together), thereby increasing the potential for an explosion, under a conservative scenario. The 1 psi overpressure levels are those at which building glass would shatter or light injuries occur due to fragments (NFPA 2014). Vapor cloud explosion impacts were estimated to extend to 41 feet for a 1 psi overpressure. This distance would not extend outside of the Project site boundaries and would not impact any offsite receptors. Therefore, impacts would be less than significant.

Note that no flying debris, fires or explosive discharge of gases occurred during the UL9540A tests, indicating the remote possibility of these occurring.

3.6 Thermal Impacts

Impacts from a fire could produce thermal radiation which could affect areas near the fire and areas offsite. During the UL9540A testing for the LG batteries, no fire occurred, but some limited thermal radiation effects were measured, effectively with levels exceeding 5 kW/m2 only within the immediate unit area. Other manufacturers' testing has produced fires and more elevated thermal radiation impacts. Therefore, these other proprietary studies are used to estimate the potential impacts if a fire were to occur at the LG units.

In order to estimate the thermal radiation at different distances from the cabinets during a fire scenario, a point source model for thermal radiation was utilized (CCPS 2003) along with the results of the "destructive" testing discussed above. The point source model uses the following equation:

$$q = \frac{x\,Q}{4\,\pi\,R^2}$$

Where

q = heat flux in kW/m^2

Q = heat release rate, kW

R = distance from the flame center, meters

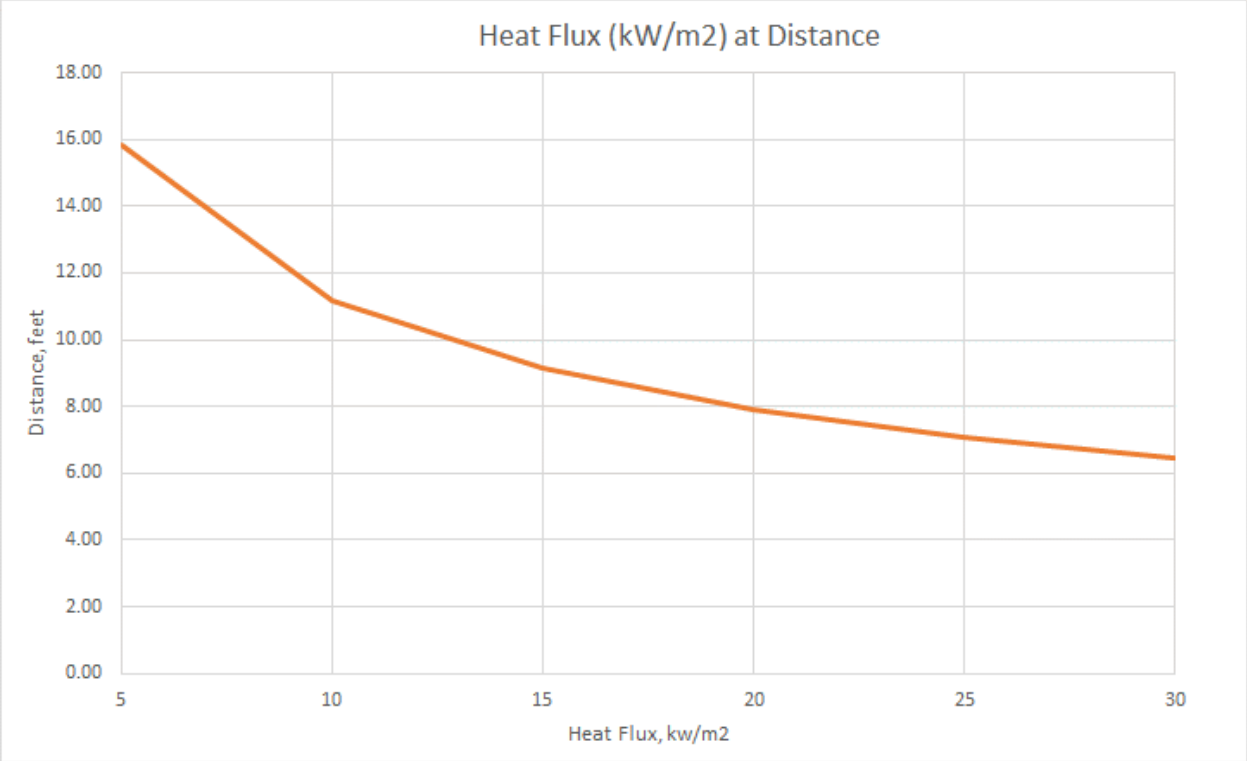
x = radiative fraction, energy fraction released as thermal radiation, with the fraction of energy released as radiation between 0.10 and 0.40 with a value of 0.35 conservatively assumed (as per SFPE 1999 and FMGlobal 2019).

Using the above point source approach, Figure 3 was produced showing the thermal flux at different distances from a unit fire. Note this is a conservative assumption as no impacts due to the atmosphere or smoke effects are assumed and a high fraction of heat to radiation is also assumed.

In general, when estimating the potential impacts of thermal radiation, both the level of heat flux and the duration are used to estimate the thermal dose or amount of heat transferred or the "thermal load". Probit equations demonstrate this effect, as higher heat flux impacts to humans and materials can be tolerated at shorter durations (Lees 2014). Table 6 below shows different heat flux levels and associated impacts on humans and materials.

Note that heat flux impacts to humans can generally be tolerated below 5 kW/m2 and below 10 kW/m2 if sufficient time to escape is feasible. Heat flux levels that can produce spontaneous ignition in building materials generally do not occur below 12.5 – 20 kW/m2.

Figure 3 Modeling and Estimated Heat Flux at Distance



Notes: using the point source model and other manufacturers test results and modeling for peak heat flux .

Table 6 Potential Thermal Impacts from Heat Flux Exposure and Duration

Incident Flux, kW/m^2	Duration	Test Distance, feet	Impact
Impacts on Humans			
4.7	Multiple minutes	16.3	Emergency actions lasting several minutes can be performed without shielding
6.3	Several minutes	14.1	Emergency actions lasting several minutes can be performed without shielding
10.0	20 seconds	11.2	Time to threshold of pain for bare skin Threshold for thermal Class IV
12.5	1 minute 10 seconds	10.0	1% fatalities First degree burns
15.8	1 minute 10 seconds	8.9	100% fatalities Significant injury from burns
25.0	10 seconds	7.1	1% fatality
Impacts on Materials			
12.5	Long exposure	10.0	Threshold for ignition of combustible materials (plastics and wood).
12.5 - 25	Long exposure	10.0 – 7.1	Wood ignites
20	< 30 seconds	7.9	Paper spontaneously ignites
20	250 seconds	7.9	Wood particle board ignites
27	Long exposure	6.8	Threshold for damage to non-combustible materials
35.0	1 minute	6.0	Cellulosic material will spontaneously ignite
35.0	< 30 seconds	6.0	Cloth spontaneously ignites
37.5	13 minutes	5.8	7mm steel plate failure
40.0	< 30 seconds	5.6	Wood spontaneously ignites

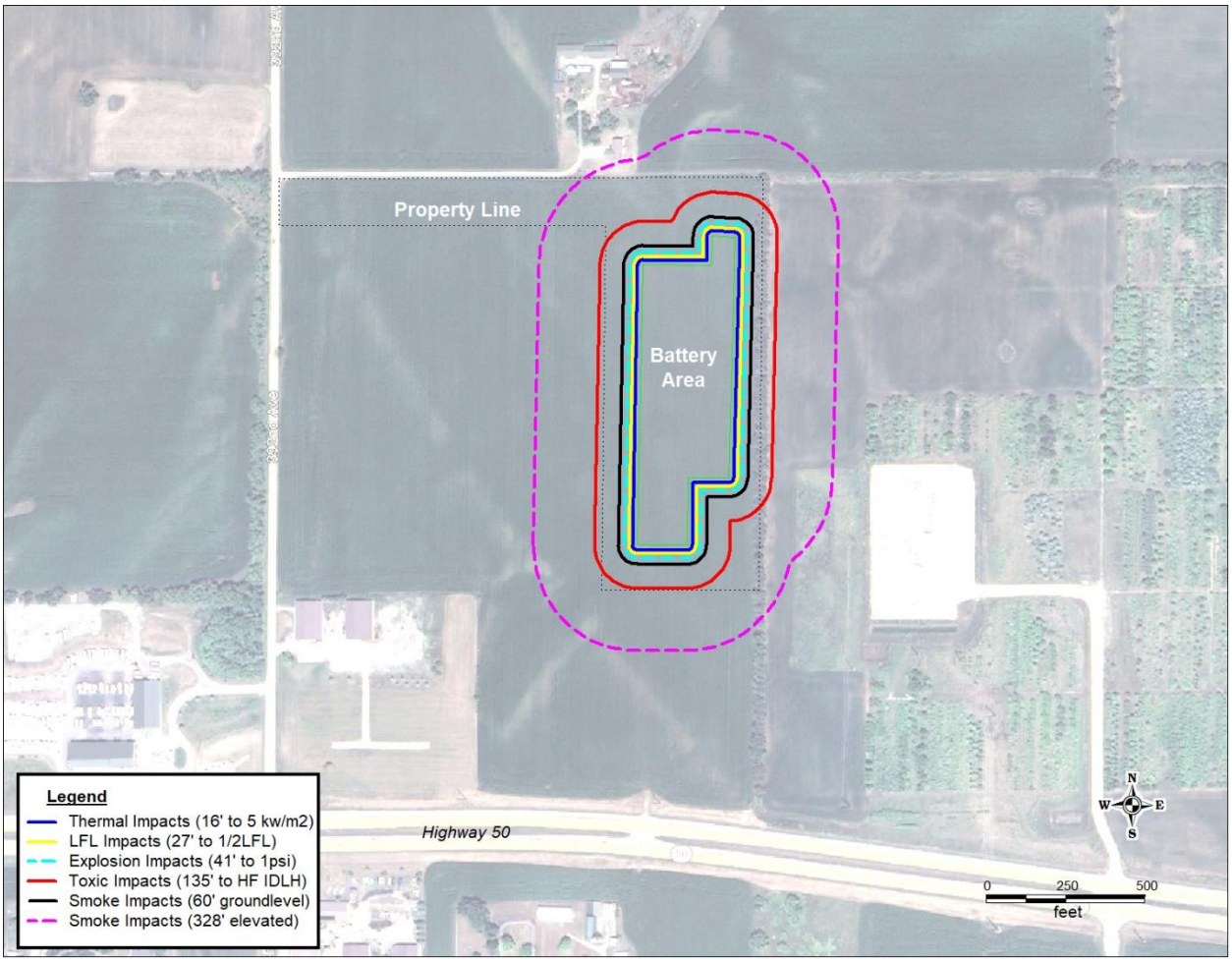
Notes: from CCPS 2003, NRC 2004, NIOSH 2017, SFPE 1999 and 2020, FMGlobal 2019

Heat flux levels would not extend outside of the Project site boundaries if a thermal scenario were to occur at one of the units located at the closest area to the site boundary (based on the 5 kW/m2 exposure). In addition, as per UL9540A testing, a battery fire would developed relatively slowly, which, along with the detection systems proposed for the site, would allow for ample time to notify the fire department and evacuate persons from the areas near the unit installations. The slow scenario development time would allow for response activities to occur before peak impacts are realized.

Figure 4 below shows the impact distances associated with the different scenarios. The impact zones in Figure 4 show the area that could be potentially affected by a scenario at any battery unit closest to the area perimeter. An individual incident would produce a zone only around that

immediately affected battery unit and, for LFL, smoke or toxic impacts, would be in the wind direction downwind and be elliptical in shape and affect a much smaller area than that depicted in Figure 4.

Figure 4 Impact Distances



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Attachment A Calculations

LG JF2 Battery System

Toxic Emission Calcs LFP, Based on cell Report UL pg 13 table 8 & 9

Pollutant	Vol %	Volume (Liter)	MW (g/mol)	Single Cell Emissions (grams)	Single Cell Rate (g/s)	Single Cell Rate (lbs/hr)	Full Unit Rate (g/s)	Full Unit Rate (lbs/hr)
Primary Compounds								
H2	59.30	38.0	2.0	3.1	0.0019	0.0152	2.7164	21.5586
CO	10.00	6.4	28.0	8.0	0.0049	0.0392	7.0000	55.5556
CO2	22.40	14.3	44.0	28.2	0.0174	0.1380	24.6400	195.5556
CH4	3.68	2.4	16.0	1.7	0.0010	0.0082	1.4720	11.6825
C2H2, C2H4	2.69	1.7	28.1	2.2	0.0013	0.0106	1.8897	14.9978
C2H6	0.53	0.3	30.1	0.5	0.0003	0.0022	0.3988	3.1653
C3H6	0.26	0.2	42.1	0.3	0.0002	0.0015	0.2737	2.1718
C3H8	0.12	0.1	44.1	0.2	0.0001	0.0007	0.1323	1.0500
C4	0.40	0.3	58.1	0.7	0.0004	0.0033	0.5810	4.6111
C5	0.62	0.4	72.2	1.3	0.0008	0.0063	1.1191	8.8817
Total	100.00	64	16.2	46.0	0.0284	0.2252	40.2230	319.2300
Trace compounds	**ppm**	**MW**						
Benzene	900	78.1		2.0E-01	1.2E-04	9.8E-04	1.7E-01	1.4E+00
Toluene	100	92.1		2.6E-02	1.6E-05	1.3E-04	2.3E-02	1.8E-01
Xylene	100	106.2		3.0E-02	1.9E-05	1.5E-04	2.6E-02	2.1E-01
HCN	1600	27.0		1.2E-01	7.6E-05	6.0E-04	1.1E-01	8.5E-01
HCL	6000	36.5		6.2E-01	3.8E-04	3.0E-03	5.4E-01	4.3E+00
HF	10000	20.0		5.7E-01	3.5E-04	2.8E-03	5.0E-01	3.9E+00

Assumes: Atmospheric Normal Temperature and Pressure (298.15K and 100.3 kpa)

Vol % and total volume provided by manufacturer from Cell Level testing

Standard temperature and pressure (STP) is defined as 0°C (273.15 K) and 1 atm of pressure

Time of event (cell), minutes 27 venting started at 23 min and ended at 50 min

Number of cells in CONTAINER 10080

Time of CONTAINER event, minutes 192

based on Unit testing, Figure F1 from vent start (33min) to approx end (65min), times 6 UNITs in a Container based on full 5.1 UNIT

Toxics and compounds based on cell level testing, UL9540A

HF based on other LFP studies (Larson 2017)

Benzene, toluene and xylene based on cell level testing

Volume based on cell level testing report, L

Temperature based on Module 1 max temp of 27C (Unit test report table 5)

Volume flowrate, m3/s 0.056

Area of vents are based on 2 square vents above each module stack of 1 ft2 ea

Battery Malfunction Flammability Analysis: LG JF2 LFP Cell

CGA P-23 Method

Component	Mole %	MW	Wt %	LEL	NFN2: Non-Flamm in Nitrogen*	Mole% x NFN2	Mole Frac/LFL
H2	59.3	2	7.30	4.0	5.7	10.40	14.83
N2	0	28	0.00	-			0.00
CO2	22.4	44	60.68	-			0.00
CO	10	28	17.24	12.5	20	0.50	0.80
Ch4	3.68	16	3.63	5	14.3	0.26	0.74
C2	3.22	30	5.95	3	12	0.27	1.07
C3	0.38	44	1.03	2.1	6.5	0.06	0.18
C4	0.4	58	1.43	1.8	5.6	0.07	0.22
C5+	0.62	72	2.75	1.4	4.4	0.14	0.44
Total	100	16.2	100		Q factor =	11.70	
Frac flamm	77.60		39.32		LFL =		5.47

* From CGA P-23 Table 1

LFL estimated based on Le Chatelier's formula

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-Flamm
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.593000
Component  2        :    43 = CO        Carbon Monoxide             0.100000
Component  3        :     1 = CH4       Methane                     0.036800
Component  4        :     2 = C2H6      Ethane                      0.032200
Component  5        :     3 = C3H8      Propane                     0.003800
Component  6        :     4 = C4H10     Isobutane                   0.004000
Component  7        :     6 = C5H12     Isopentane                  0.006200
Component  8        :    17 = CO2       Carbon Dioxide              0.224000
Component  9        :
Component 10        :

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

RELEASE MENU
Type of release: Regulated

Release duration	60 min
Regulated flow rate	0.09 lb/sec
Pipe inner diameter	22.63 inches
Equivalent release diameter	19.20 inches
Height of release point	9.5 feet
Angle of release from horizontal	90.0 degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor dispersion - Flammable endpoints

Concentration endpoint 1	LFL mol%
Concentration endpoint 2	1/2 LFL mol%
Concentration endpoint 3	1/2 LFL mol%
Dispersion coefficient averaging time	1.0 min

Baker-Strehlow-Tang parameters

Fuel reactivity	High
Obstacle density	High
Flame expansion	3-D

Overpressure endpoints

Overpressure endpoint 1	3.00 psi
Overpressure endpoint 2	1.00 psi
Overpressure endpoint 3	1.00 psi

NOTES:

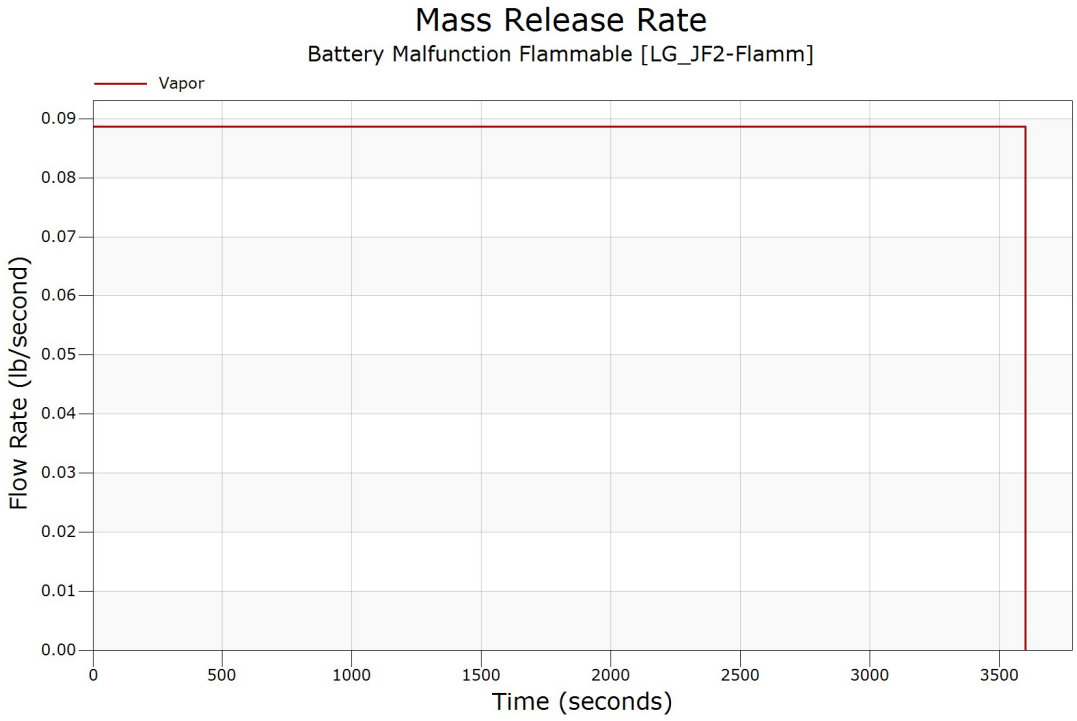
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Jet Fire [1st minute] = 0.8868000E-01 lb/sec.
Jet Fire [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction Flammable [LG_JF2-Flamm]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
3	Propane, C3H8
4	Isobutane, C4H10
6	Isopentane, C5H12
17	Carbon Dioxide, CO2

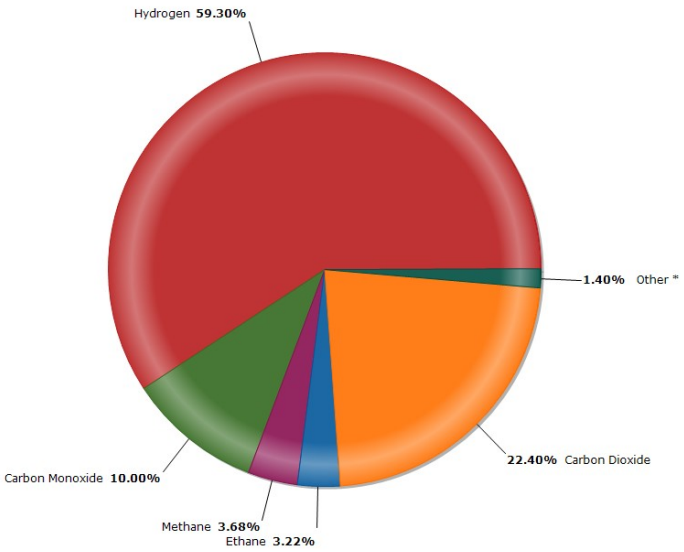
Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.593000	0.593000	0.000000	0.000000	0.593000	0.000000
43	0.100000	0.100000	0.000000	0.000000	0.100000	0.000000
1	0.036800	0.036800	0.000000	0.000000	0.036800	0.000000
2	0.032200	0.032200	0.000000	0.000000	0.032200	0.000000
3	0.003800	0.003800	0.000000	0.000000	0.003800	0.000000
4	0.004000	0.004000	0.000000	0.000000	0.004000	0.000000
6	0.006200	0.006200	0.000000	0.000000	0.006200	0.000000
17	0.224000	0.224000	0.000000	0.000000	0.224000	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Flammable Limits (Mole %) of Fluid Streams

Limit	Feed Stream	Momentum Jet Stream	Liquid Pool Stream
LFL	5.47	5.47	
UFL	49.83	49.83	
LBV		0.75 m/s	

Momentum Jet Stream
Battery Malfunction Flammable [LG_JF2-Flamm]



* Other, Propane 0.38%, Isobutane 0.40%, Isopentane 0.62%

Momentum Jet Dispersion

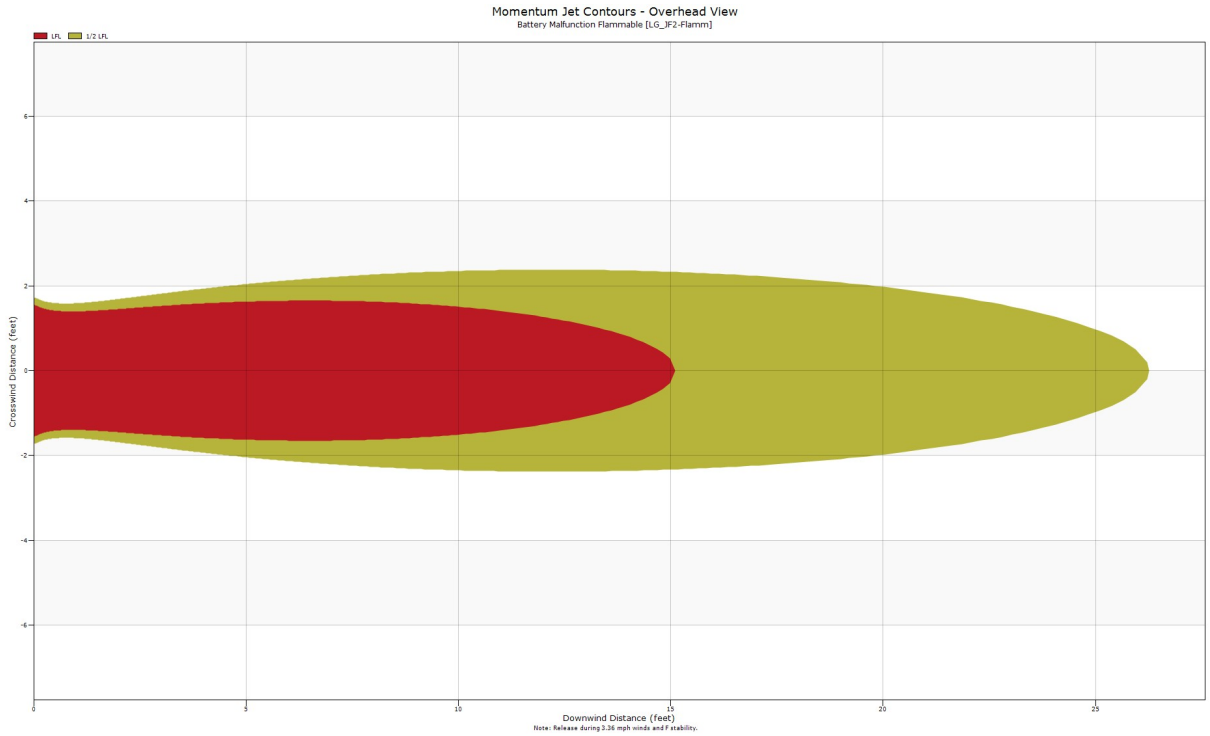
concentration limits

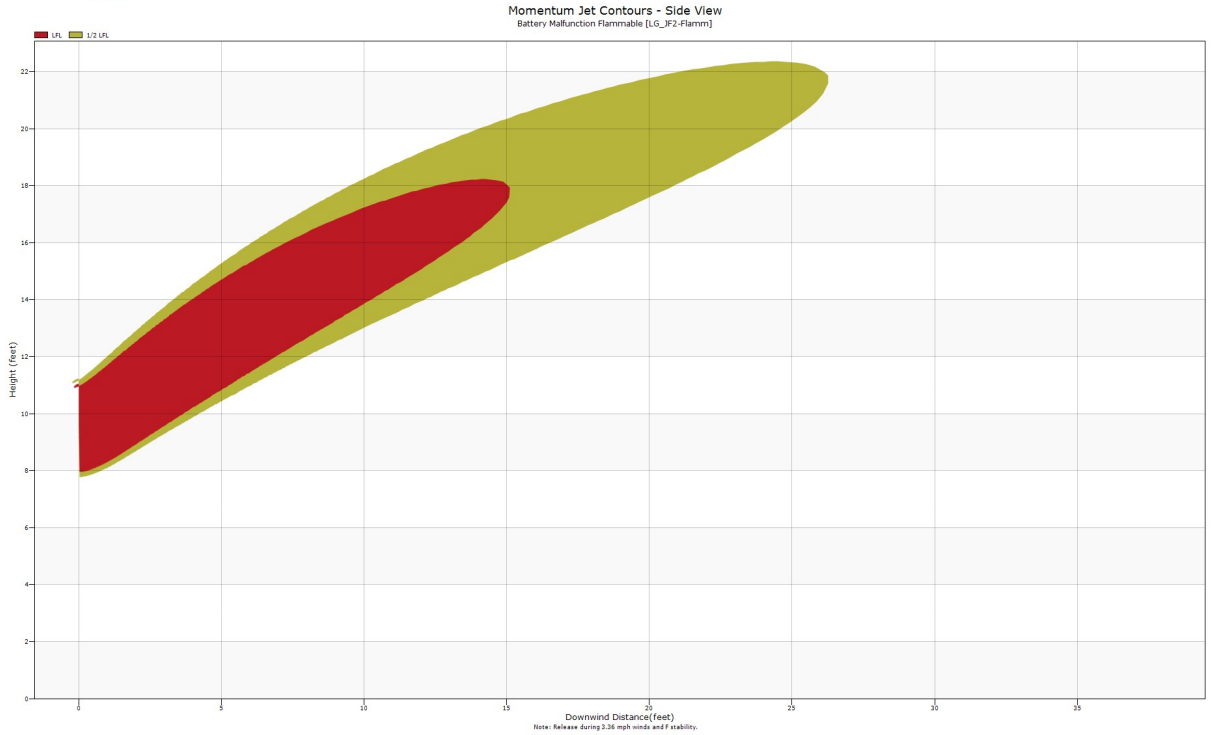
Endpoint 1 (highest) = 0.054704 mole fraction
Endpoint 2 (middle) = 0.027352 mole fraction
Endpoint 3 (lowest) = 0.027352 mole fraction

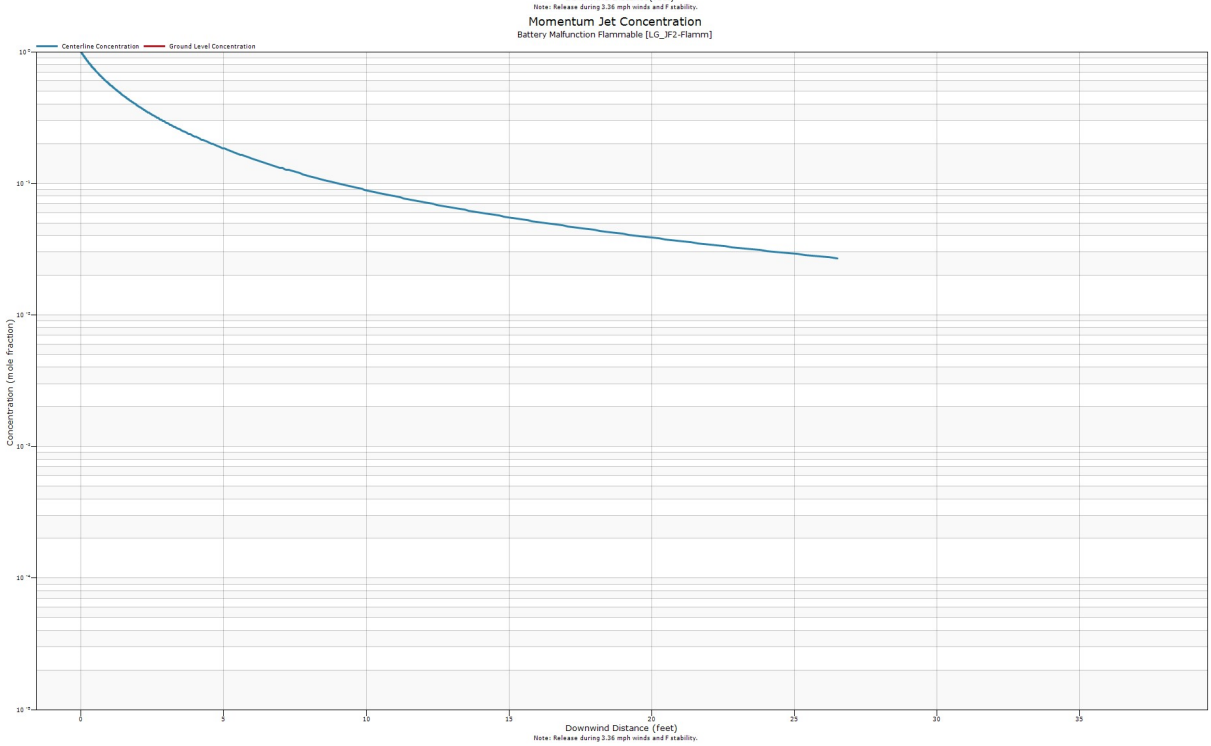
downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	1.000000	0.000000	1.7	1.7	1.5	9.5
0.5	0.723370	0.000000	1.6	1.6	1.4	9.6
1.0	0.566246	0.000000	1.6	1.6	1.4	9.9
1.5	0.462183	0.000000	1.6	1.6	1.4	10.3
2.0	0.387807	0.000000	1.7	1.7	1.5	10.7
2.5	0.332121	0.000000	1.8	1.8	1.5	11.0
3.0	0.288960	0.000000	1.8	1.8	1.5	11.4
3.5	0.254719	0.000000	1.9	1.9	1.6	11.7
4.0	0.226859	0.000000	1.9	1.9	1.6	12.1
4.5	0.203710	0.000000	2.0	2.0	1.6	12.4
5.0	0.184474	0.000000	2.0	2.0	1.6	12.8
5.5	0.168054	0.000000	2.1	2.1	1.6	13.1
6.0	0.154088	0.000000	2.1	2.1	1.6	13.4
6.5	0.142016	0.000000	2.2	2.2	1.7	13.7
7.0	0.131405	0.000000	2.2	2.2	1.6	14.0
7.5	0.122193	0.000000	2.2	2.2	1.6	14.3
8.0	0.113908	0.000000	2.3	2.3	1.6	14.6
8.5	0.106595	0.000000	2.3	2.3	1.6	14.8
9.0	0.100036	0.000000	2.3	2.3	1.6	15.1
9.5	0.094148	0.000000	2.3	2.3	1.5	15.4
10.0	0.088850	0.000000	2.4	2.4	1.5	15.6
10.5	0.084039	0.000000	2.4	2.4	1.5	15.9
11.0	0.079652	0.000000	2.4	2.4	1.4	16.1
11.5	0.075660	0.000000	2.4	2.4	1.3	16.3
12.0	0.071985	0.000000	2.4	2.4	1.3	16.6
12.5	0.068610	0.000000	2.4	2.4	1.2	16.8
13.0	0.065504	0.000000	2.4	2.4	1.1	17.0
13.5	0.062629	0.000000	2.4	2.4	1.0	17.2
14.0	0.059973	0.000000	2.4	2.4	0.8	17.5
14.5	0.057491	0.000000	2.3	2.3	0.6	17.7
15.0	0.055192	0.000000	2.3	2.3	0.2	17.9
15.5	0.053025	0.000000	2.3	2.3	0.0	18.1
16.0	0.051022	0.000000	2.3	2.3	0.0	18.3
16.5	0.049143	0.000000	2.3	2.3	0.0	18.5
17.0	0.047368	0.000000	2.2	2.2	0.0	18.7

downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
17.5	0.045705	0.000000	2.2	2.2	0.0	18.9
18.0	0.044146	0.000000	2.2	2.2	0.0	19.0
18.5	0.042665	0.000000	2.1	2.1	0.0	19.2
19.0	0.041272	0.000000	2.1	2.1	0.0	19.4
19.5	0.039955	0.000000	2.0	2.0	0.0	19.6
20.0	0.038703	0.000000	2.0	2.0	0.0	19.8
20.5	0.037520	0.000000	1.9	1.9	0.0	19.9
21.0	0.036398	0.000000	1.9	1.9	0.0	20.1
21.5	0.035337	0.000000	1.8	1.8	0.0	20.3
22.0	0.034322	0.000000	1.7	1.7	0.0	20.5
22.5	0.033354	0.000000	1.6	1.6	0.0	20.6
23.0	0.032435	0.000000	1.5	1.5	0.0	20.8
23.5	0.031561	0.000000	1.4	1.4	0.0	20.9
24.0	0.030714	0.000000	1.3	1.3	0.0	21.1
24.5	0.029914	0.000000	1.1	1.1	0.0	21.3
25.0	0.029149	0.000000	1.0	1.0	0.0	21.4
25.5	0.028413	0.000000	0.8	0.8	0.0	21.6
26.0	0.027709	0.000000	0.4	0.4	0.0	21.7

	Endpoint (mole frac., mixture)	Downwind Distance (feet)	Approximate Time (seconds)
1	0.054704 (LFL)	15.1	3
2	0.027352 (1/2 LFL)	26.3	6
3	0.027352 (1/2 LFL)	26.3	6




Momentum Jet Contours - Side View
Battery Malfunction Flammable [LG_JF2-Flamm]
LFL
1/2 LFL
Height (feet)
Downwind Distance(feet)
Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction Flammable [LG_JF2-Flamm]
Centerline Concentration
Ground Level Concentration
Concentration (mole fraction)
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

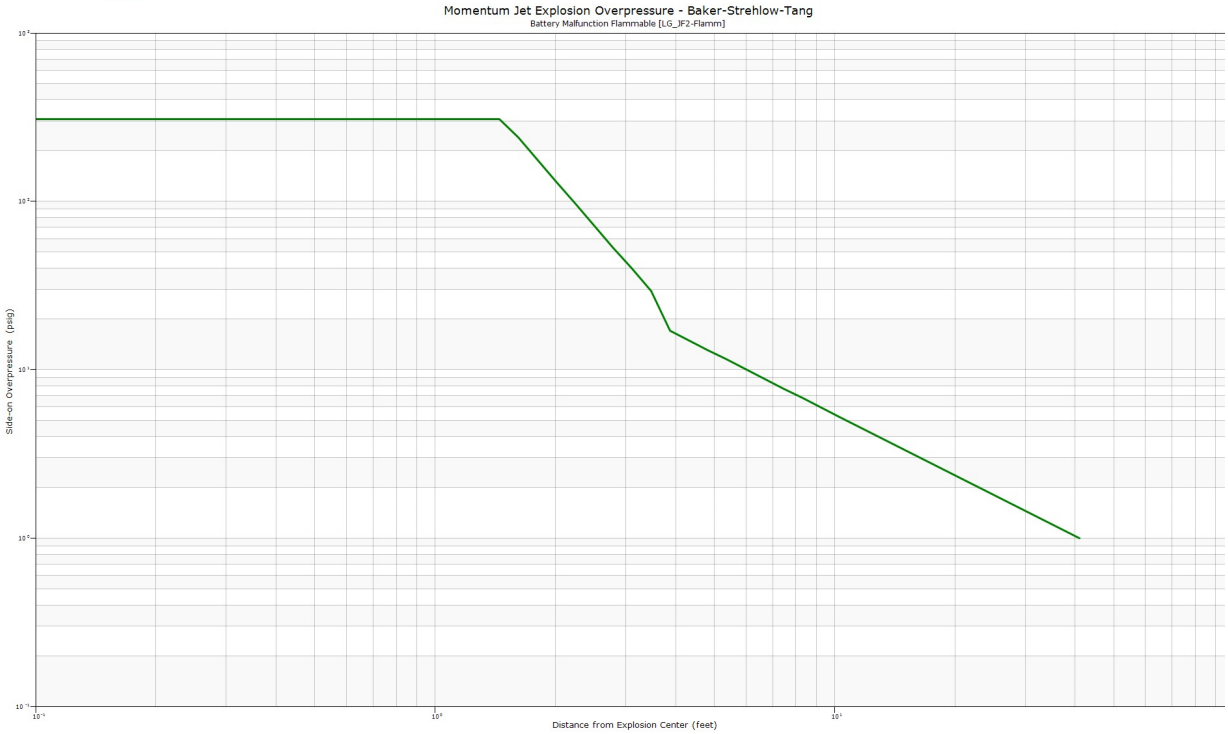
Momentum Jet Explosion

Fuel Reactivity: High Obstacle Density: High
Flame Expansion: 3-D Flame Speed: 5.20

Mass of released material involved in explosion: 0.296815 lbs.

Distance from Center of Flammable Cloud (feet)	Overpressure (psi gauge)	Impulse (psi-s)
0.0	308.61	0.0357
0.9	308.61	0.0357
1.0	308.61	0.0321
1.2	308.61	0.0289
1.3	308.61	0.0259
1.4	308.61	0.0233
1.6	239.10	0.0209
1.8	177.17	0.0188
2.0	131.27	0.0169
2.2	97.27	0.0152
2.5	72.07	0.0137
2.8	53.40	0.0123
3.1	39.57	0.0110
3.5	29.32	0.0099
3.9	17.01	0.0089
4.3	14.92	0.0080
4.8	13.09	0.0072
5.4	11.49	0.0065
6.0	10.08	0.0058
6.7	8.84	0.0052
7.4	7.76	0.0047
8.3	6.81	0.0042
9.3	5.97	0.0038
10.3	5.24	0.0034
41.0	1.00	0.0009

The downwind distance to 3.00 psi is 26.5 feet
The downwind distance to 1.00 psi is 41.0 feet
The downwind distance to 1.00 psi is 41.0 feet


Momentum Jet Explosion Overpressure - Baker-Strehlow-Tang
Battery Malfunction Flammable [LG_JF2-Flamm]
Side-on Overpressure (psig)
Distance from Explosion Center (feet)

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-toxicBenz
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.592263
Component  2        :    43 = CO        Carbon Monoxide             0.099876
Component  3        :     1 = CH4       Methane                     0.036754
Component  4        :     2 = C2H6      Ethane                      0.035955
Component  5        :    50 = HF        Hydrogen Fluoride           0.000145
Component  6        :     4 = C4H10     Isobutane                   0.010187
Component  7        :   284 = C8H10     ortho-Xylene                0.000100
Component  8        :   266 = C6H6      Benzene                     0.000899
Component  9        :   281 = C7H8      Toluene                     0.000100
Component 10        :    17 = CO2       Carbon Dioxide              0.223721

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

RELEASE MENU
Type of release: Regulated

Release duration	60	min
Regulated flow rate	0.09	lb/sec
Pipe inner diameter	22.63	inches
Equivalent release diameter	19.20	inches
Height of release point	9.5	feet
Angle of release from horizontal	90.0	degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor generation and dispersion - Toxic endpoints
Tracking component 266 = C6H6 Benzene

Concentration endpoint 1	1000.0	ppm
Concentration endpoint 2	500.0	ppm
Concentration endpoint 3	150.0	ppm
Dispersion coefficient averaging time	30	min

NOTES:

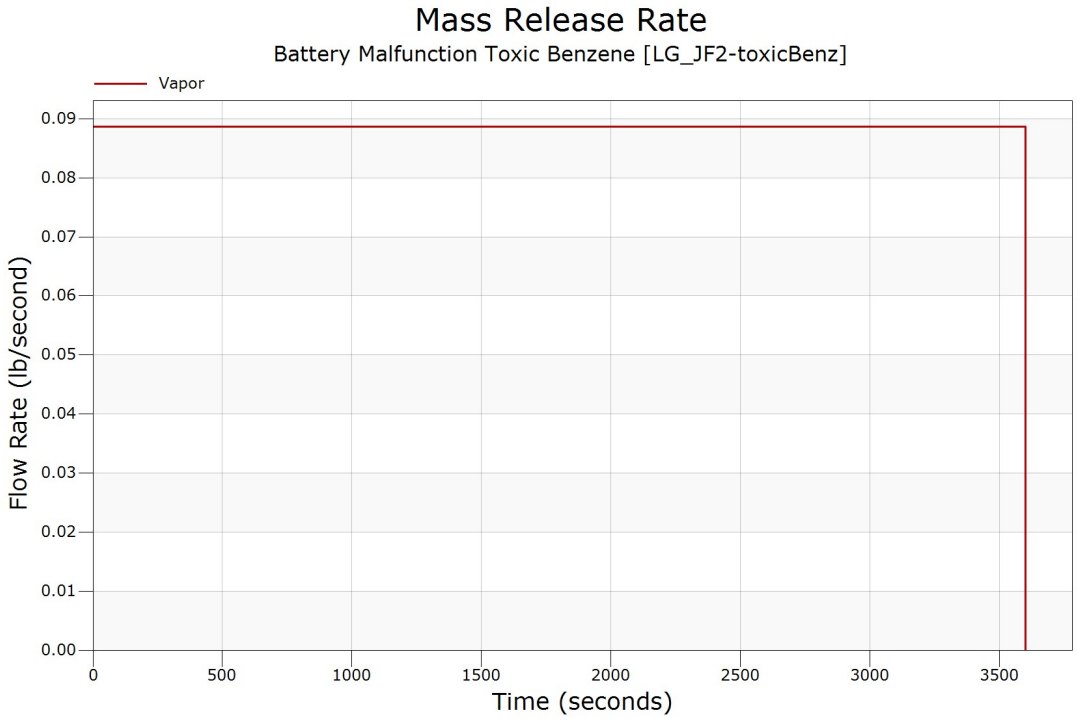
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Immediate Jet [1st minute] = 0.8868000E-01 lb/sec.
Delayed Jet [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time

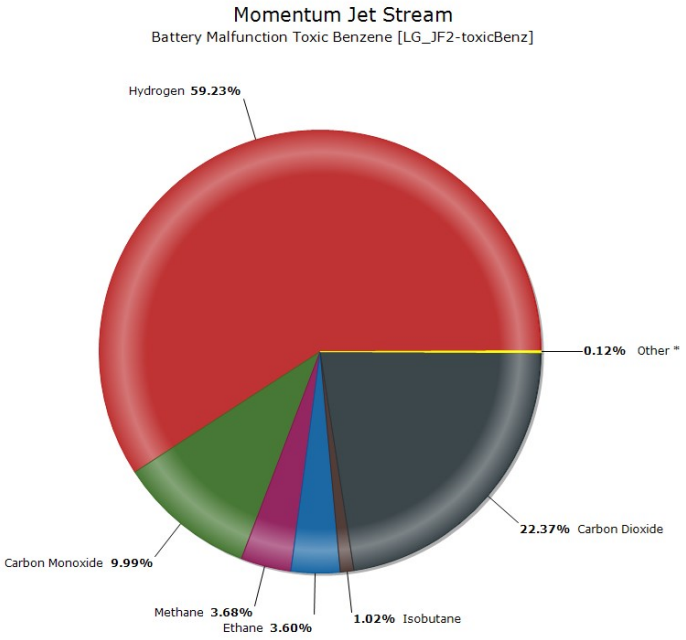

Mass Release Rate
Battery Malfunction Toxic Benzene [LG_JF2-toxicBenz]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
50	Hydrogen Fluoride, HF
4	Isobutane, C4H10
284	ortho-Xylene, C8H10
266	Benzene, C6H6
281	Toluene, C7H8
17	Carbon Dioxide, CO2

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.592263	0.592263	0.000000	0.000000	0.592263	0.000000
43	0.099876	0.099876	0.000000	0.000000	0.099876	0.000000
1	0.036754	0.036754	0.000000	0.000000	0.036754	0.000000
2	0.035955	0.035955	0.000000	0.000000	0.035955	0.000000
50	0.000145	0.000145	0.000000	0.000000	0.000145	0.000000
4	0.010187	0.010187	0.000000	0.000000	0.010187	0.000000
284	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
266	0.000899	0.000899	0.000000	0.000000	0.000899	0.000000
281	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
17	0.223721	0.223721	0.000000	0.000000	0.223721	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000



* Other, Hydrogen Fluoride 0.01%, ortho-Xylene 0.01%, Benzene 0.09%, Toluene 0.01%

Momentum Jet Dispersion

concentration limits

Endpoint 1 (highest) = 1000.0 ppm
Endpoint 2 (middle) = 500.0 ppm
Endpoint 3 (lowest) = 150.0 ppm

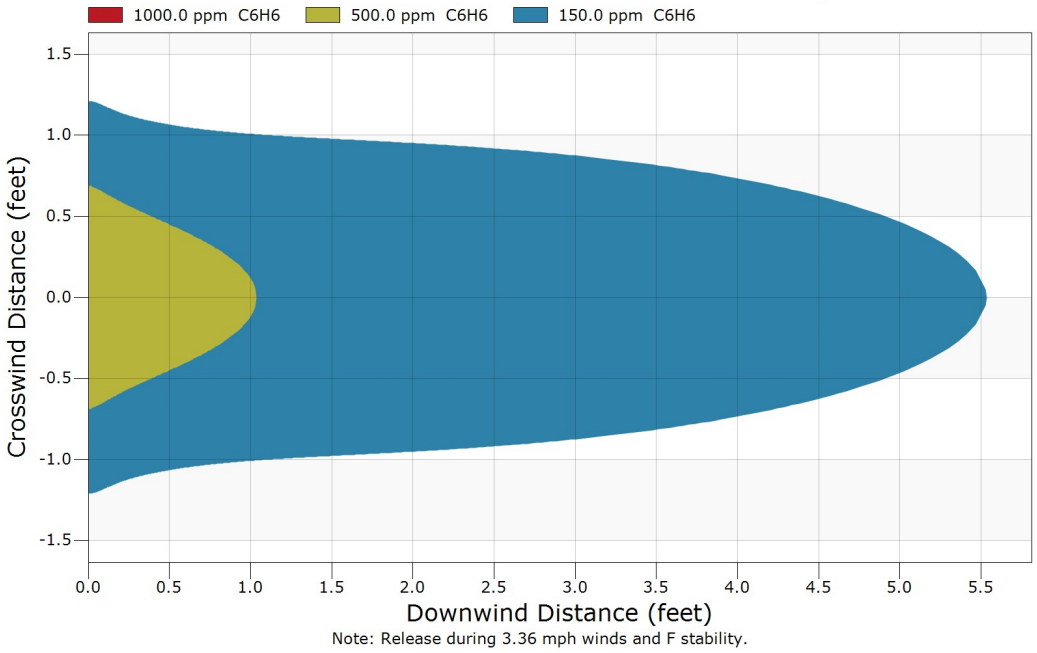
downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	898.880	0.000	1.2	0.7	0.0	9.5
0.1	835.464	0.000	1.2	0.6	0.0	9.5
0.2	778.487	0.000	1.1	0.6	0.0	9.5
0.3	729.354	0.000	1.1	0.5	0.0	9.6
0.4	687.000	0.000	1.1	0.5	0.0	9.6
0.5	649.612	0.000	1.1	0.5	0.0	9.6
0.6	615.950	0.000	1.1	0.4	0.0	9.7
0.7	585.539	0.000	1.0	0.4	0.0	9.8
0.8	557.456	0.000	1.0	0.3	0.0	9.8
0.9	531.995	0.000	1.0	0.2	0.0	9.9
1.0	508.586	0.000	1.0	0.1	0.0	9.9
1.1	486.878	0.000	1.0	0.0	0.0	10.0
1.2	466.961	0.000	1.0	0.0	0.0	10.1
1.3	448.320	0.000	1.0	0.0	0.0	10.2
1.4	431.036	0.000	1.0	0.0	0.0	10.2
1.5	414.879	0.000	1.0	0.0	0.0	10.3
1.6	399.816	0.000	1.0	0.0	0.0	10.4
1.7	385.660	0.000	1.0	0.0	0.0	10.4
1.8	372.375	0.000	1.0	0.0	0.0	10.5
1.9	359.904	0.000	1.0	0.0	0.0	10.6
2.0	348.164	0.000	1.0	0.0	0.0	10.7
2.1	336.943	0.000	0.9	0.0	0.0	10.7
2.2	326.470	0.000	0.9	0.0	0.0	10.8
2.3	316.577	0.000	0.9	0.0	0.0	10.9
2.4	307.104	0.000	0.9	0.0	0.0	11.0
2.5	298.242	0.000	0.9	0.0	0.0	11.0
2.6	289.625	0.000	0.9	0.0	0.0	11.1
2.7	281.584	0.000	0.9	0.0	0.0	11.2
2.8	273.780	0.000	0.9	0.0	0.0	11.2
2.9	266.442	0.000	0.9	0.0	0.0	11.3
3.0	259.392	0.000	0.9	0.0	0.0	11.4
3.1	252.756	0.000	0.9	0.0	0.0	11.5
3.2	246.177	0.000	0.9	0.0	0.0	11.5
3.3	240.032	0.000	0.8	0.0	0.0	11.6
3.4	234.197	0.000	0.8	0.0	0.0	11.7

downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
3.5	228.594	0.000	0.8	0.0	0.0	11.7
3.6	223.151	0.000	0.8	0.0	0.0	11.8
3.7	217.862	0.000	0.8	0.0	0.0	11.9
3.8	212.943	0.000	0.8	0.0	0.0	12.0
3.9	208.143	0.000	0.8	0.0	0.0	12.0
4.0	203.642	0.000	0.7	0.0	0.0	12.1
4.1	199.105	0.000	0.7	0.0	0.0	12.2
4.2	194.778	0.000	0.7	0.0	0.0	12.2
4.3	190.682	0.000	0.7	0.0	0.0	12.3
4.4	186.696	0.000	0.7	0.0	0.0	12.4
4.5	182.882	0.000	0.6	0.0	0.0	12.4
4.6	179.227	0.000	0.6	0.0	0.0	12.5
4.7	175.688	0.000	0.6	0.0	0.0	12.6
4.8	172.162	0.000	0.5	0.0	0.0	12.6
4.9	168.861	0.000	0.5	0.0	0.0	12.7
5.0	165.619	0.000	0.5	0.0	0.0	12.8
5.1	162.467	0.000	0.4	0.0	0.0	12.8
5.2	159.437	0.000	0.4	0.0	0.0	12.9
5.3	156.528	0.000	0.3	0.0	0.0	13.0
5.4	153.627	0.000	0.2	0.0	0.0	13.0
5.5	150.899	0.000	0.1	0.0	0.0	13.1

	Endpoint (ppm, C6H6)	Downwind Distance (feet)	Approximate Time (seconds)
1	1000.0	0.0	0
2	500.0	1.0	0
3	150.0	5.5	1

Momentum Jet Contours - Overhead View

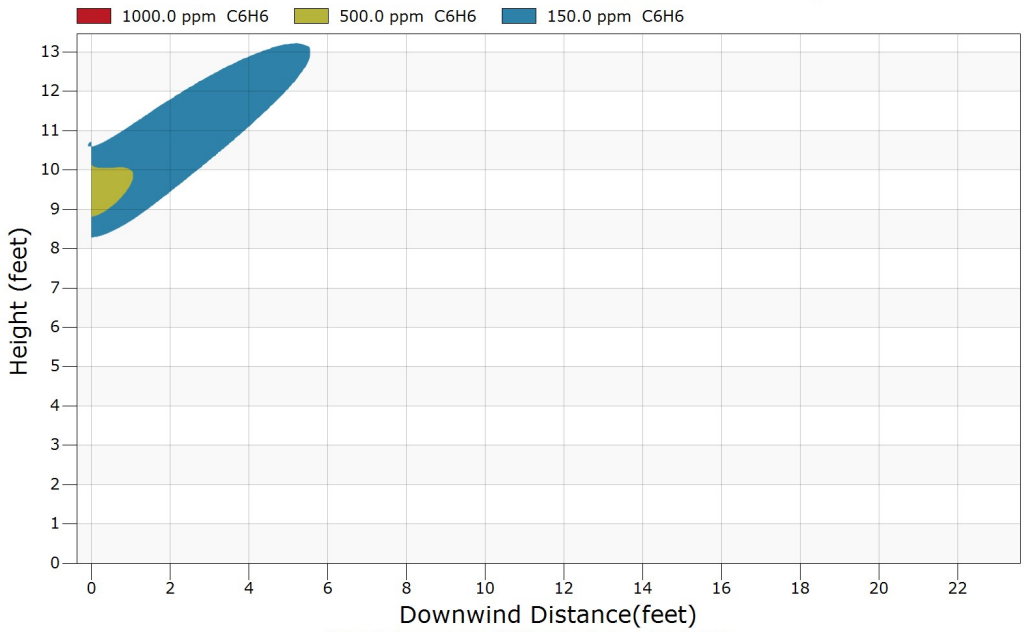
Battery Malfunction Toxic Benzene [LG_JF2-toxicBenz]



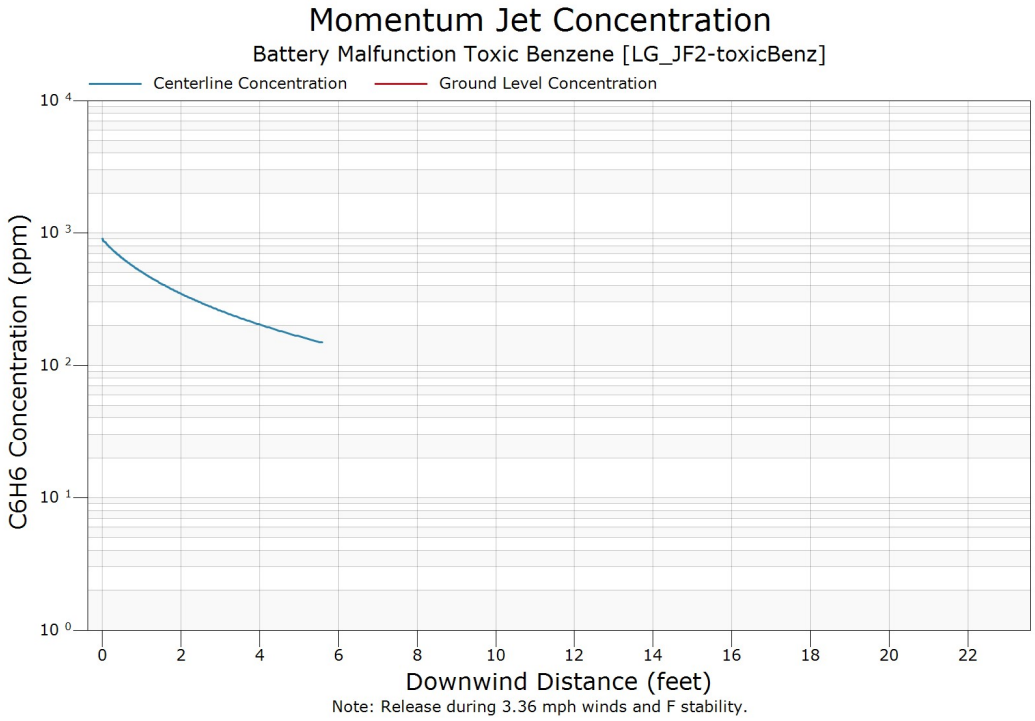
Note: Release during 3.36 mph winds and F stability.

Momentum Jet Contours - Side View

Battery Malfunction Toxic Benzene [LG_JF2-toxicBenz]



Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction Toxic Benzene [LG_JF2-toxicBenz]
Centerline Concentration
Ground Level Concentration
C6H6 Concentration (ppm)
10 4
10 3
10 2
10 1
10 0
0
2
4
6
8
10
12
14
16
18
20
22
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-toxicCO
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.592263
Component  2        :    43 = CO        Carbon Monoxide             0.099876
Component  3        :     1 = CH4       Methane                     0.036754
Component  4        :     2 = C2H6      Ethane                      0.035955
Component  5        :    50 = HF        Hydrogen Fluoride           0.000145
Component  6        :     4 = C4H10     Isobutane                   0.010187
Component  7        :   284 = C8H10     ortho-Xylene                0.000100
Component  8        :   266 = C6H6      Benzene                     0.000899
Component  9        :   281 = C7H8      Toluene                     0.000100
Component 10        :    17 = CO2       Carbon Dioxide              0.223721

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

```
RELEASE MENU
Type of release:   Regulated
Release duration                                    60 min
Regulated flow rate                               0.09 lb/sec
Pipe inner diameter                              22.63 inches
Equivalent release diameter                      19.20 inches
Height of release point                            9.5 feet
Angle of release from horizontal                  90.0 degrees

  NOTES:

IMPOUNDMENT MENU
Unconfined

  NOTES:

VDVE MENU
Vapor generation and dispersion - Toxic endpoints
Tracking component   43 = CO        Carbon Monoxide
  Concentration endpoint 1                      1200.0 ppm
  Concentration endpoint 2                       500.0 ppm
  Concentration endpoint 3                       350.0 ppm
Dispersion coefficient averaging time               30 min


  NOTES:
```

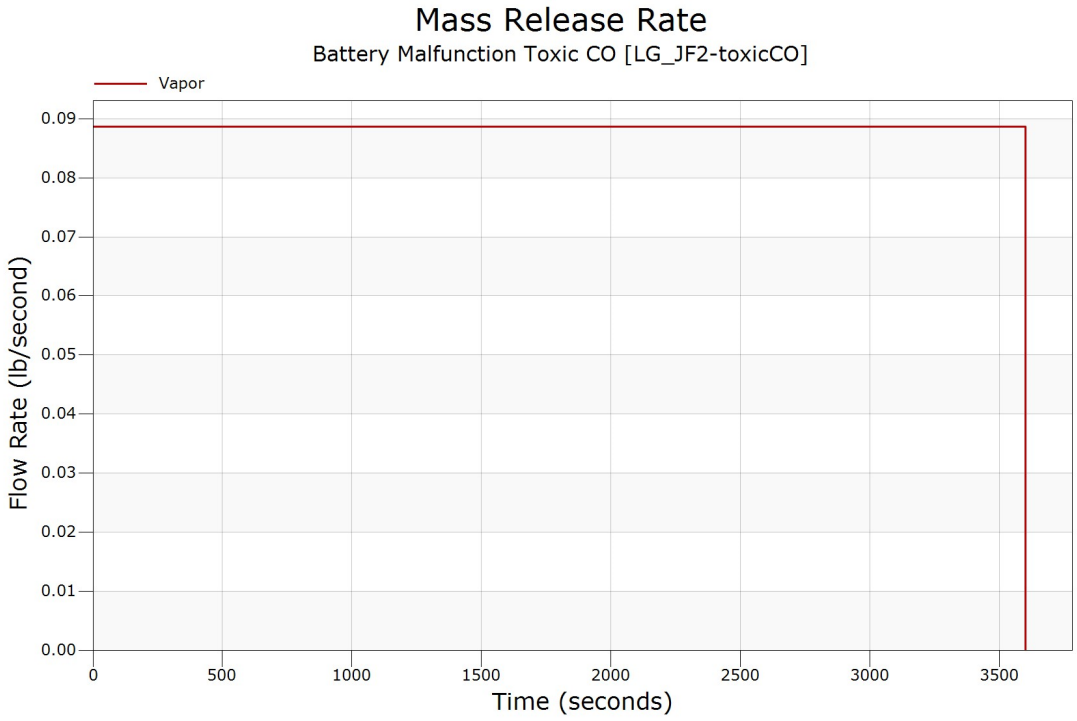
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Immediate Jet [1st minute] = 0.8868000E-01 lb/sec.
Delayed Jet [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction Toxic CO [LG_JF2-toxicCO]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

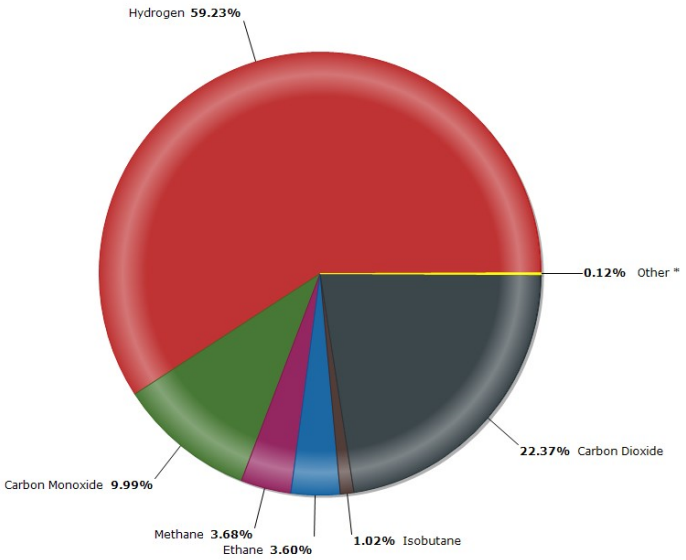
Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
50	Hydrogen Fluoride, HF
4	Isobutane, C4H10
284	ortho-Xylene, C8H10
266	Benzene, C6H6
281	Toluene, C7H8
17	Carbon Dioxide, CO2

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.592263	0.592263	0.000000	0.000000	0.592263	0.000000
43	0.099876	0.099876	0.000000	0.000000	0.099876	0.000000
1	0.036754	0.036754	0.000000	0.000000	0.036754	0.000000
2	0.035955	0.035955	0.000000	0.000000	0.035955	0.000000
50	0.000145	0.000145	0.000000	0.000000	0.000145	0.000000
4	0.010187	0.010187	0.000000	0.000000	0.010187	0.000000
284	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
266	0.000899	0.000899	0.000000	0.000000	0.000899	0.000000
281	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
17	0.223721	0.223721	0.000000	0.000000	0.223721	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Momentum Jet Stream
Battery Malfunction Toxic CO [LG_JF2-toxicCO]



* Other, Hydrogen Fluoride 0.01%, ortho-Xylene 0.01%, Benzene 0.09%, Toluene 0.01%

Momentum Jet Dispersion

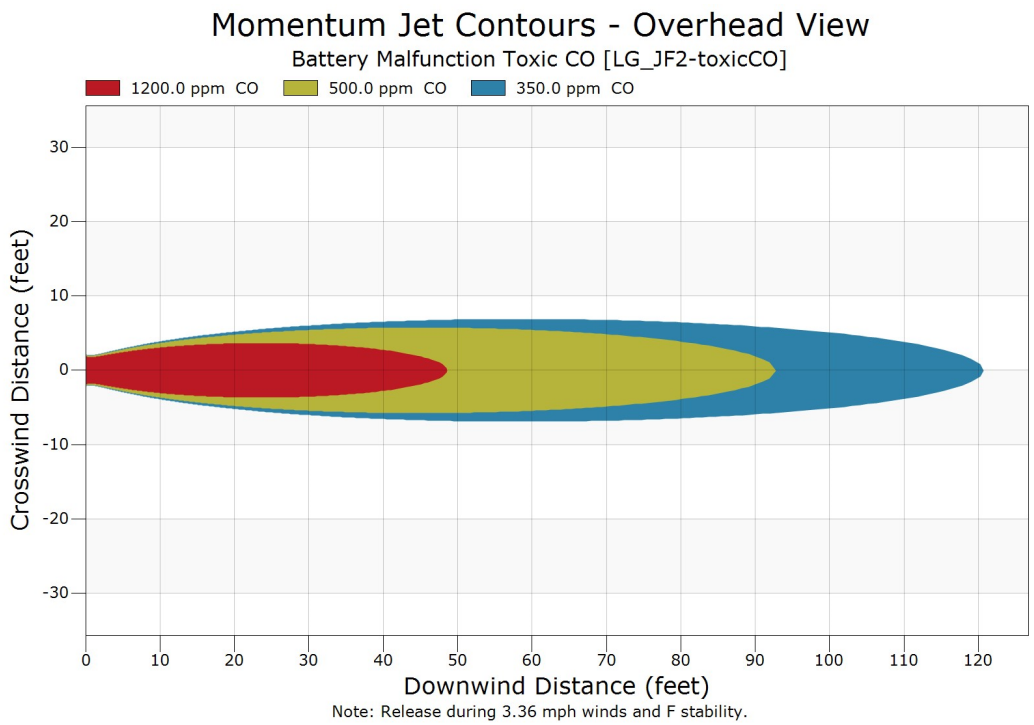
concentration limits

Endpoint 1 (highest) = 1200.0 ppm
Endpoint 2 (middle) = 500.0 ppm
Endpoint 3 (lowest) = 350.0 ppm

downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	99875.600	0.000	2.2	2.1	1.9	9.5
2	33130.694	0.000	2.4	2.3	2.0	11.0
5	18399.938	0.000	2.9	2.8	2.4	12.8
7	12174.171	0.000	3.5	3.3	2.8	14.3
10	8862.809	0.000	3.9	3.7	3.1	15.6
12	6845.196	0.000	4.3	4.0	3.3	16.8
15	5506.357	0.000	4.6	4.3	3.4	17.9
18	4560.673	0.000	4.9	4.6	3.6	18.9
20	3862.274	0.000	5.2	4.8	3.6	19.8
22	3329.102	0.000	5.4	5.0	3.7	20.6
25	2909.979	0.000	5.7	5.2	3.7	21.4
28	2572.552	0.000	5.9	5.3	3.6	22.2
30	2296.032	0.000	6.0	5.4	3.5	22.9
32	2065.784	0.000	6.2	5.5	3.4	23.6
35	1873.483	0.000	6.3	5.6	3.3	24.2
38	1709.151	0.000	6.5	5.7	3.0	24.8
40	1564.783	0.000	6.6	5.7	2.8	25.4
42	1442.270	0.000	6.6	5.7	2.4	26.0
45	1333.810	0.000	6.7	5.8	1.9	26.6
48	1239.804	0.000	6.8	5.8	1.1	27.1
50	1155.397	0.000	6.8	5.7	0.0	27.6
53	1079.940	0.000	6.9	5.7	0.0	28.1
55	1013.039	0.000	6.9	5.6	0.0	28.6
58	952.651	0.000	6.9	5.5	0.0	29.1
60	898.378	0.000	6.9	5.4	0.0	29.5
62	849.546	0.000	6.9	5.3	0.0	29.9
65	806.050	0.000	6.9	5.2	0.0	30.3
68	765.968	0.000	6.8	5.0	0.0	30.6
70	729.974	0.000	6.8	4.9	0.0	31.0
72	696.368	0.000	6.7	4.7	0.0	31.3
75	665.335	0.000	6.7	4.4	0.0	31.6
78	636.986	0.000	6.6	4.2	0.0	31.9
80	610.314	0.001	6.5	3.9	0.0	32.2
82	585.813	0.001	6.4	3.5	0.0	32.4
85	562.644	0.001	6.2	3.1	0.0	32.7

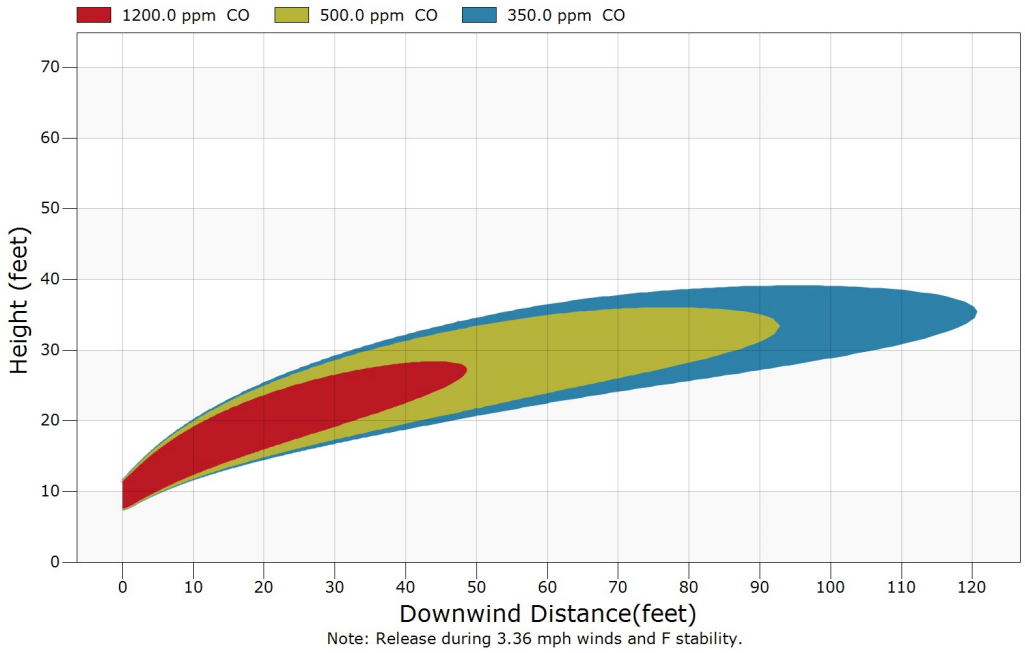
downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
88	541.260	0.002	6.1	2.6	0.0	32.9
90	521.232	0.002	5.9	1.9	0.0	33.2
92	502.290	0.003	5.7	0.4	0.0	33.4
95	484.589	0.003	5.6	0.0	0.0	33.6
98	467.901	0.004	5.3	0.0	0.0	33.8
100	452.217	0.005	5.1	0.0	0.0	34.0
102	437.311	0.006	4.8	0.0	0.0	34.2
105	423.418	0.008	4.5	0.0	0.0	34.4
108	409.915	0.010	4.2	0.0	0.0	34.6
110	397.287	0.012	3.8	0.0	0.0	34.7
112	385.309	0.014	3.4	0.0	0.0	34.9
115	373.935	0.017	2.8	0.0	0.0	35.1
118	362.984	0.021	2.1	0.0	0.0	35.2
120	352.649	0.024	0.9	0.0	0.0	35.4

	Endpoint (ppm, CO)	Downwind Distance (feet)	Approximate Time (seconds)
1	1200.0	48.6	10
2	500.0	92.8	19
3	350.0	120.7	25



Momentum Jet Contours - Side View

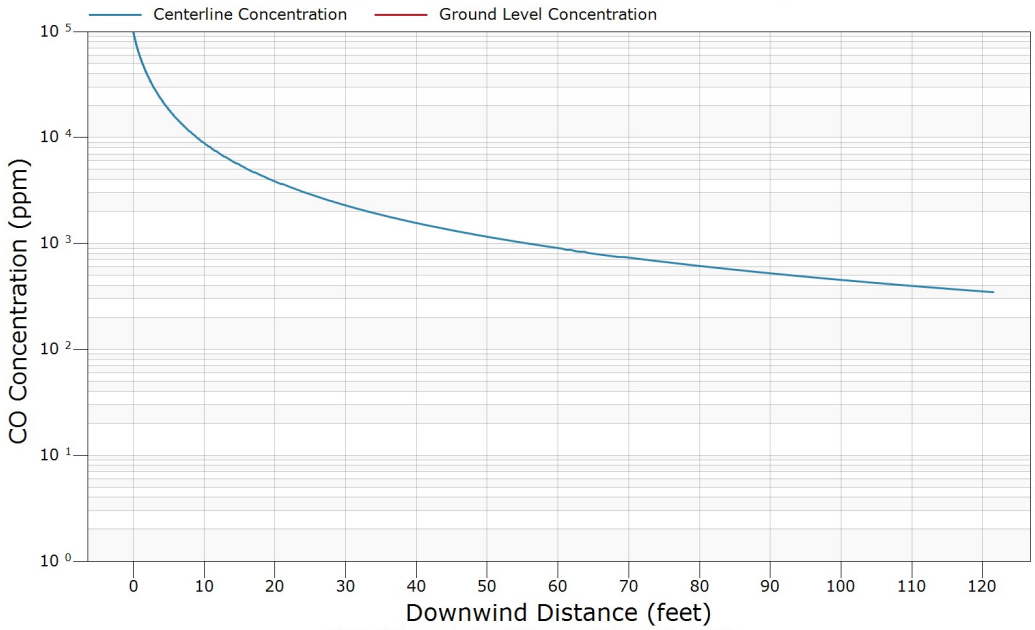
Battery Malfunction Toxic CO [LG_JF2-toxicCO]



Note: Release during 3.36 mph winds and F stability.

Momentum Jet Concentration

Battery Malfunction Toxic CO [LG_JF2-toxicCO]



Note: Release during 3.36 mph winds and F stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-toxicHF_High
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES: High HF emission case: HF 10,000 ppm

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.584500
Component  2        :    43 = CO        Carbon Monoxide             0.100000
Component  3        :     1 = CH4       Methane                     0.036800
Component  4        :     2 = C2H6      Ethane                      0.036000
Component  5        :    50 = HF        Hydrogen Fluoride           0.010000
Component  6        :     4 = C4H10     Isobutane                   0.004000
Component  7        :    26 = HCl       Hydrogen Chloride           0.003000
Component  8        :   103 = HCN       Hydrogen Cyanide            0.001600
Component  9        :   281 = C7H8      Toluene                     0.000100
Component 10        :    17 = CO2       Carbon Dioxide              0.224000

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES: Assumes HF is 50% of CO levels

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
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RELEASE MENU
Type of release: Regulated

Release duration	60 min
Regulated flow rate	0.09 lb/sec
Pipe inner diameter	22.63 inches
Equivalent release diameter	19.20 inches
Height of release point	9.5 feet
Angle of release from horizontal	90.0 degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor generation and dispersion - Toxic endpoints
Tracking component 50 = HF Hydrogen Fluoride

Concentration endpoint 1	50.0 ppm
Concentration endpoint 2	30.0 ppm
Concentration endpoint 3	20.0 ppm
Dispersion coefficient averaging time	30 min

NOTES:

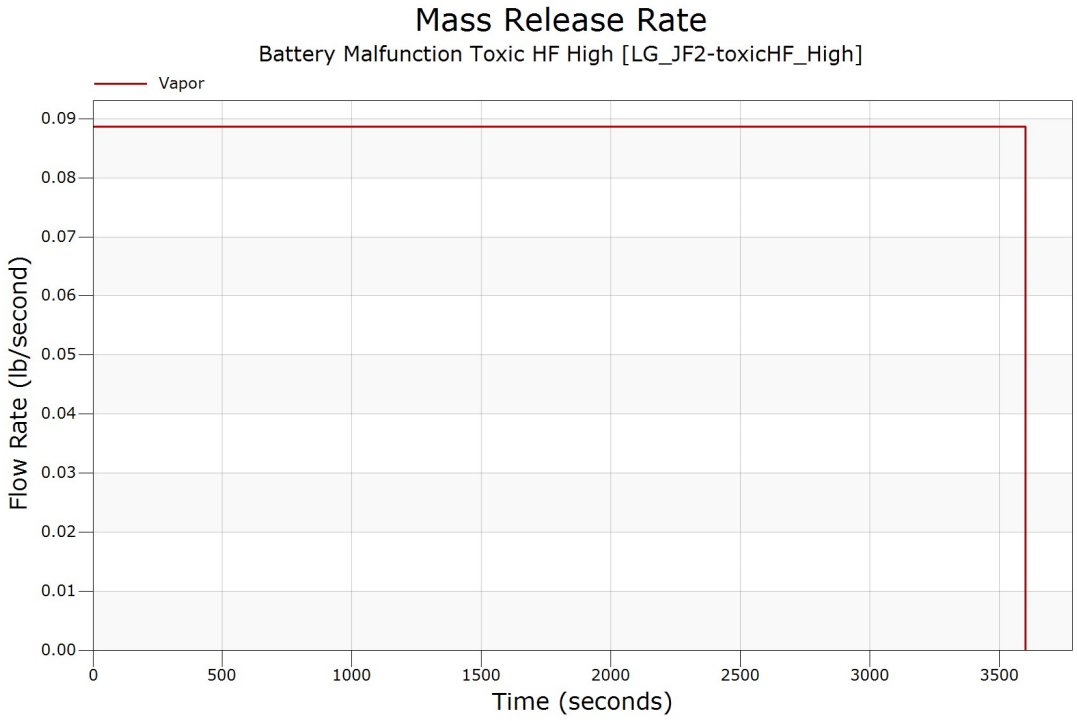
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Immediate Jet [1st minute] = 0.8868000E-01 lb/sec.
Delayed Jet [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction Toxic HF High [LG_JF2-toxicHF_High]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

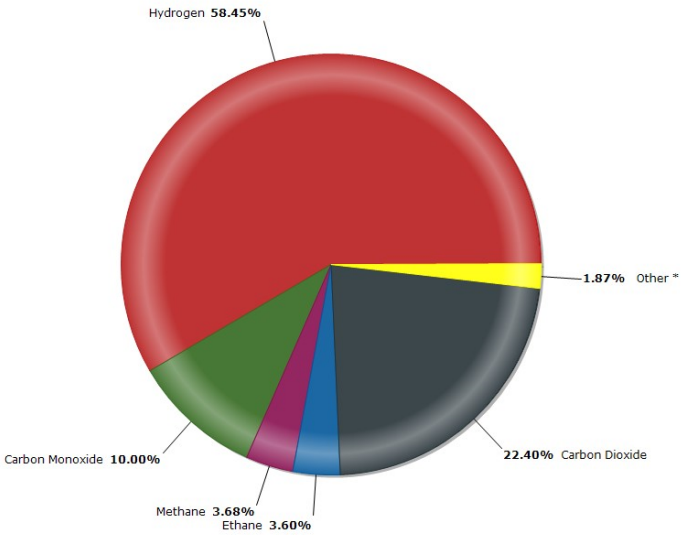
Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
50	Hydrogen Fluoride, HF
4	Isobutane, C4H10
26	Hydrogen Chloride, HCl
103	Hydrogen Cyanide, HCN
281	Toluene, C7H8
17	Carbon Dioxide, CO2

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.584500	0.584500	0.000000	0.000000	0.584500	0.000000
43	0.100000	0.100000	0.000000	0.000000	0.100000	0.000000
1	0.036800	0.036800	0.000000	0.000000	0.036800	0.000000
2	0.036000	0.036000	0.000000	0.000000	0.036000	0.000000
50	0.010000	0.010000	0.000000	0.000000	0.010000	0.000000
4	0.004000	0.004000	0.000000	0.000000	0.004000	0.000000
26	0.003000	0.003000	0.000000	0.000000	0.003000	0.000000
103	0.001600	0.001600	0.000000	0.000000	0.001600	0.000000
281	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
17	0.224000	0.224000	0.000000	0.000000	0.224000	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Momentum Jet Stream
Battery Malfunction Toxic HF High [LG_JF2-toxicHF_High]



* Other, Hydrogen Fluoride 1.00%, Isobutane 0.40%, Hydrogen Chloride 0.30%, Hydrogen Cyanide 0.16%, Toluene 0.01%

Momentum Jet Dispersion

concentration limits

Endpoint 1 (highest) = 50.0 ppm
Endpoint 2 (middle) = 30.0 ppm
Endpoint 3 (lowest) = 20.0 ppm

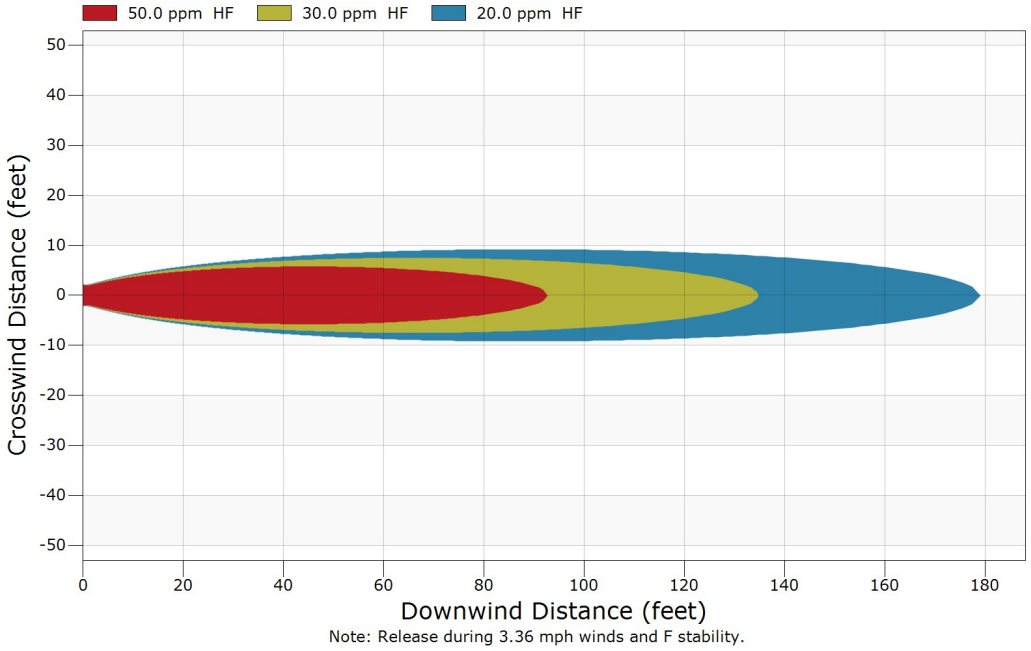
downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	10000.000	0.000	2.3	2.2	2.1	9.5
2	3310.038	0.000	2.5	2.4	2.3	11.0
5	1837.736	0.000	3.1	3.0	2.8	12.8
7	1215.843	0.000	3.7	3.5	3.3	14.3
10	885.157	0.000	4.2	4.0	3.7	15.7
12	683.480	0.000	4.7	4.4	4.0	16.8
15	549.691	0.000	5.1	4.8	4.3	17.9
18	455.347	0.000	5.4	5.1	4.6	18.9
20	385.577	0.000	5.8	5.4	4.8	19.8
22	332.341	0.000	6.1	5.6	5.0	20.7
25	290.487	0.000	6.4	5.9	5.2	21.5
28	256.774	0.000	6.6	6.1	5.3	22.2
30	229.193	0.000	6.9	6.3	5.4	23.0
32	206.271	0.000	7.1	6.5	5.5	23.6
35	187.021	0.000	7.3	6.6	5.6	24.3
38	170.625	0.000	7.5	6.8	5.7	24.9
40	156.314	0.000	7.7	6.9	5.7	25.5
42	144.126	0.000	7.9	7.0	5.8	26.1
45	133.176	0.000	8.0	7.1	5.8	26.6
48	123.767	0.000	8.2	7.2	5.8	27.2
50	115.331	0.000	8.3	7.3	5.7	27.7
53	107.848	0.000	8.4	7.3	5.7	28.2
55	101.231	0.000	8.5	7.4	5.6	28.6
58	95.161	0.000	8.6	7.4	5.5	29.1
60	89.777	0.000	8.7	7.5	5.5	29.6
62	84.950	0.000	8.8	7.5	5.3	30.0
65	80.549	0.000	8.9	7.5	5.2	30.3
68	76.548	0.000	9.0	7.5	5.0	30.7
70	72.952	0.000	9.0	7.5	4.9	31.1
72	69.595	0.000	9.1	7.4	4.7	31.4
75	66.496	0.000	9.1	7.4	4.4	31.7
78	63.666	0.000	9.1	7.4	4.2	32.0
80	61.028	0.000	9.2	7.3	3.9	32.2
82	58.559	0.000	9.2	7.2	3.5	32.5
85	56.247	0.000	9.2	7.2	3.1	32.8

downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
88	54.113	0.000	9.2	7.1	2.6	33.0
90	52.115	0.000	9.2	7.0	1.9	33.2
92	50.223	0.000	9.2	6.9	0.4	33.5
95	48.474	0.000	9.2	6.8	0.0	33.7
98	46.789	0.000	9.1	6.6	0.0	33.9
100	45.222	0.001	9.1	6.5	0.0	34.1
102	43.732	0.001	9.1	6.3	0.0	34.3
105	42.344	0.001	9.0	6.1	0.0	34.4
108	40.995	0.001	9.0	5.9	0.0	34.6
110	39.733	0.001	8.9	5.7	0.0	34.8
112	38.536	0.001	8.9	5.5	0.0	35.0
115	37.399	0.002	8.8	5.2	0.0	35.1
118	36.308	0.002	8.7	4.9	0.0	35.3
120	35.269	0.002	8.6	4.6	0.0	35.4
122	34.277	0.003	8.5	4.2	0.0	35.6
125	33.334	0.003	8.4	3.8	0.0	35.7
128	32.442	0.004	8.3	3.3	0.0	35.8
130	31.574	0.004	8.2	2.7	0.0	36.0
132	30.750	0.005	8.0	1.9	0.0	36.1
135	29.952	0.006	7.9	0.0	0.0	36.2
138	29.193	0.007	7.7	0.0	0.0	36.4
140	28.463	0.008	7.6	0.0	0.0	36.5
142	27.762	0.009	7.4	0.0	0.0	36.6
145	27.094	0.010	7.2	0.0	0.0	36.7
148	26.445	0.011	7.0	0.0	0.0	36.8
150	25.819	0.012	6.7	0.0	0.0	36.9
152	25.217	0.014	6.5	0.0	0.0	37.0
155	24.639	0.015	6.2	0.0	0.0	37.1
158	24.082	0.017	6.0	0.0	0.0	37.2
160	23.547	0.019	5.6	0.0	0.0	37.3
162	23.031	0.021	5.3	0.0	0.0	37.4
165	22.533	0.023	4.9	0.0	0.0	37.5
168	22.047	0.025	4.5	0.0	0.0	37.6
170	21.577	0.027	4.0	0.0	0.0	37.7
172	21.123	0.030	3.4	0.0	0.0	37.8
175	20.685	0.032	2.7	0.0	0.0	37.9
178	20.262	0.035	1.7	0.0	0.0	38.0

	Endpoint (ppm, HF)	Downwind Distance (feet)	Approximate Time (seconds)
1	50.0	92.8	19
2	30.0	134.9	27
3	20.0	179.1	36

Momentum Jet Contours - Overhead View

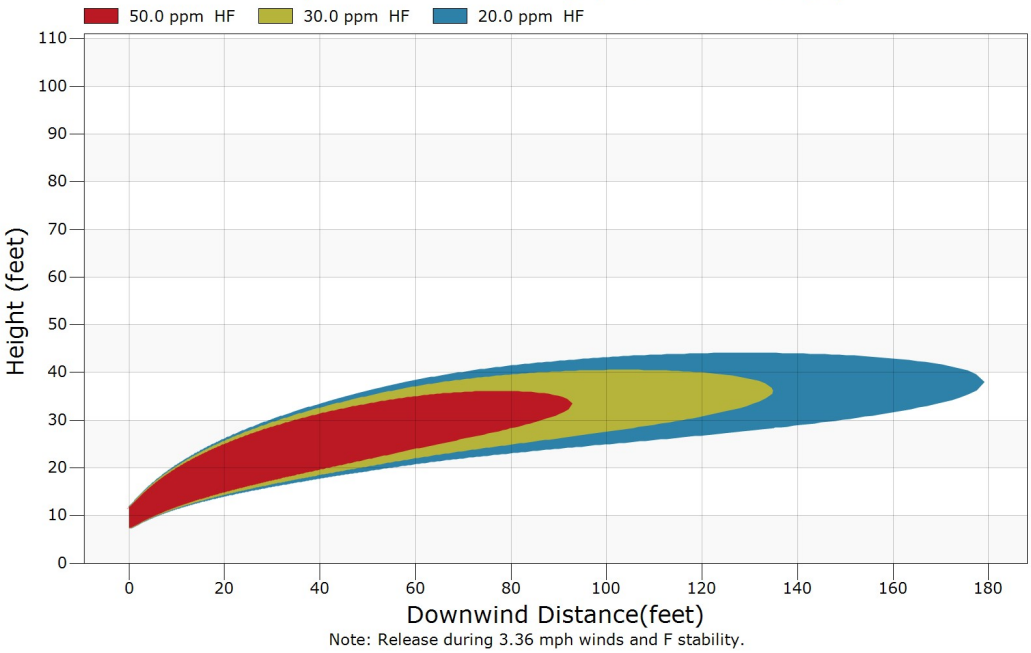
Battery Malfunction Toxic HF High [LG_JF2-toxicHF_High]



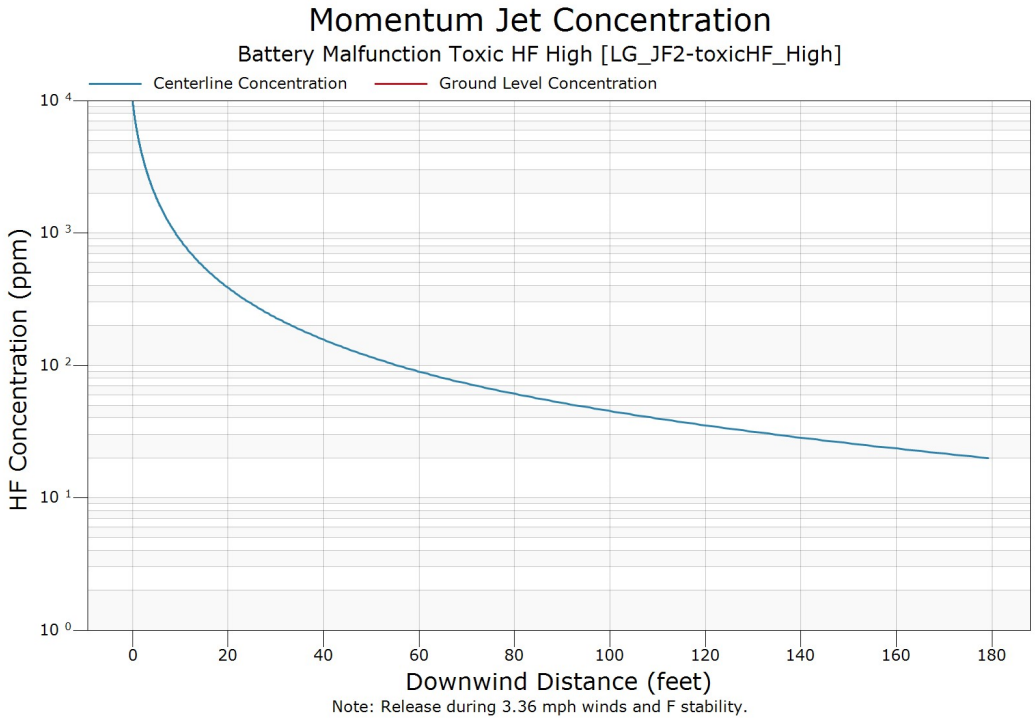
Note: Release during 3.36 mph winds and F stability.

Momentum Jet Contours - Side View

Battery Malfunction Toxic HF High [LG_JF2-toxicHF_High]



Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction Toxic HF High [LG_JF2-toxicHF_High]
Centerline Concentration
Ground Level Concentration
HF Concentration (ppm)
10 4
10 3
10 2
10 1
10 0
0
20
40
60
80
100
120
140
160
180
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-toxicHCL_High
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES: High HCL emission case: HCL  3,000 ppm

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.581500
Component  2        :    43 = CO        Carbon Monoxide             0.100000
Component  3        :     1 = CH4       Methane                     0.036800
Component  4        :     2 = C2H6      Ethane                      0.036000
Component  5        :    50 = HF        Hydrogen Fluoride           0.010000
Component  6        :     4 = C4H10     Isobutane                   0.004000
Component  7        :    26 = HCl       Hydrogen Chloride           0.006000
Component  8        :   103 = HCN       Hydrogen Cyanide            0.001600
Component  9        :   281 = C7H8      Toluene                     0.000100
Component 10        :    17 = CO2       Carbon Dioxide              0.224000

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES: Assumes HF is 50% of CO levels

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

```
RELEASE MENU
Type of release:   Regulated
Release duration                                  60 min
Regulated flow rate                             0.09 lb/sec
Pipe inner diameter                            22.63 inches
Equivalent release diameter                    19.20 inches
Height of release point                          9.5 feet
Angle of release from horizontal                90.0 degrees

  NOTES:

IMPOUNDMENT MENU
Unconfined

  NOTES:

VDVE MENU
Vapor generation and dispersion - Toxic endpoints
Tracking component   26 = HCl       Hydrogen Chloride
  Concentration endpoint 1                     150.0 ppm
  Concentration endpoint 2                      50.0 ppm
  Concentration endpoint 3                      20.0 ppm
Dispersion coefficient averaging time             30 min


  NOTES:
```

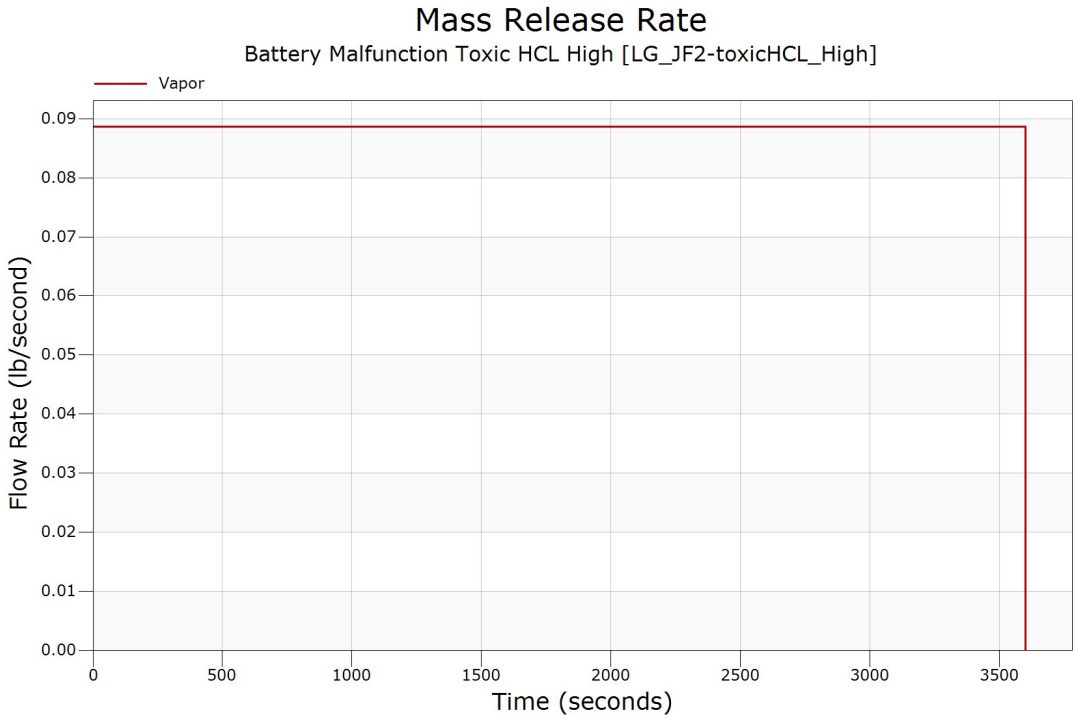
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Immediate Jet [1st minute] = 0.8868000E-01 lb/sec.
Delayed Jet [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction Toxic HCL High [LG_JF2-toxicHCL_High]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

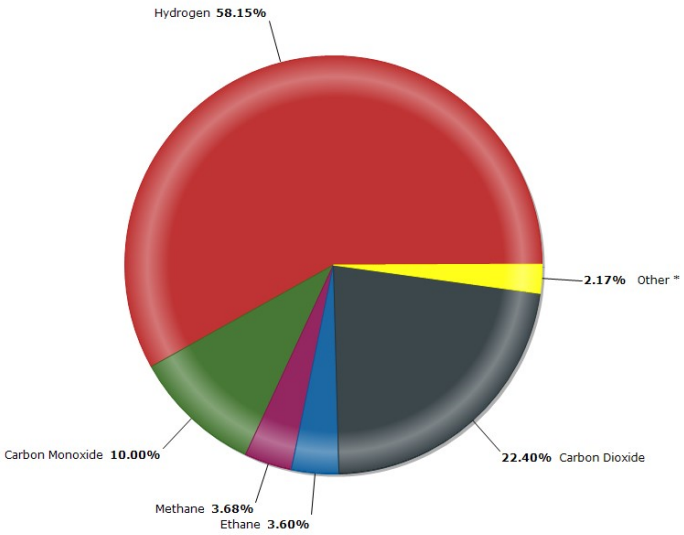
Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
50	Hydrogen Fluoride, HF
4	Isobutane, C4H10
26	Hydrogen Chloride, HCl
103	Hydrogen Cyanide, HCN
281	Toluene, C7H8
17	Carbon Dioxide, CO2

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.581500	0.581500	0.000000	0.000000	0.581500	0.000000
43	0.100000	0.100000	0.000000	0.000000	0.100000	0.000000
1	0.036800	0.036800	0.000000	0.000000	0.036800	0.000000
2	0.036000	0.036000	0.000000	0.000000	0.036000	0.000000
50	0.010000	0.010000	0.000000	0.000000	0.010000	0.000000
4	0.004000	0.004000	0.000000	0.000000	0.004000	0.000000
26	0.006000	0.006000	0.000000	0.000000	0.006000	0.000000
103	0.001600	0.001600	0.000000	0.000000	0.001600	0.000000
281	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
17	0.224000	0.224000	0.000000	0.000000	0.224000	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Momentum Jet Stream
Battery Malfunction Toxic HCL High [LG_JF2-toxicHCL_High]



* Other, Hydrogen Fluoride 1.00%, Isobutane 0.40%, Hydrogen Chloride 0.60%, Hydrogen Cyanide 0.16%, Toluene 0.01%

Momentum Jet Dispersion

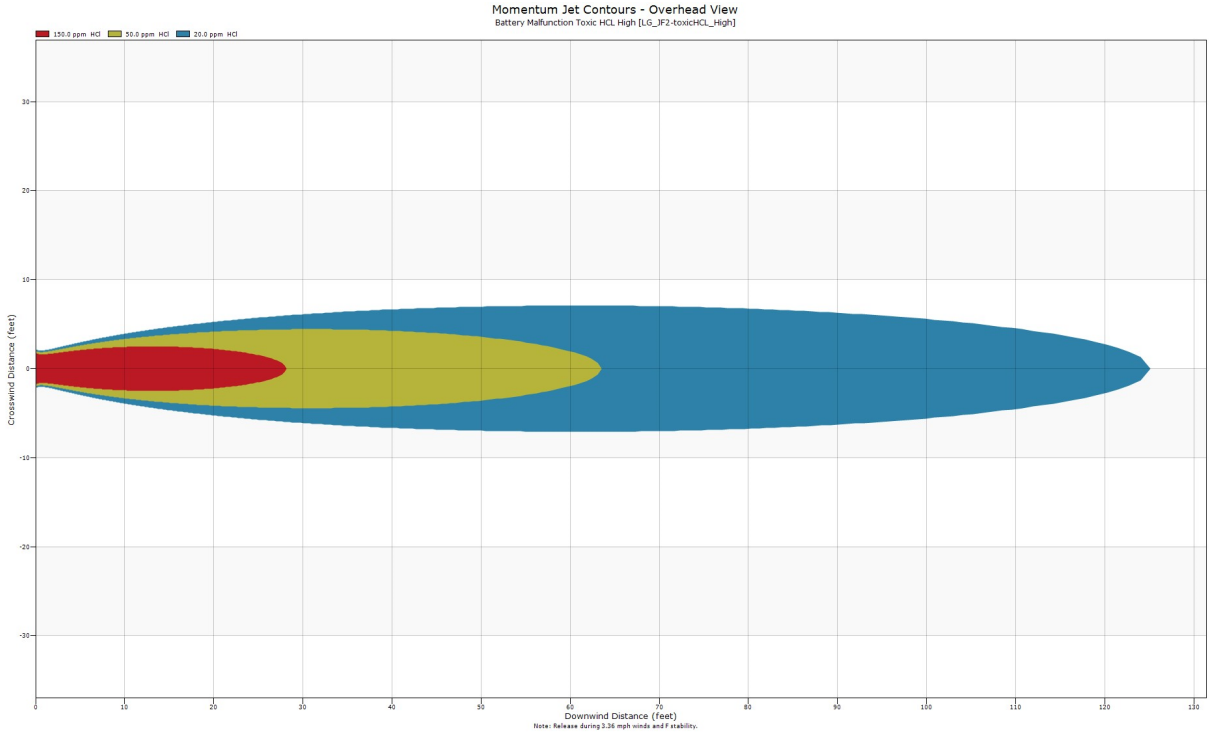
concentration limits

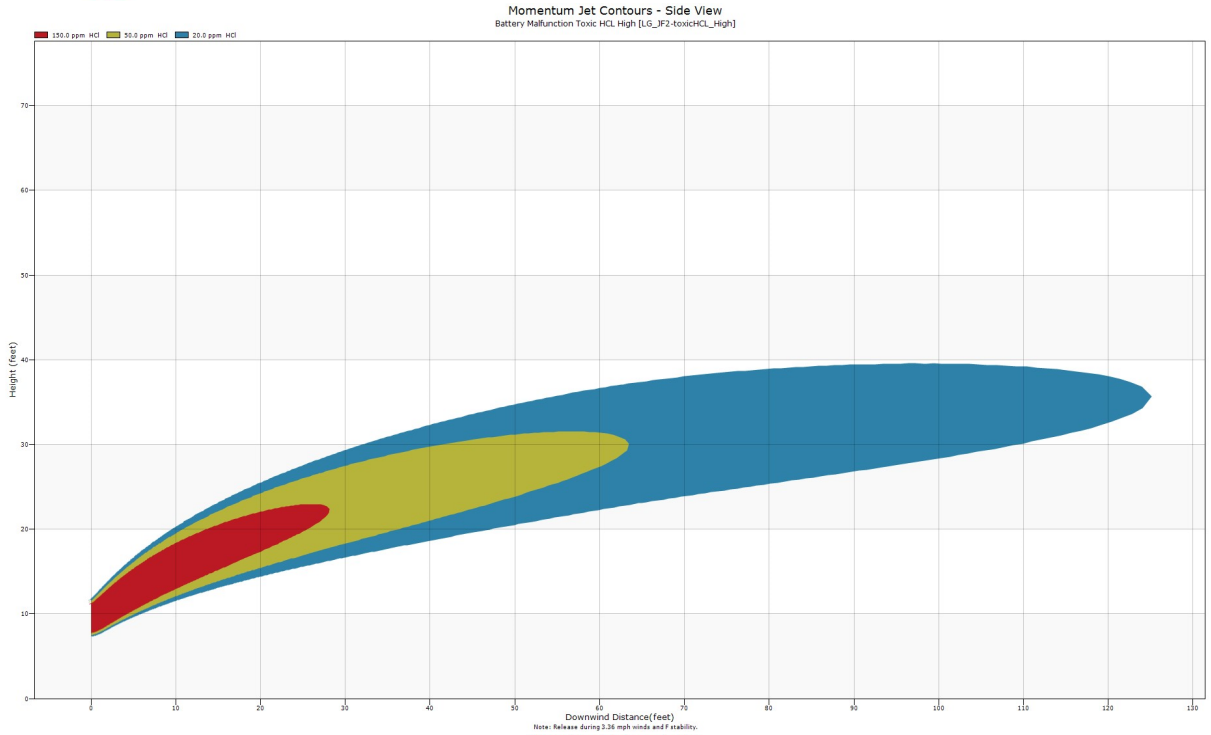
Endpoint 1 (highest) = 150.0 ppm
Endpoint 2 (middle) = 50.0 ppm
Endpoint 3 (lowest) = 20.0 ppm

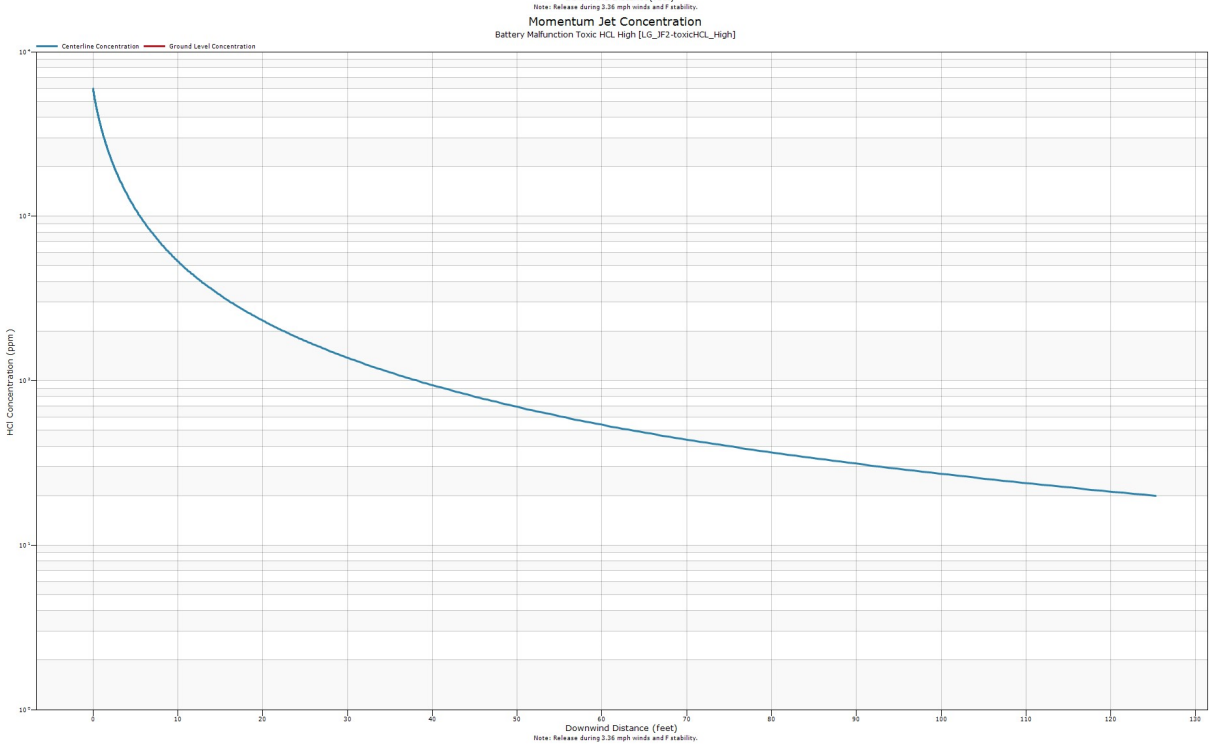
downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	6000.000	0.000	2.2	2.0	1.7	9.5
2	1990.501	0.000	2.4	2.1	1.8	11.0
5	1105.387	0.000	3.0	2.6	2.1	12.8
7	731.558	0.000	3.5	3.0	2.3	14.3
10	532.585	0.000	3.9	3.3	2.4	15.6
12	411.151	0.000	4.3	3.6	2.5	16.8
15	330.825	0.000	4.7	3.8	2.5	17.9
18	273.976	0.000	5.0	4.0	2.4	18.9
20	232.067	0.000	5.3	4.2	2.2	19.8
22	199.982	0.000	5.5	4.3	1.9	20.6
25	174.767	0.000	5.7	4.4	1.5	21.4
28	154.531	0.000	5.9	4.4	0.7	22.2
30	137.955	0.000	6.1	4.4	0.0	22.9
32	124.095	0.000	6.3	4.4	0.0	23.6
35	112.529	0.000	6.4	4.4	0.0	24.2
38	102.669	0.000	6.6	4.3	0.0	24.8
40	94.007	0.000	6.7	4.3	0.0	25.4
42	86.649	0.000	6.8	4.1	0.0	26.0
45	80.116	0.000	6.8	4.0	0.0	26.6
48	74.456	0.000	6.9	3.8	0.0	27.1
50	69.383	0.000	7.0	3.6	0.0	27.6
53	64.847	0.000	7.0	3.3	0.0	28.1
55	60.840	0.000	7.1	3.0	0.0	28.6
58	57.223	0.000	7.1	2.5	0.0	29.0
60	53.977	0.000	7.1	2.0	0.0	29.5
62	51.039	0.000	7.1	1.0	0.0	29.9
65	48.423	0.000	7.1	0.0	0.0	30.3
68	46.014	0.000	7.0	0.0	0.0	30.6
70	43.848	0.000	7.0	0.0	0.0	31.0
72	41.826	0.000	7.0	0.0	0.0	31.3
75	39.960	0.000	6.9	0.0	0.0	31.6
78	38.259	0.000	6.8	0.0	0.0	31.9
80	36.671	0.000	6.8	0.0	0.0	32.2
82	35.187	0.000	6.7	0.0	0.0	32.4
85	33.796	0.000	6.5	0.0	0.0	32.7

downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
88	32.513	0.000	6.4	0.0	0.0	32.9
90	31.311	0.000	6.3	0.0	0.0	33.2
92	30.174	0.000	6.1	0.0	0.0	33.4
95	29.110	0.000	6.0	0.0	0.0	33.6
98	28.106	0.000	5.8	0.0	0.0	33.8
100	27.162	0.000	5.6	0.0	0.0	34.0
102	26.265	0.000	5.4	0.0	0.0	34.2
105	25.429	0.000	5.1	0.0	0.0	34.4
108	24.621	0.001	4.8	0.0	0.0	34.6
110	23.865	0.001	4.5	0.0	0.0	34.7
112	23.148	0.001	4.2	0.0	0.0	34.9
115	22.467	0.001	3.8	0.0	0.0	35.1
118	21.811	0.001	3.3	0.0	0.0	35.2
120	21.187	0.001	2.7	0.0	0.0	35.4
122	20.592	0.002	2.0	0.0	0.0	35.5
125	20.024	0.002	0.1	0.0	0.0	35.6

	Endpoint (ppm, HCl)	Downwind Distance (feet)	Approximate Time (seconds)
1	150.0	28.1	6
2	50.0	63.5	13
3	20.0	125.1	25




Momentum Jet Contours - Side View
Battery Malfunction Toxic HCL High [LG_JF2-toxicHCL_High]
150.0 ppm HCl
50.0 ppm HCl
20.0 ppm HCl
Height (feet)
Downwind Distance(feet)
Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction Toxic HCL High [LG_JF2-toxicHCL_High]
Centerline Concentration
Ground Level Concentration
HCl Concentration (ppm)
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : LG_JF2-toxicHCN_High
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES: High HCN emission case: HCN  1,600 ppm

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen                    0.584500
Component  2        :    43 = CO        Carbon Monoxide             0.100000
Component  3        :     1 = CH4       Methane                     0.036800
Component  4        :     2 = C2H6      Ethane                      0.036000
Component  5        :    50 = HF        Hydrogen Fluoride           0.010000
Component  6        :     4 = C4H10     Isobutane                   0.004000
Component  7        :    26 = HCl       Hydrogen Chloride           0.003000
Component  8        :   103 = HCN       Hydrogen Cyanide            0.001600
Component  9        :   281 = C7H8      Toluene                     0.000100
Component 10        :    17 = CO2       Carbon Dioxide              0.224000

Temperature         :        81.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES: Assumes HF is 50% of CO levels

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity          1.0000 Btu/hr-ft-F
  Substrate density                          100 lb/cu.ft
  Substrate heat Capacity                   0.24 Btu/lb-F
  Substrate delay time                        60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

```
RELEASE MENU
Type of release:   Regulated
Release duration                                  60 min
Regulated flow rate                             0.09 lb/sec
Pipe inner diameter                            22.63 inches
Equivalent release diameter                    19.20 inches
Height of release point                          9.5 feet
Angle of release from horizontal                90.0 degrees

  NOTES:

IMPOUNDMENT MENU
Unconfined

  NOTES:

VDVE MENU
Vapor generation and dispersion - Toxic endpoints
Tracking component  103 = HCN       Hydrogen Cyanide
  Concentration endpoint 1                      50.0 ppm
  Concentration endpoint 2                      25.0 ppm
  Concentration endpoint 3                      10.0 ppm
Dispersion coefficient averaging time             30 min


  NOTES:
```

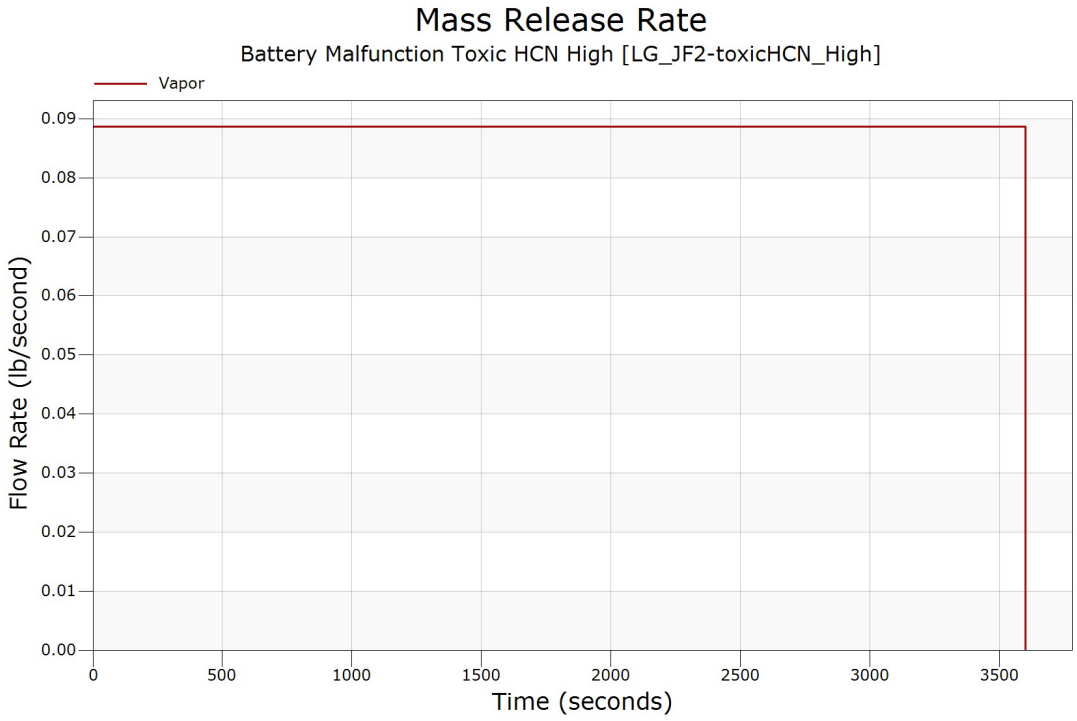
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.100000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.300000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.500000	8.868000E-02	0.000000	0.000000	8.868000E-02
0.700000	8.868000E-02	0.000000	0.000000	8.868000E-02
1.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
3.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
5.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
7.000000	8.868000E-02	0.000000	0.000000	8.868000E-02
10.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
20.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
30.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
40.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
50.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
60.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
70.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
85.00000	8.868000E-02	0.000000	0.000000	8.868000E-02
100.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
200.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
300.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
400.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
500.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
600.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
700.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
850.0000	8.868000E-02	0.000000	0.000000	8.868000E-02
1000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
2000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3000.000	8.868000E-02	0.000000	0.000000	8.868000E-02
3600.000	8.868000E-02	0.000000	0.000000	8.868000E-02
Totals (lb)	319.2480	0.000000	0.000000	319.2480

Flowrate for Immediate Jet [1st minute] = 0.8868000E-01 lb/sec.
Delayed Jet [2-3 minutes] = 0.8868000E-01 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction Toxic HCN High [LG_JF2-toxicHCN_High]
Vapor
Flow Rate (lb/second)
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

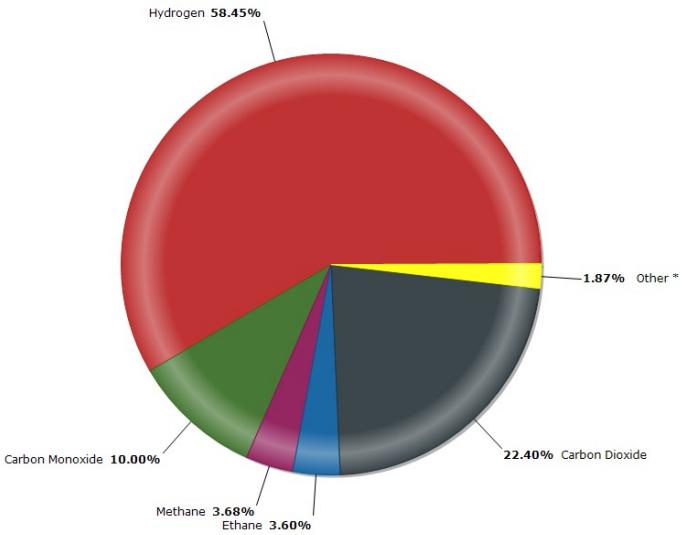
Release Compositions

Component Number	Component Name, Formula
51	Hydrogen, H2
43	Carbon Monoxide, CO
1	Methane, CH4
2	Ethane, C2H6
50	Hydrogen Fluoride, HF
4	Isobutane, C4H10
26	Hydrogen Chloride, HCl
103	Hydrogen Cyanide, HCN
281	Toluene, C7H8
17	Carbon Dioxide, CO2

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.584500	0.584500	0.000000	0.000000	0.584500	0.000000
43	0.100000	0.100000	0.000000	0.000000	0.100000	0.000000
1	0.036800	0.036800	0.000000	0.000000	0.036800	0.000000
2	0.036000	0.036000	0.000000	0.000000	0.036000	0.000000
50	0.010000	0.010000	0.000000	0.000000	0.010000	0.000000
4	0.004000	0.004000	0.000000	0.000000	0.004000	0.000000
26	0.003000	0.003000	0.000000	0.000000	0.003000	0.000000
103	0.001600	0.001600	0.000000	0.000000	0.001600	0.000000
281	0.000100	0.000100	0.000000	0.000000	0.000100	0.000000
17	0.224000	0.224000	0.000000	0.000000	0.224000	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Momentum Jet Stream
Battery Malfunction Toxic HCN High [LG_JF2-toxicHCN_High]



* Other, Hydrogen Fluoride 1.00%, Isobutane 0.40%, Hydrogen Chloride 0.30%, Hydrogen Cyanide 0.16%, Toluene 0.01%

Momentum Jet Dispersion

concentration limits

Endpoint 1 (highest) = 50.0 ppm
Endpoint 2 (middle) = 25.0 ppm
Endpoint 3 (lowest) = 10.0 ppm

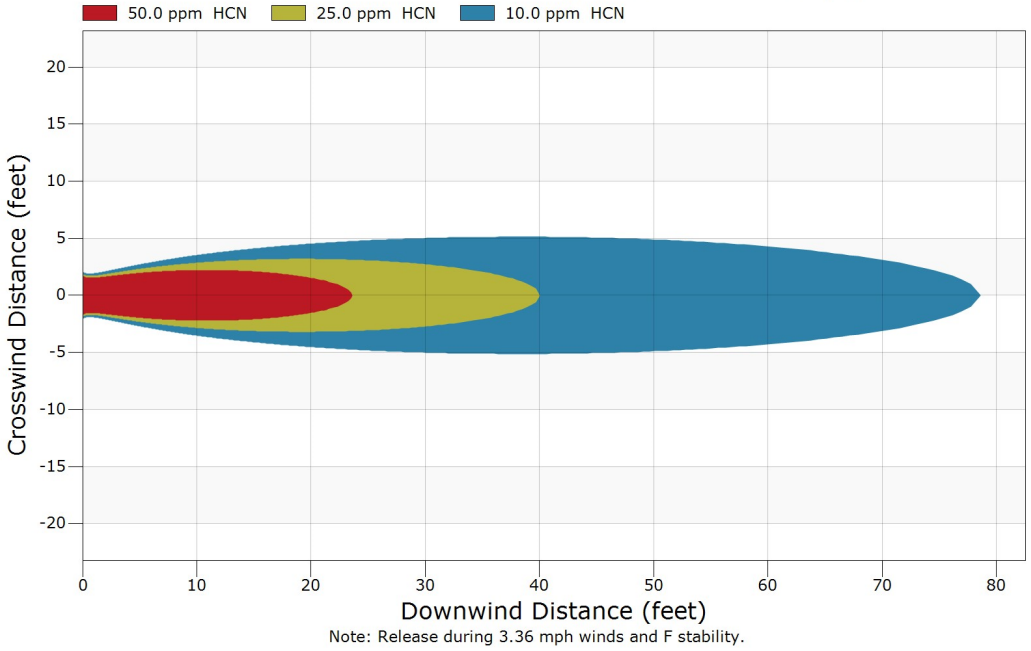
downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	1600.000	0.000	2.0	1.9	1.7	9.5
1	903.651	0.000	1.9	1.7	1.6	9.9
2	618.610	0.000	2.1	1.9	1.6	10.7
3	460.683	0.000	2.3	2.0	1.8	11.4
4	361.432	0.000	2.5	2.2	1.9	12.1
5	293.982	0.000	2.7	2.3	2.0	12.8
6	245.577	0.000	2.9	2.5	2.0	13.4
7	209.452	0.000	3.1	2.6	2.1	14.0
8	181.596	0.000	3.2	2.7	2.2	14.6
9	159.469	0.000	3.4	2.8	2.2	15.1
10	141.654	0.000	3.5	2.9	2.2	15.7
11	126.961	0.000	3.7	2.9	2.2	16.1
12	114.694	0.000	3.8	3.0	2.2	16.6
13	104.380	0.000	3.9	3.0	2.2	17.1
14	95.583	0.000	4.0	3.1	2.2	17.5
15	87.980	0.000	4.1	3.1	2.1	17.9
16	81.319	0.000	4.2	3.2	2.0	18.3
17	75.508	0.000	4.3	3.2	1.9	18.7
18	70.355	0.000	4.4	3.2	1.8	19.1
19	65.793	0.000	4.5	3.2	1.7	19.5
20	61.696	0.000	4.5	3.2	1.5	19.8
21	58.042	0.000	4.6	3.2	1.3	20.2
22	54.716	0.000	4.7	3.2	1.1	20.5
23	51.714	0.000	4.7	3.1	0.7	20.8
24	48.971	0.000	4.8	3.1	0.0	21.2
25	46.478	0.000	4.8	3.1	0.0	21.5
26	44.190	0.000	4.9	3.0	0.0	21.8
27	42.075	0.000	4.9	3.0	0.0	22.1
28	40.137	0.000	5.0	2.9	0.0	22.4
29	38.346	0.000	5.0	2.8	0.0	22.7
30	36.680	0.000	5.0	2.7	0.0	23.0
31	35.132	0.000	5.1	2.6	0.0	23.2
32	33.703	0.000	5.1	2.5	0.0	23.5
33	32.353	0.000	5.1	2.4	0.0	23.8
34	31.074	0.000	5.1	2.2	0.0	24.0

downwind distance (ft)	centerline conc. (ppm)	ground conc. (ppm)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
35	29.912	0.000	5.1	2.1	0.0	24.3
36	28.812	0.000	5.1	1.9	0.0	24.5
37	27.771	0.000	5.1	1.6	0.0	24.8
38	26.799	0.000	5.1	1.4	0.0	25.0
39	25.880	0.000	5.1	1.0	0.0	25.3
40	25.018	0.000	5.1	0.0	0.0	25.5
41	24.210	0.000	5.1	0.0	0.0	25.7
42	23.426	0.000	5.1	0.0	0.0	26.0
43	22.694	0.000	5.1	0.0	0.0	26.2
44	21.998	0.000	5.1	0.0	0.0	26.4
45	21.314	0.000	5.1	0.0	0.0	26.6
46	20.694	0.000	5.0	0.0	0.0	26.8
47	20.106	0.000	5.0	0.0	0.0	27.0
48	19.528	0.000	5.0	0.0	0.0	27.3
49	18.979	0.000	4.9	0.0	0.0	27.5
50	18.454	0.000	4.9	0.0	0.0	27.7
51	17.965	0.000	4.9	0.0	0.0	27.9
52	17.485	0.000	4.8	0.0	0.0	28.1
53	17.026	0.000	4.8	0.0	0.0	28.3
54	16.612	0.000	4.7	0.0	0.0	28.5
55	16.194	0.000	4.6	0.0	0.0	28.6
56	15.794	0.000	4.6	0.0	0.0	28.8
57	15.410	0.000	4.5	0.0	0.0	29.0
58	15.053	0.000	4.4	0.0	0.0	29.2
59	14.703	0.000	4.4	0.0	0.0	29.4
60	14.370	0.000	4.3	0.0	0.0	29.6
61	14.046	0.000	4.2	0.0	0.0	29.7
62	13.749	0.000	4.1	0.0	0.0	29.9
63	13.451	0.000	4.0	0.0	0.0	30.0
64	13.167	0.000	3.9	0.0	0.0	30.2
65	12.891	0.000	3.8	0.0	0.0	30.3
66	12.630	0.000	3.7	0.0	0.0	30.5
67	12.371	0.000	3.5	0.0	0.0	30.6
68	12.129	0.000	3.4	0.0	0.0	30.8
69	11.897	0.000	3.3	0.0	0.0	30.9
70	11.672	0.000	3.1	0.0	0.0	31.1
71	11.453	0.000	2.9	0.0	0.0	31.2
72	11.238	0.000	2.8	0.0	0.0	31.3
73	11.034	0.000	2.6	0.0	0.0	31.4
74	10.835	0.000	2.3	0.0	0.0	31.6
75	10.639	0.000	2.1	0.0	0.0	31.7
76	10.454	0.000	1.8	0.0	0.0	31.8
77	10.274	0.000	1.4	0.0	0.0	31.9
78	10.099	0.000	0.7	0.0	0.0	32.0
79	9.927	0.000	0.0	0.0	0.0	32.1

	Endpoint (ppm, HCN)	Downwind Distance (feet)	Approximate Time (seconds)
1	50.0	23.6	5
2	25.0	40.0	8
3	10.0	78.6	16

Momentum Jet Contours - Overhead View

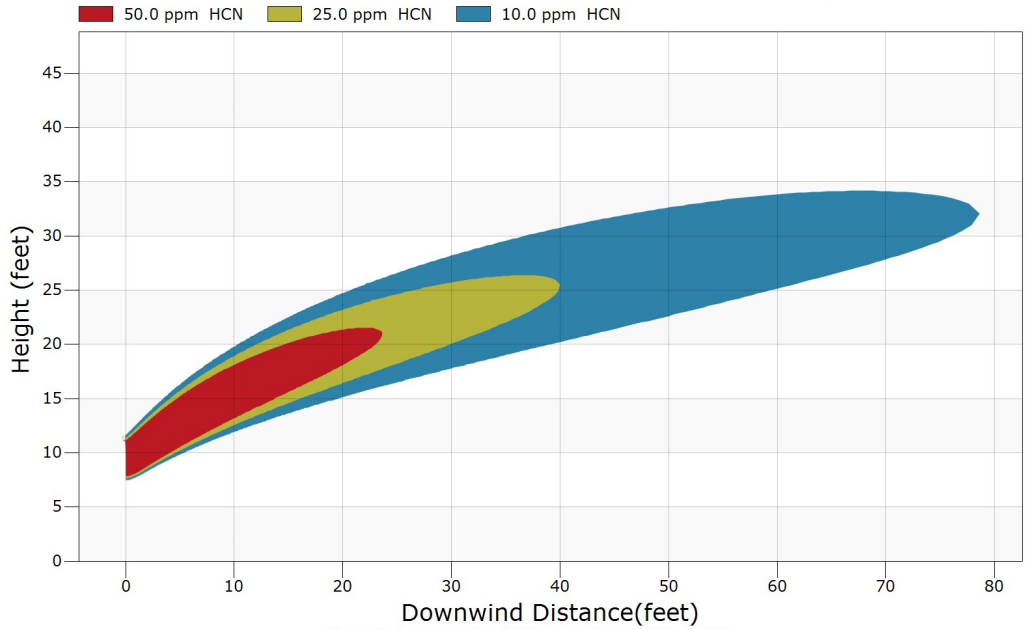
Battery Malfunction Toxic HCN High [LG_JF2-toxicHCN_High]



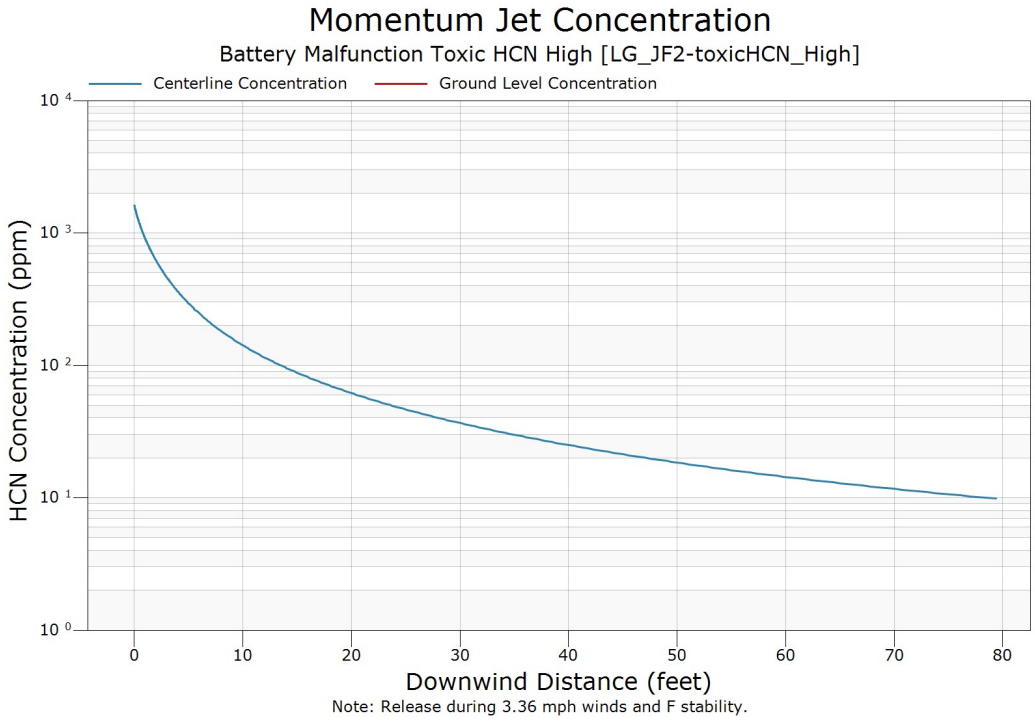
Note: Release during 3.36 mph winds and F stability.

Momentum Jet Contours - Side View

Battery Malfunction Toxic HCN High [LG_JF2-toxicHCN_High]



Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction Toxic HCN High [LG_JF2-toxicHCN_High]
Centerline Concentration
Ground Level Concentration
HCN Concentration (ppm)
10 4
10 3
10 2
10 1
10 0
0
10
20
30
40
50
60
70
80
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : B-1vertCombustionHighCaseWind
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen(equilibrium)       0.013905
Component  2        :    43 = CO        Carbon Monoxide             0.000099
Component  3        :    17 = CO2       Carbon Dioxide              0.000671
Component  4        :     1 = CH4       Methane                     0.000099
Component  5        :    89 = NO2       Nitrogen Dioxide            0.689369
Component  6        :    52 = H2O       Water                       0.295858
Component  7        :
Component  8        :
Component  9        :
Component 10        :

Temperature         :      1652.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                    10.00 mph
Wind speed measurement height                  32.8 feet
Stability class <A-F>                             D
Relative humidity                                70 %
Air temperature                                77.0 °F
Spill surface temperature                      77.0 °F

Substrate name                             Soil
  Substrate thermal conductivity            1.0000 Btu/hr-ft-F
  Substrate density                            100 lb/cu.ft
  Substrate heat Capacity                     0.24 Btu/lb-F
  Substrate delay time                          60 sec
Surrounding terrain                        Long grass or crops > 15 cm (6 in)

  NOTES:
```

RELEASE MENU
Type of release: Regulated, Continuous release

Release duration	60	min
Regulated flow rate	632.70	lb/sec
Pipe inner diameter	106.00	inches
Equivalent release diameter	106.00	inches
Height of release point	7.8	feet
Angle of release from horizontal	90.0	degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor generation and dispersion - Flammable calculation

Concentration endpoint 1	10.000000	mol%
Concentration endpoint 2	5.000000	mol%
Concentration endpoint 3	1.000000	mol%

Dispersion coefficient averaging time 1 min

NOTES:

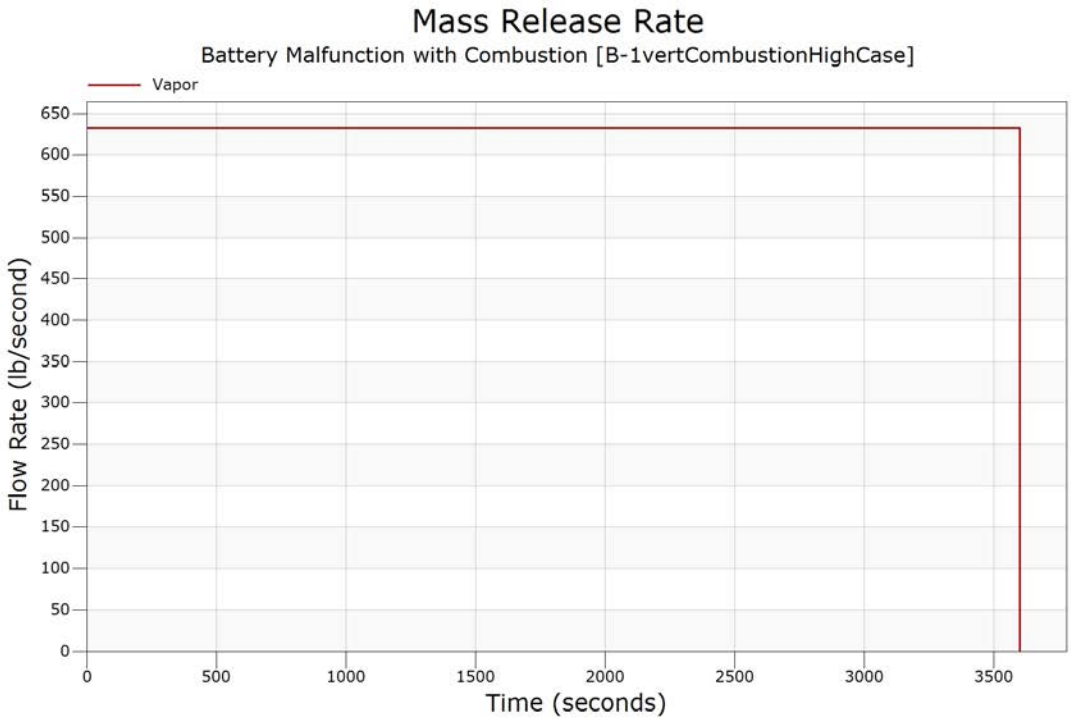
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	632.7001	0.000000	0.000000	632.7001
0.1000000	632.7001	0.000000	0.000000	632.7001
0.3000000	632.7001	0.000000	0.000000	632.7001
0.5000000	632.7001	0.000000	0.000000	632.7001
0.7000000	632.7001	0.000000	0.000000	632.7001
1.000000	632.7001	0.000000	0.000000	632.7001
3.000000	632.7001	0.000000	0.000000	632.7001
5.000000	632.7001	0.000000	0.000000	632.7001
7.000000	632.7001	0.000000	0.000000	632.7001
10.00000	632.7001	0.000000	0.000000	632.7001
20.00000	632.7001	0.000000	0.000000	632.7001
30.00000	632.7001	0.000000	0.000000	632.7001
40.00000	632.7001	0.000000	0.000000	632.7001
50.00000	632.7001	0.000000	0.000000	632.7001
60.00000	632.7001	0.000000	0.000000	632.7001
70.00000	632.7001	0.000000	0.000000	632.7001
85.00000	632.7001	0.000000	0.000000	632.7001
100.0000	632.7001	0.000000	0.000000	632.7001
200.0000	632.7001	0.000000	0.000000	632.7001
300.0000	632.7001	0.000000	0.000000	632.7001
400.0000	632.7001	0.000000	0.000000	632.7001
500.0000	632.7001	0.000000	0.000000	632.7001
600.0000	632.7001	0.000000	0.000000	632.7001
700.0000	632.7001	0.000000	0.000000	632.7001
850.0000	632.7001	0.000000	0.000000	632.7001
1000.000	632.7001	0.000000	0.000000	632.7001
2000.000	632.7001	0.000000	0.000000	632.7001
3000.000	632.7001	0.000000	0.000000	632.7001
3600.000	632.7001	0.000000	0.000000	632.7001
Totals (lb)	2277720.	0.000000	0.000000	2277720.

Flowrate for Jet Fire [immediate ignition] = 632.7001 lb/sec.
Jet Fire [delayed ignition] = 632.7001 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction with Combustion [B-1vertCombustionHighCase]
Vapor
Flow Rate (lb/second)
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

Release Compositions

Component Number	Component Name, Formula
51	Hydrogen(equilibrium), H2
43	Carbon Monoxide, CO
17	Carbon Dioxide, CO2
1	Methane, CH4
89	Nitrogen Dioxide, NO2
52	Water, H2O

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.013905	0.013905	0.000000	0.000000	0.013905	0.000000
43	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
17	0.000671	0.000671	0.000000	0.000000	0.000671	0.000000
1	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
89	0.689369	0.689369	0.000000	0.000000	0.689369	0.000000
52	0.295858	0.295858	0.000000	0.000000	0.295858	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Flammable Limits (Mole %) of Fluid Streams

Limit	Feed Stream	Momentum Jet Stream	Liquid Pool Stream
LFL	100.00	100.00	
UFL	100.00	100.00	
LBV		0.00 m/s	

Momentum Jet Dispersion

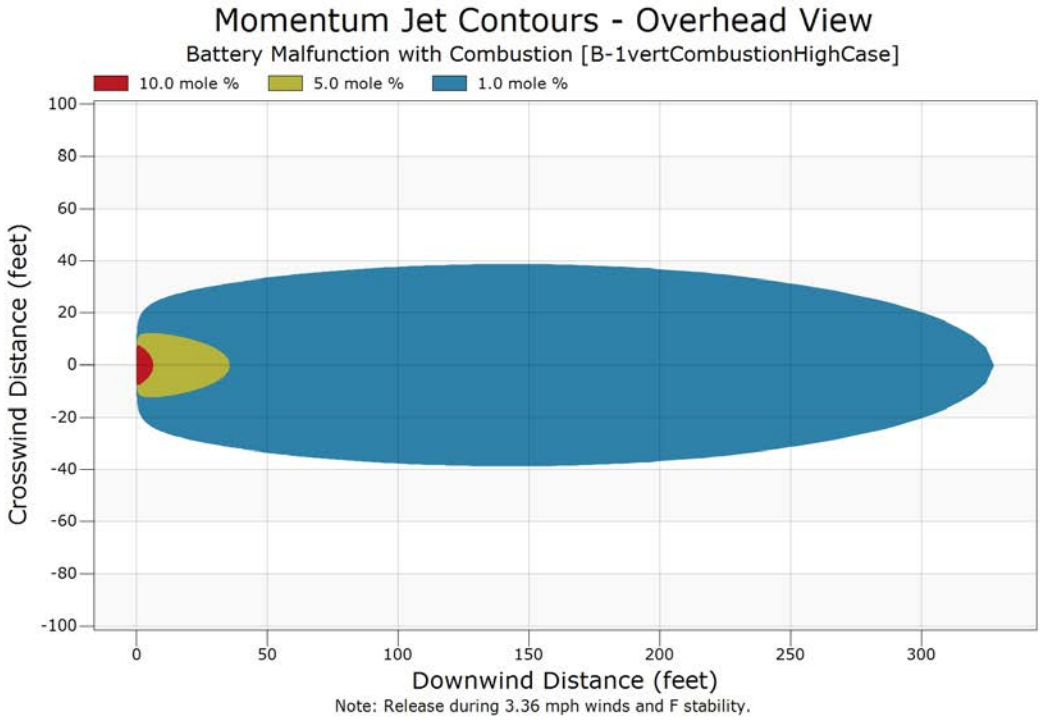
concentration limits

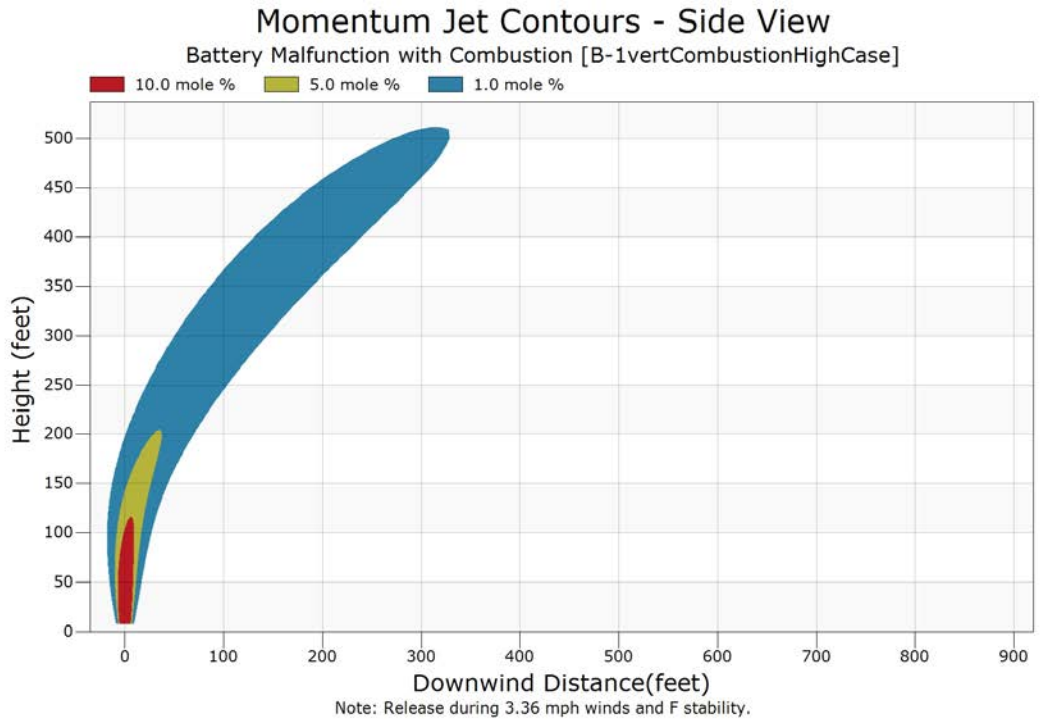
Endpoint 1 (highest) = 0.100000 mole fraction
Endpoint 2 (middle) = 0.050000 mole fraction
Endpoint 3 (lowest) = 0.010000 mole fraction

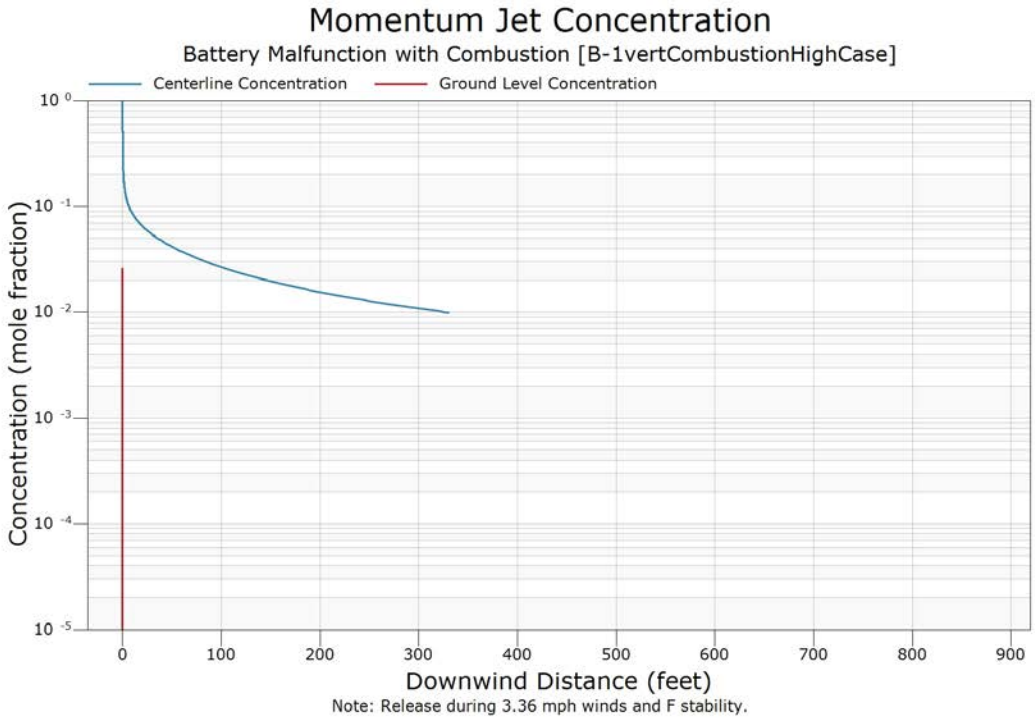
downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	1.000000	0.000000	9.1	6.8	5.7	7.7
5	0.108710	0.000000	23.1	12.4	3.9	107.7
10	0.085169	0.000000	25.6	12.1	0.0	133.8
15	0.073108	0.000000	27.3	11.3	0.0	152.2
20	0.065083	0.000000	28.6	10.2	0.0	167.2
25	0.059069	0.000000	29.6	8.6	0.0	180.3
30	0.054358	0.000000	30.6	6.5	0.0	192.1
35	0.050401	0.000000	31.4	2.0	0.0	202.9
40	0.047118	0.000000	32.2	0.0	0.0	213.1
45	0.044223	0.000000	32.9	0.0	0.0	222.7
50	0.041727	0.000000	33.5	0.0	0.0	231.8
55	0.039541	0.000000	34.1	0.0	0.0	240.5
60	0.037543	0.000000	34.6	0.0	0.0	248.8
65	0.035748	0.000000	35.1	0.0	0.0	256.8
70	0.034139	0.000000	35.6	0.0	0.0	264.6
75	0.032667	0.000000	36.0	0.0	0.0	272.1
80	0.031298	0.000000	36.4	0.0	0.0	279.4
85	0.030051	0.000000	36.8	0.0	0.0	286.5
90	0.028910	0.000000	37.1	0.0	0.0	293.4
95	0.027854	0.000000	37.4	0.0	0.0	300.1
100	0.026848	0.000000	37.7	0.0	0.0	306.6
105	0.025906	0.000000	37.9	0.0	0.0	313.0
110	0.025053	0.000000	38.1	0.0	0.0	319.2
115	0.024246	0.000000	38.3	0.0	0.0	325.3
120	0.023496	0.000000	38.4	0.0	0.0	331.2
125	0.022773	0.000000	38.5	0.0	0.0	337.2
130	0.022094	0.000000	38.6	0.0	0.0	342.9
135	0.021460	0.000000	38.7	0.0	0.0	348.4
140	0.020853	0.000000	38.7	0.0	0.0	354.0
145	0.020304	0.000000	38.7	0.0	0.0	359.4
150	0.019764	0.000000	38.7	0.0	0.0	364.6
155	0.019248	0.000000	38.6	0.0	0.0	369.9
160	0.018755	0.000000	38.6	0.0	0.0	375.0
165	0.018278	0.000000	38.4	0.0	0.0	380.1
170	0.017838	0.000000	38.3	0.0	0.0	385.0

downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
175	0.017399	0.000000	38.1	0.0	0.0	389.8
180	0.016997	0.000000	37.9	0.0	0.0	394.5
185	0.016608	0.000000	37.7	0.0	0.0	399.3
190	0.016236	0.000000	37.4	0.0	0.0	403.8
195	0.015891	0.000000	37.2	0.0	0.0	408.4
200	0.015536	0.000000	36.8	0.0	0.0	412.8
205	0.015216	0.000000	36.4	0.0	0.0	417.3
210	0.014899	0.000000	36.0	0.0	0.0	421.7
215	0.014598	0.000000	35.6	0.0	0.0	425.8
220	0.014316	0.000000	35.2	0.0	0.0	430.2
225	0.014027	0.000000	34.6	0.0	0.0	434.2
230	0.013764	0.000000	34.1	0.0	0.0	438.4
235	0.013507	0.000000	33.5	0.0	0.0	442.3
240	0.013255	0.000000	32.9	0.0	0.0	446.2
245	0.013014	0.000000	32.2	0.0	0.0	450.2
250	0.012783	0.000000	31.5	0.0	0.0	454.1
255	0.012562	0.000000	30.7	0.0	0.0	457.9
260	0.012345	0.000000	29.9	0.0	0.0	461.5
265	0.012131	0.000000	29.0	0.0	0.0	465.2
270	0.011926	0.000000	28.0	0.0	0.0	468.9
275	0.011730	0.000000	27.0	0.0	0.0	472.5
280	0.011543	0.000000	25.9	0.0	0.0	476.0
285	0.011362	0.000000	24.7	0.0	0.0	479.5
290	0.011180	0.000000	23.3	0.0	0.0	483.0
295	0.011004	0.000000	21.8	0.0	0.0	486.3
300	0.010836	0.000000	20.2	0.0	0.0	489.7
305	0.010674	0.000000	18.4	0.0	0.0	493.0
310	0.010518	0.000000	16.3	0.0	0.0	496.3
315	0.010362	0.000000	13.9	0.0	0.0	499.5
320	0.010219	0.000000	10.9	0.0	0.0	502.6
325	0.010073	0.000000	6.1	0.0	0.0	505.7
330	0.009933	0.000000	0.0	0.0	0.0	508.8

	Endpoint (mole frac., mixture)	Downwind Distance (feet)	Approximate Time (seconds)
1	0.100000	6.4	1
2	0.050000	35.6	1
3	0.010000	327.6	9


Momentum Jet Contours - Overhead View
Battery Malfunction with Combustion [B-1vertCombustionHighCase]
10.0 mole %
5.0 mole %
1.0 mole %
Crosswind Distance (feet)
100
80
60
40
20
0
-20
-40
-60
-80
-100
0
50
100
150
200
250
300
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.


Momentum Jet Contours - Side View
Battery Malfunction with Combustion [B-1vertCombustionHighCase]
10.0 mole %
5.0 mole %
1.0 mole %
Height (feet)
500
450
400
350
300
250
200
150
100
50
0
0
100
200
300
400
500
600
700
800
900
Downwind Distance(feet)
Note: Release during 3.36 mph winds and F stability.


Momentum Jet Concentration
Battery Malfunction with Combustion [B-1vertCombustionHighCase]
Centerline Concentration
Ground Level Concentration
Concentration (mole fraction)
10 0
10 -1
10 -2
10 -3
10 -4
10 -5
0
100
200
300
400
500
600
700
800
900
Downwind Distance (feet)
Note: Release during 3.36 mph winds and F stability.

RELEASE MENU
Type of release: Regulated, Continuous release

Release duration	60	min
Regulated flow rate	632.70	lb/sec
Pipe inner diameter	106.00	inches
Equivalent release diameter	106.00	inches
Height of release point	7.8	feet
Angle of release from horizontal	90.0	degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor generation and dispersion - Flammable calculation

Concentration endpoint 1	10.000000	mol%
Concentration endpoint 2	5.000000	mol%
Concentration endpoint 3	1.000000	mol%

Dispersion coefficient averaging time 1 min

NOTES:

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : B-1vertCombustionHighCase
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen(equilibrium)       0.013905
Component  2        :    43 = CO        Carbon Monoxide             0.000099
Component  3        :    17 = CO2       Carbon Dioxide              0.000671
Component  4        :     1 = CH4       Methane                     0.000099
Component  5        :    89 = NO2       Nitrogen Dioxide            0.689369
Component  6        :    52 = H2O       Water                       0.295858
Component  7        :
Component  8        :
Component  9        :
Component 10        :

Temperature         :      1652.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                    3.36 mph
Wind speed measurement height                 32.8 feet
Stability class <A-F>                            F
Relative humidity                               70 %
Air temperature                               77.0 °F
Spill surface temperature                     77.0 °F

Substrate name                          Soil
  Substrate thermal conductivity         1.0000 Btu/hr-ft-F
  Substrate density                         100 lb/cu.ft
  Substrate heat Capacity                  0.24 Btu/lb-F
  Substrate delay time                       60 sec
Surrounding terrain                     Long grass or crops > 15 cm (6 in)

  NOTES:
```

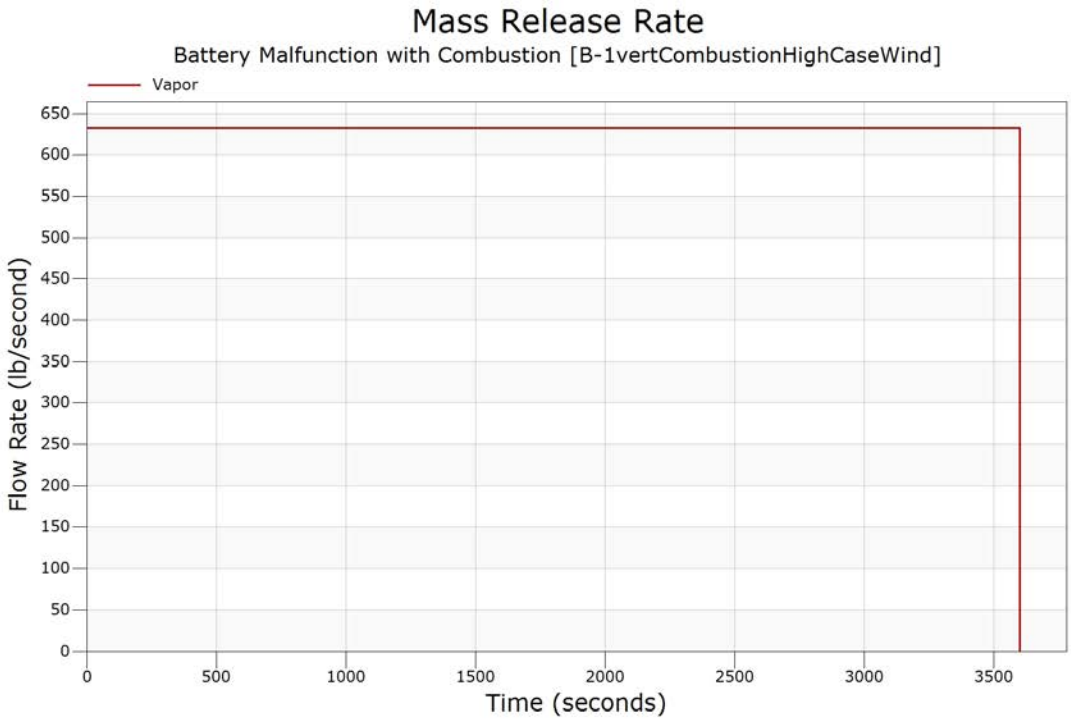
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	632.7001	0.000000	0.000000	632.7001
0.1000000	632.7001	0.000000	0.000000	632.7001
0.3000000	632.7001	0.000000	0.000000	632.7001
0.5000000	632.7001	0.000000	0.000000	632.7001
0.7000000	632.7001	0.000000	0.000000	632.7001
1.000000	632.7001	0.000000	0.000000	632.7001
3.000000	632.7001	0.000000	0.000000	632.7001
5.000000	632.7001	0.000000	0.000000	632.7001
7.000000	632.7001	0.000000	0.000000	632.7001
10.00000	632.7001	0.000000	0.000000	632.7001
20.00000	632.7001	0.000000	0.000000	632.7001
30.00000	632.7001	0.000000	0.000000	632.7001
40.00000	632.7001	0.000000	0.000000	632.7001
50.00000	632.7001	0.000000	0.000000	632.7001
60.00000	632.7001	0.000000	0.000000	632.7001
70.00000	632.7001	0.000000	0.000000	632.7001
85.00000	632.7001	0.000000	0.000000	632.7001
100.0000	632.7001	0.000000	0.000000	632.7001
200.0000	632.7001	0.000000	0.000000	632.7001
300.0000	632.7001	0.000000	0.000000	632.7001
400.0000	632.7001	0.000000	0.000000	632.7001
500.0000	632.7001	0.000000	0.000000	632.7001
600.0000	632.7001	0.000000	0.000000	632.7001
700.0000	632.7001	0.000000	0.000000	632.7001
850.0000	632.7001	0.000000	0.000000	632.7001
1000.000	632.7001	0.000000	0.000000	632.7001
2000.000	632.7001	0.000000	0.000000	632.7001
3000.000	632.7001	0.000000	0.000000	632.7001
3600.000	632.7001	0.000000	0.000000	632.7001
Totals (lb)	2277720.	0.000000	0.000000	2277720.

Flowrate for Jet Fire [immediate ignition] = 632.7001 lb/sec.
Jet Fire [delayed ignition] = 632.7001 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction with Combustion [B-1vertCombustionHighCaseWind]
Vapor
Flow Rate (lb/second)
650
600
550
500
450
400
350
300
250
200
150
100
50
0
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

Release Compositions

Component Number	Component Name, Formula
51	Hydrogen(equilibrium), H2
43	Carbon Monoxide, CO
17	Carbon Dioxide, CO2
1	Methane, CH4
89	Nitrogen Dioxide, NO2
52	Water, H2O

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.013905	0.013905	0.000000	0.000000	0.013905	0.000000
43	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
17	0.000671	0.000671	0.000000	0.000000	0.000671	0.000000
1	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
89	0.689369	0.689369	0.000000	0.000000	0.689369	0.000000
52	0.295858	0.295858	0.000000	0.000000	0.295858	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Flammable Limits (Mole %) of Fluid Streams

Limit	Feed Stream	Momentum Jet Stream	Liquid Pool Stream
LFL	100.00	100.00	
UFL	100.00	100.00	
LBV		0.00 m/s	

Momentum Jet Dispersion

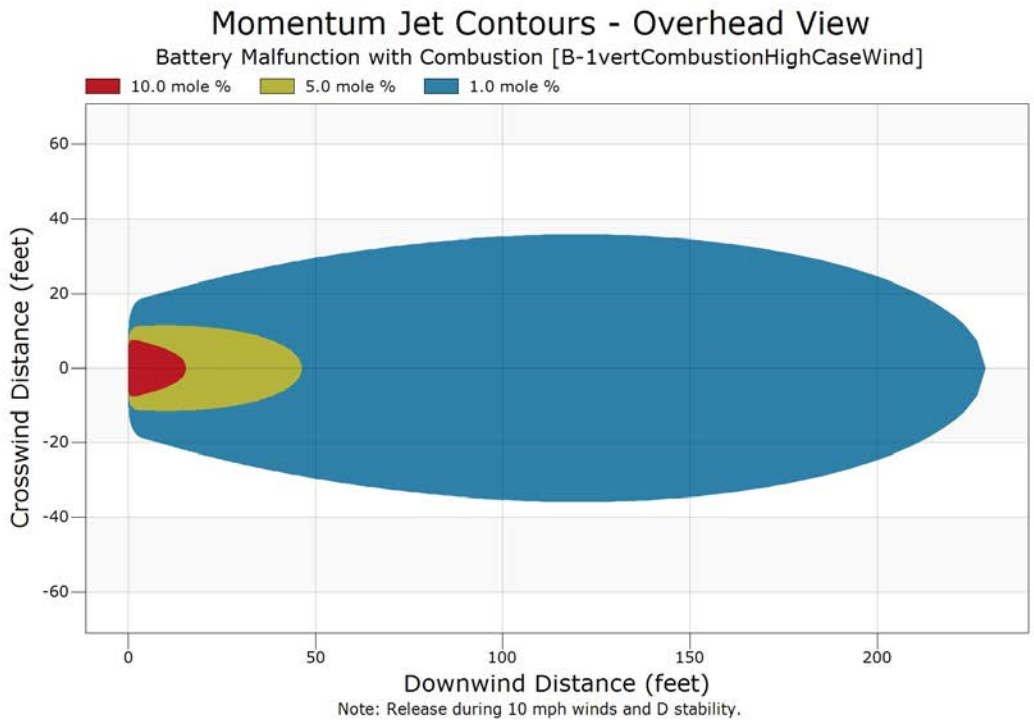
concentration limits

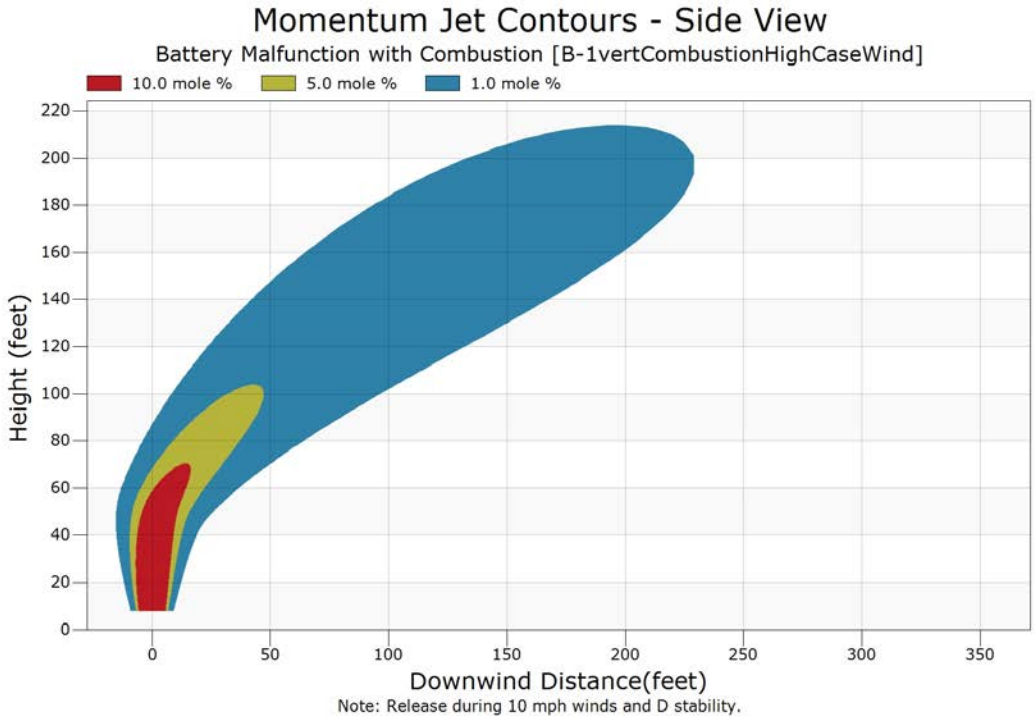
Endpoint 1 (highest) = 0.100000 mole fraction
Endpoint 2 (middle) = 0.050000 mole fraction
Endpoint 3 (lowest) = 0.010000 mole fraction

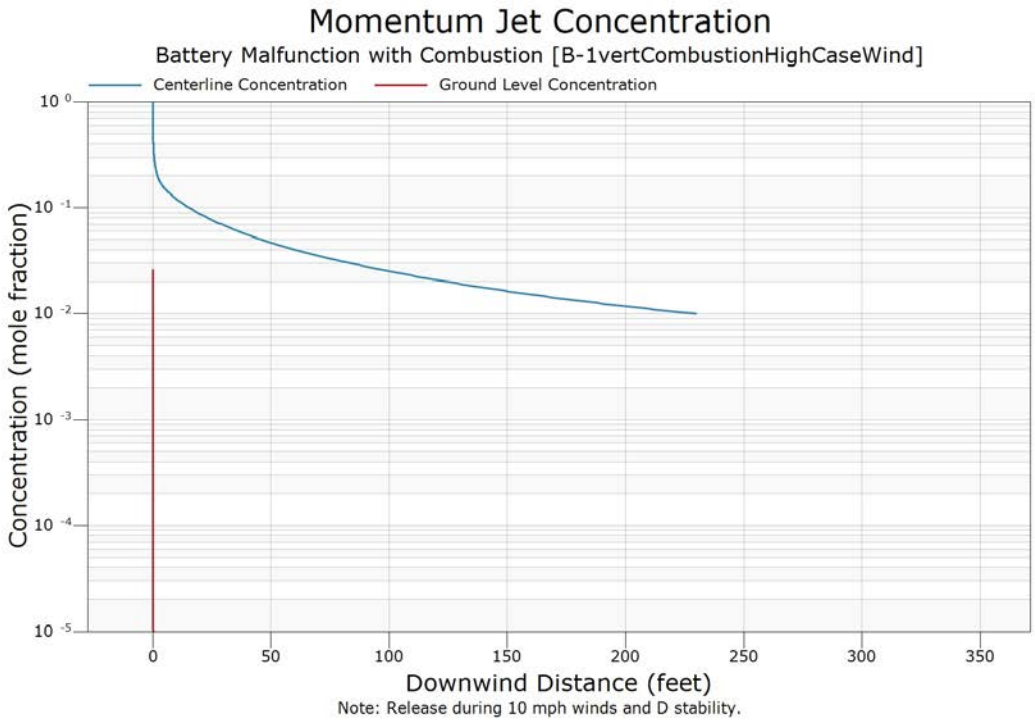
downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	1.000000	0.000000	9.1	6.8	5.7	7.7
5	0.152590	0.000000	19.1	11.5	6.8	54.1
10	0.121143	0.000000	20.5	11.5	5.1	62.7
15	0.101440	0.000000	21.9	11.4	1.5	69.6
20	0.087403	0.000000	23.2	11.2	0.0	75.9
25	0.076783	0.000000	24.5	10.6	0.0	81.6
30	0.068379	0.000000	25.6	9.8	0.0	87.0
35	0.061574	0.000000	26.7	8.6	0.0	92.1
40	0.055932	0.000000	27.7	6.7	0.0	96.9
45	0.051150	0.000000	28.7	3.2	0.0	101.5
50	0.047075	0.000000	29.6	0.0	0.0	105.9
55	0.043538	0.000000	30.4	0.0	0.0	110.1
60	0.040462	0.000000	31.2	0.0	0.0	114.2
65	0.037733	0.000000	31.9	0.0	0.0	118.2
70	0.035339	0.000000	32.6	0.0	0.0	122.0
75	0.033181	0.000000	33.2	0.0	0.0	125.6
80	0.031229	0.000000	33.7	0.0	0.0	129.2
85	0.029484	0.000000	34.2	0.0	0.0	132.7
90	0.027906	0.000000	34.6	0.0	0.0	136.0
95	0.026454	0.000000	34.9	0.0	0.0	139.2
100	0.025132	0.000000	35.2	0.0	0.0	142.4
105	0.023923	0.000000	35.5	0.0	0.0	145.5
110	0.022815	0.000000	35.6	0.0	0.0	148.5
115	0.021784	0.000000	35.7	0.0	0.0	151.3
120	0.020834	0.000000	35.8	0.0	0.0	154.2
125	0.019963	0.000000	35.8	0.0	0.0	156.9
130	0.019140	0.000000	35.7	0.0	0.0	159.6
135	0.018367	0.000000	35.5	0.0	0.0	162.2
140	0.017648	0.000000	35.2	0.0	0.0	164.7
145	0.016977	0.000000	34.9	0.0	0.0	167.2
150	0.016349	0.000000	34.5	0.0	0.0	169.6
155	0.015761	0.000000	34.0	0.0	0.0	172.0
160	0.015205	0.000000	33.4	0.0	0.0	174.3
165	0.014685	0.000000	32.8	0.0	0.0	176.5
170	0.014193	0.000000	32.0	0.0	0.0	178.7

downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
175	0.013729	0.000001	31.1	0.0	0.0	180.8
180	0.013291	0.000001	30.1	0.0	0.0	182.9
185	0.012873	0.000001	29.0	0.0	0.0	184.9
190	0.012480	0.000001	27.7	0.0	0.0	186.9
195	0.012105	0.000001	26.2	0.0	0.0	188.9
200	0.011749	0.000001	24.6	0.0	0.0	190.8
205	0.011412	0.000001	22.7	0.0	0.0	192.6
210	0.011091	0.000001	20.4	0.0	0.0	194.4
215	0.010783	0.000002	17.8	0.0	0.0	196.2
220	0.010490	0.000002	14.4	0.0	0.0	198.0
225	0.010210	0.000002	9.5	0.0	0.0	199.6

	Endpoint (mole frac., mixture)	Downwind Distance (feet)	Approximate Time (seconds)
1	0.100000	15.4	0
2	0.050000	46.3	1
3	0.010000	228.9	4




Momentum Jet Contours - Side View
Battery Malfunction with Combustion [B-1vertCombustionHighCaseWind]
10.0 mole %
5.0 mole %
1.0 mole %
Height (feet)
Downwind Distance(feet)
Note: Release during 10 mph winds and D stability.


Momentum Jet Concentration
Battery Malfunction with Combustion [B-1vertCombustionHighCaseWind]
Centerline Concentration
Ground Level Concentration
Concentration (mole fraction)
Downwind Distance (feet)
Note: Release during 10 mph winds and D stability.

Case Inputs

```
Case Type           : Vapor Dispersion
Case Name           : B-1vertCombustionLowCase
User ID             : GC
Project Number      :
Type of Units       : English Units

  NOTES:

MATERIAL MENU
Materials Released  : Number  Formula   Name                        Fraction
Component  1        :    51 = H2        Hydrogen(equilibrium)       0.013905
Component  2        :    43 = CO        Carbon Monoxide             0.000099
Component  3        :    17 = CO2       Carbon Dioxide              0.000671
Component  4        :     1 = CH4       Methane                     0.000099
Component  5        :    89 = NO2       Nitrogen Dioxide            0.689369
Component  6        :    52 = H2O       Water                       0.295858
Component  7        :
Component  8        :
Component  9        :
Component 10        :

Temperature         :      1652.00 °F
Pressure            :        15.00 psia
The material is Indeterminate


  NOTES:

ENVIRONMENT MENU
Wind speed                                      10.00 mph
Wind speed measurement height                    32.8 feet
Stability class <A-F>                               D
Relative humidity                                  70 %
Air temperature                                  77.0 °F
Spill surface temperature                        77.0 °F

Substrate name                            Soil
  Substrate thermal conductivity              1.0000 Btu/hr-ft-F
  Substrate density                              100 lb/cu.ft
  Substrate heat Capacity                       0.24 Btu/lb-F
  Substrate delay time                            60 sec
Surrounding terrain                       Long grass or crops > 15 cm (6 in)

  NOTES:
```

RELEASE MENU

Type of release:	Regulated, Continuous release	
Release duration	60	min
Regulated flow rate	63.93	lb/sec
Pipe inner diameter	106.00	inches
Equivalent release diameter	106.00	inches
Height of release point	7.8	feet
Angle of release from horizontal	90.0	degrees

NOTES:

IMPOUNDMENT MENU
Unconfined

NOTES:

VDVE MENU
Vapor generation and dispersion - Flammable calculation

Concentration endpoint 1	10.000000	mol%
Concentration endpoint 2	5.000000	mol%
Concentration endpoint 3	1.000000	mol%

Dispersion coefficient averaging time	1	min

NOTES:

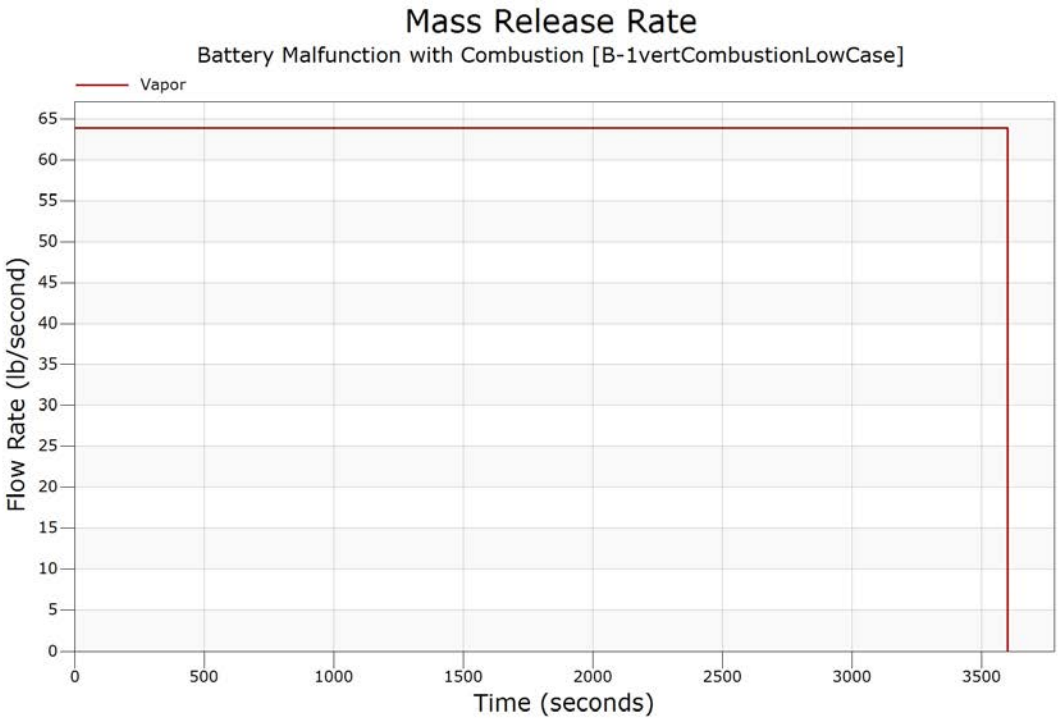
Release Model

WARNING USER ASSUMES RESPONSIBLIITY FOR INPUT CONSISTENCY IN REGULATED RELEASE CASE

Time (sec)	Vapor (lb/sec)	Aerosol Rate (lb/sec)	Liquid Rate (lb/sec)	Total Rate (lb/sec)
0.000000	63.93000	0.000000	0.000000	63.93000
0.1000000	63.93000	0.000000	0.000000	63.93000
0.3000000	63.93000	0.000000	0.000000	63.93000
0.5000000	63.93000	0.000000	0.000000	63.93000
0.7000000	63.93000	0.000000	0.000000	63.93000
1.000000	63.93000	0.000000	0.000000	63.93000
3.000000	63.93000	0.000000	0.000000	63.93000
5.000000	63.93000	0.000000	0.000000	63.93000
7.000000	63.93000	0.000000	0.000000	63.93000
10.00000	63.93000	0.000000	0.000000	63.93000
20.00000	63.93000	0.000000	0.000000	63.93000
30.00000	63.93000	0.000000	0.000000	63.93000
40.00000	63.93000	0.000000	0.000000	63.93000
50.00000	63.93000	0.000000	0.000000	63.93000
60.00000	63.93000	0.000000	0.000000	63.93000
70.00000	63.93000	0.000000	0.000000	63.93000
85.00000	63.93000	0.000000	0.000000	63.93000
100.0000	63.93000	0.000000	0.000000	63.93000
200.0000	63.93000	0.000000	0.000000	63.93000
300.0000	63.93000	0.000000	0.000000	63.93000
400.0000	63.93000	0.000000	0.000000	63.93000
500.0000	63.93000	0.000000	0.000000	63.93000
600.0000	63.93000	0.000000	0.000000	63.93000
700.0000	63.93000	0.000000	0.000000	63.93000
850.0000	63.93000	0.000000	0.000000	63.93000
1000.000	63.93000	0.000000	0.000000	63.93000
2000.000	63.93000	0.000000	0.000000	63.93000
3000.000	63.93000	0.000000	0.000000	63.93000
3600.000	63.93000	0.000000	0.000000	63.93000
Totals (lb)	230148.0	0.000000	0.000000	230148.0

Flowrate for Jet Fire [immediate ignition] = 63.93000 lb/sec.
Jet Fire [delayed ignition] = 63.93000 lb/sec.

Reason for Ending: Reached Stop Time


Mass Release Rate
Battery Malfunction with Combustion [B-1vertCombustionLowCase]
Vapor
Flow Rate (lb/second)
0
5
10
15
20
25
30
35
40
45
50
55
60
65
0
500
1000
1500
2000
2500
3000
3500
Time (seconds)

Release Compositions

Component Number	Component Name, Formula
51	Hydrogen(equilibrium), H2
43	Carbon Monoxide, CO
17	Carbon Dioxide, CO2
1	Methane, CH4
89	Nitrogen Dioxide, NO2
52	Water, H2O

Composition (Mole Fraction) of Fluid Streams

Comp. No.	Feed Stream	Momentum Jet Stream				Liquid Pool Stream
		Flashed Vapor	Evaporated Vapor	Aerosol Liquid	Total Stream	Liquid to Ground
51	0.013905	0.013905	0.000000	0.000000	0.013905	0.000000
43	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
17	0.000671	0.000671	0.000000	0.000000	0.000671	0.000000
1	0.000099	0.000099	0.000000	0.000000	0.000099	0.000000
89	0.689369	0.689369	0.000000	0.000000	0.689369	0.000000
52	0.295858	0.295858	0.000000	0.000000	0.295858	0.000000
	1.000000	1.000000	0.000000	0.000000	1.000000	0.000000

Flammable Limits (Mole %) of Fluid Streams

Limit	Feed Stream	Momentum Jet Stream	Liquid Pool Stream
LFL	100.00	100.00	
UFL	100.00	100.00	
LBV		0.00 m/s	

Momentum Jet Dispersion

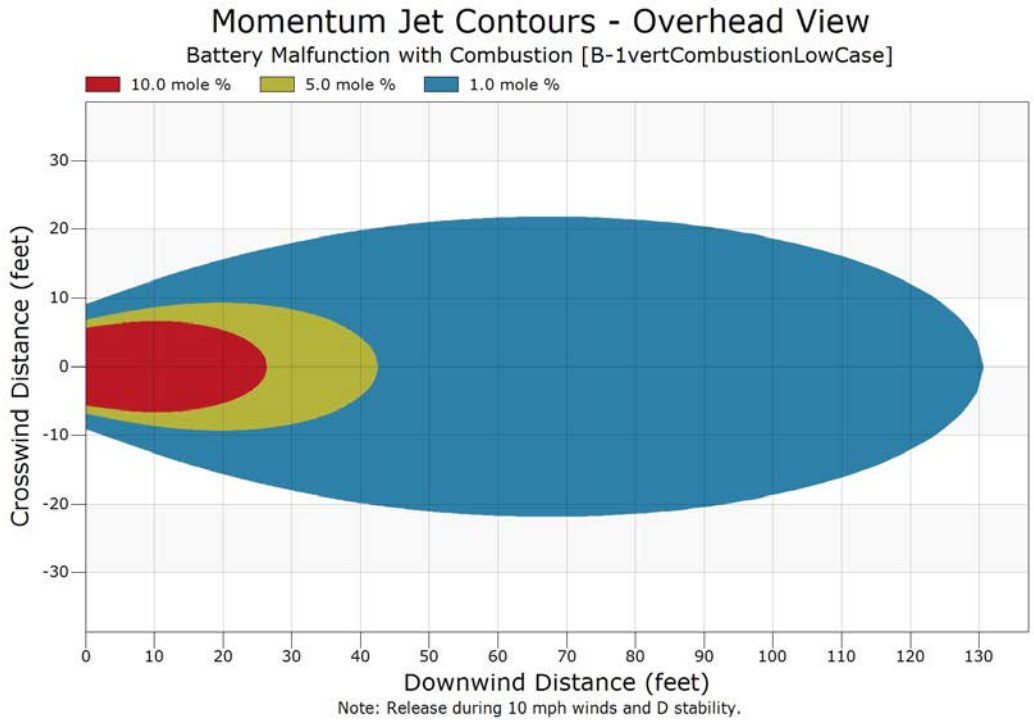
concentration limits

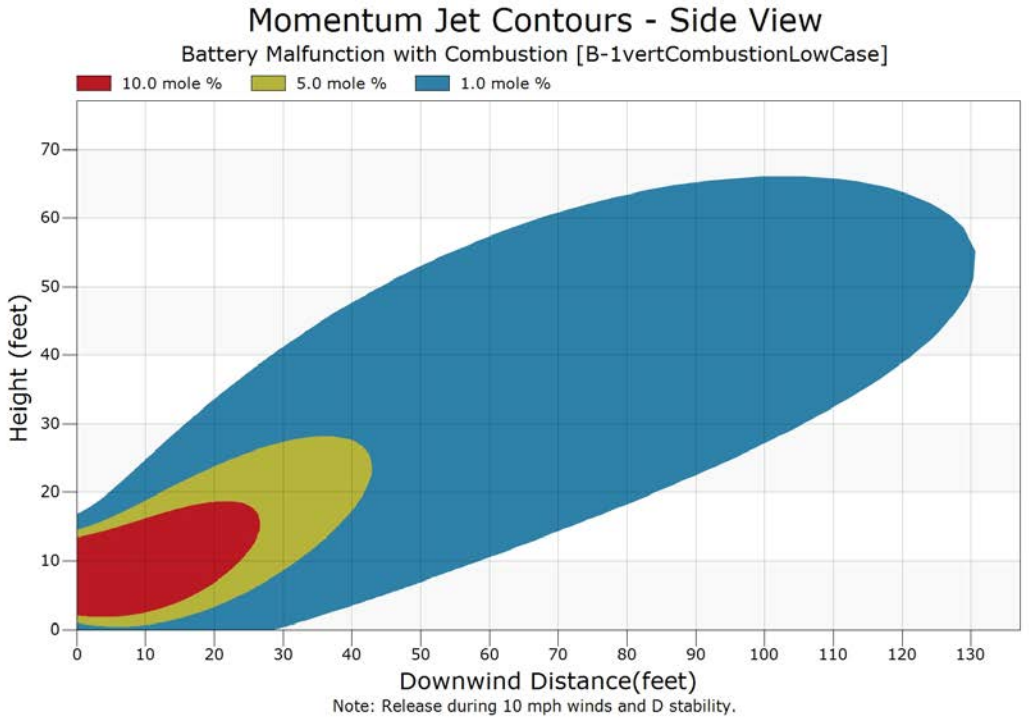
Endpoint 1 (highest) = 0.100000 mole fraction
Endpoint 2 (middle) = 0.050000 mole fraction
Endpoint 3 (lowest) = 0.010000 mole fraction

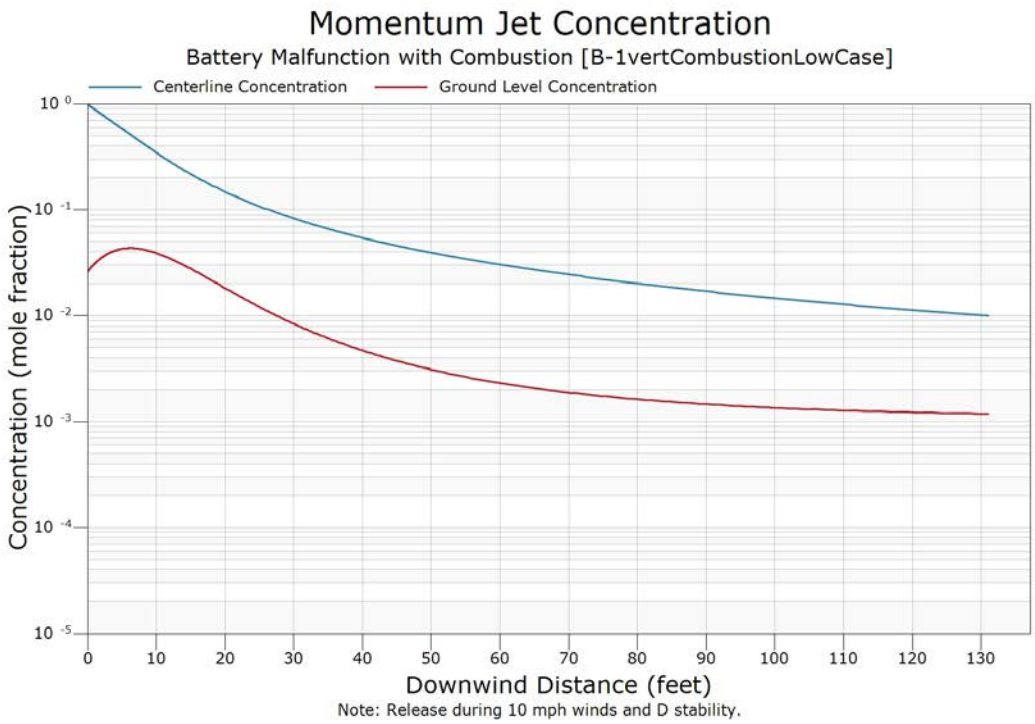
downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
0	1.000000	0.000000	9.1	6.8	5.7	7.7
3	0.760889	0.037002	10.0	7.3	6.0	7.8
5	0.584698	0.042718	10.9	7.8	6.3	8.1
7	0.449199	0.042792	11.8	8.3	6.5	8.6
10	0.346711	0.039003	12.6	8.6	6.6	9.3
13	0.272026	0.033436	13.4	8.9	6.5	10.2
15	0.217595	0.027760	14.2	9.1	6.4	11.2
18	0.177672	0.022592	15.0	9.3	6.0	12.3
20	0.147962	0.018284	15.7	9.3	5.4	13.5
23	0.125401	0.014818	16.3	9.2	4.4	14.8
25	0.107950	0.012120	16.9	9.1	2.7	16.2
28	0.094095	0.010003	17.5	8.8	0.0	17.5
30	0.082968	0.008380	18.0	8.4	0.0	18.9
33	0.073884	0.007133	18.6	7.8	0.0	20.2
35	0.066365	0.006133	19.0	7.0	0.0	21.6
38	0.060083	0.005342	19.4	5.9	0.0	22.9
40	0.054650	0.004694	19.8	4.3	0.0	24.2
43	0.050077	0.004174	20.2	0.2	0.0	25.5
45	0.046089	0.003746	20.5	0.0	0.0	26.8
48	0.042647	0.003396	20.8	0.0	0.0	28.0
50	0.039616	0.003102	21.1	0.0	0.0	29.2
53	0.036935	0.002855	21.3	0.0	0.0	30.4
55	0.034524	0.002645	21.5	0.0	0.0	31.5
58	0.032393	0.002470	21.6	0.0	0.0	32.7
60	0.030473	0.002313	21.7	0.0	0.0	33.8
62	0.028735	0.002181	21.8	0.0	0.0	34.8
65	0.027167	0.002071	21.8	0.0	0.0	35.8
68	0.025744	0.001973	21.9	0.0	0.0	36.8
70	0.024441	0.001882	21.8	0.0	0.0	37.8
73	0.023231	0.001806	21.8	0.0	0.0	38.8
75	0.022144	0.001737	21.7	0.0	0.0	39.7
78	0.021136	0.001679	21.6	0.0	0.0	40.6
80	0.020196	0.001626	21.4	0.0	0.0	41.5
83	0.019320	0.001576	21.2	0.0	0.0	42.3
85	0.018508	0.001533	21.0	0.0	0.0	43.2

downwind distance (ft)	centerline conc. (mole frac.)	ground conc. (mole frac.)	Endpoint3 1/2 width (ft)	Endpoint2 1/2 width (ft)	Endpoint1 1/2 width (ft)	centerline height (ft)
88	0.017752	0.001497	20.7	0.0	0.0	44.0
90	0.017047	0.001460	20.4	0.0	0.0	44.8
93	0.016392	0.001426	20.1	0.0	0.0	45.6
95	0.015773	0.001401	19.7	0.0	0.0	46.3
98	0.015202	0.001375	19.2	0.0	0.0	47.0
100	0.014659	0.001350	18.7	0.0	0.0	47.7
103	0.014147	0.001328	18.2	0.0	0.0	48.4
105	0.013671	0.001311	17.6	0.0	0.0	49.1
108	0.013221	0.001293	16.9	0.0	0.0	49.8
110	0.012795	0.001277	16.1	0.0	0.0	50.4
112	0.012387	0.001262	15.3	0.0	0.0	51.0
115	0.012003	0.001249	14.4	0.0	0.0	51.6
118	0.011638	0.001237	13.3	0.0	0.0	52.2
120	0.011291	0.001226	12.1	0.0	0.0	52.8
123	0.010963	0.001217	10.7	0.0	0.0	53.3
125	0.010647	0.001207	8.9	0.0	0.0	53.9
128	0.010349	0.001199	6.7	0.0	0.0	54.4
130	0.010066	0.001191	2.4	0.0	0.0	55.0

	Endpoint (mole frac., mixture)	Downwind Distance (feet)	Approximate Time (seconds)
1	0.100000	26.4	1
2	0.050000	42.5	2
3	0.010000	130.6	6




Momentum Jet Contours - Side View
Battery Malfunction with Combustion [B-1vertCombustionLowCase]
10.0 mole %
5.0 mole %
1.0 mole %
Height (feet)
0
10
20
30
40
50
60
70
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Downwind Distance(feet)
Note: Release during 10 mph winds and D stability.

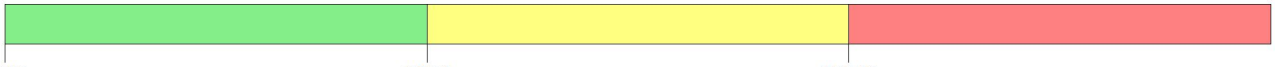

Momentum Jet Concentration
Battery Malfunction with Combustion [B-1vertCombustionLowCase]
Centerline Concentration
Ground Level Concentration
Concentration (mole fraction)
10 0
10 -1
10 -2
10 -3
10 -4
10 -5
0
10
20
30
40
50
60
70
80
90
100
110
120
130
Downwind Distance (feet)
Note: Release during 10 mph winds and D stability.

PROJECT TITLE:

LG Battery Thermal offgassing

PLOT FILE OF HIGH 1ST HIGH 1-HR VALUES FOR SOURCE GROUP: ALL ug/m^3

Max: 13685 [ug/m^3] at (394820.00, 4715931.00)



COMMENTS: HF Contours in ug/m3 corresponding to 10ppm, 5ppm and 1ppm. Note: IDLH is 30ppm	SOURCES: **1**	COMPANY NAME:	
	RECEPTORS: **10000**	MODELER:	
	OUTPUT TYPE: **Concentration**	SCALE: 1:10,721 0 0.4 km	
	MAX: **13685 ug/m^3**	DATE: **5/29/2025**	PROJECT NO.: