PLACEWORKS

# TECHNICAL MEMORANDUM

| | |
|---|---|
| DATE | September 17, 2025 |
| TO | Kathy Tai<br>Development Services Manager<br>City of Industry<br>15625 East Stafford Street, Suite 100, Industry, CA 91744 |
| FROM | Steve Bush, P.E., Senior Engineer |
| SUBJECT | Emergency Air Toxics Analysis for Thermal Runaway Reaction<br>Marici Battery Energy Storage Facility<br>IND-22.17 |

## 1. Introduction

The proposed project involves the construction and operation of an approximately 400-megawatt (MW) battery energy storage system (BESS). The proposed project would provide service to the City of Industry and reliability to the regional electric grid by receiving energy (charging) from the Southern California Edison (SCE) Walnut Substation, storing energy on-site, and then delivering energy (discharging) back to the SCE Substation, which is located at 16398 Gale Avenue in the City of Industry (adjacent to the Project Site's east property line) via an overhead tie-line.

In the past, BESS facilities primarily used lithium-ion battery packs, which were susceptible to thermal runaway reactions resulting in toxic air emissions, fires, and explosions. The proposed project would use lithium iron phosphate (LFP) battery packs, which have better thermal stability, longer lifespan, and less air toxic emissions compared to lithium-ion battery packs (i.e., nickel-manganese-cobalt [NMC] lithium-ion batteries) used at older BESS facilities.

This evaluation is intended to supplement the environmental analysis being conducted for the proposed project pursuant to the California Environmental Quality Act (CEQA). It focuses on the potential air emissions that could result in the event of a thermal runaway reaction and the impacts on the surrounding environment. The following reports were reviewed and included as part of the analysis and discussion contained herein:

- » Hazard Dynamics, Marici Plume Study, dated August 14, 2025.
- » Sungrow, User Manual, Battery Container, PowerTitan 2.0-STU5015UX-2H-US, Version 13, dated April 2025.
- » Fisher Engineering, Fire Protection Engineering Analysis for Tesla Megapack 2 and Megapack 2 XL, dated January 23, 2023.
- » Claasen, M., et. al., Characterization of Lithium-Ion Battery Fire Emissions, Part 2: Particle Size Distributions and Emission Factors. Batteries, 2024, 10 (10), 366. Published October 16, 2024.

## 1.1 PROJECT LOCATION

The 9.2-acre site (Project Site) is in the western end of the City of Industry, which is within Los Angeles County, California. The Project Site is generally bound by Gale Avenue to the south; Ward Way and warehouses and commercial properties to the west; Union Pacific Railroad (UPRR)/Metro rail lines and a rail yard to the north; and the Southern California Edison (SCE) Walnut Substation to the east. The Project Site has addresses of 16233, 16207, and 16253 Gale Avenue, and consists of five contiguous parcels (Assessor's Parcel Numbers 8242-016-033, -034, -036, -044, and -061).

The Project Site is surrounded by a mix of land uses, including industrial and warehouse uses to the north and west, the SCE Walnut Substation to the east, and residential uses to the south beyond Gale Avenue in the unincorporated Los Angeles County community of Hacienda Heights. The nearest sensitive receptors to the project are single-family residences approximately 85 feet south of the Project Site and approximately 110 feet south from the closest proposed battery enclosure.

# 2. BESS Evaluation

## 2.1 PROJECT DESCRIPTION

The selected battery cells and components for the proposed project are the Sungrow PowerTitan 2.0 (ST5015kWh-2H-US), which consist of containerized battery energy storage units. The BESS would be housed in 480 outdoor battery enclosures, each containing 48 battery modules consisting of 104 battery cells (i.e., 4,992 battery cells per enclosure). The battery enclosures are 8 ft long, 9.5 ft high, and 19.9 ft wide. The proposed container and battery cells are depicted in Figure 1.

### Figure 1 – Sungrow PowerTitan 2.0 Components

Source: Hazard Dynamics 2025.

The PowerTitan 2.0 battery type are LFP cells. No toxic air contaminants (TACs) are emitted during normal operation of a BESS. However, there is the potential for TAC emissions to be released during a thermal runaway event if a fire occurs within a container due to battery malfunction, elevated temperatures, and battery combustion. The *Marici Plume Study* conducted by Hazard Dynamics included an evaluation of potential air toxics that could be released from a PowerTitan 2.0 in the scenario of a thermal runaway reaction that consumed all battery cells in a single enclosure (Hazard Dynamics 2025). This is considered a worst-case scenario as battery combustion testing shows that it is not likely for the runaway reaction to propagate between modules (Hazard Dynamics 2025). The results of the *Marici Plume Study* concluded that the concentrations of battery vent gas (such as carbon monoxide) would not result in a significant risk to off-site receptors for any modeled scenario (Hazard Dynamics 2025). The *Marici Plume Study* also conducted flammable gas modeling and found that the flammable region, defined as the lower flammable limit (LFL) was only present above the exhaust vents and the flammable footprint for the ½ LFL and the ¼ LFL extended a distance of only 1.4 meters from the exhaust vent.

## 2.2 LOS ANGELES COUNTY FIRE DEPARTMENT REQUIREMENTS FOR BESS

BESS facilities must meet the requirements of the National Fire Protection Association (NFPA), which issues standards for addressing energy storage systems (NFPA 2022). The proposed BESS battery enclosures would be equipped with fire monitoring systems, controls, and liquid cooling units to keep the batteries at optimal operating temperatures. The fire monitoring systems consist of smoke and heat sensors, gas detectors, alarms, remote monitoring, and an NFPA 69-compliant ventilation system to prevent an explosive atmosphere. The fire protection system would have an alarm that would trigger core power shutdown during a fire, smoke, overheating, overpressure, or other issues. Also, once the concentration of combustible gas reaches 10 percent LEL, the combustible gas detector will activate the exhaust system to turn on. The entire project power shutdown would occur automatically during electrical fault conditions (e.g., high-voltage, high-frequency, ground fault). In addition, the proposed BESS would be equipped with breakers that could be opened manually to power down different equipment at the proposed project.

LACoFD has experience in the permitting of BESS projects and will be responsible for plan checking and approvals. LACoFD has implemented additional permitting requirements to ensure fire safety related to the BESS, as follows:

- Fire Hydrants: Per LACoFD regulations, the project design must include internal hydrants at distances that will ensure a maximum hose pull of 150 feet. This is a shorter distance than is typical for a warehouse building and allows for faster response times for defensive firefighting.
- Training: The BESS facility will include one or two days of fire department training with a qualified fire and battery safety engineer.
- Hazard Mitigation Plan / Emergency Response Plan: The BESS facility will include a formal hazard mitigation analysis and site-level emergency response plan generated by a qualified fire safety engineer for the specific design of the project. This will be reviewed and approved by LACoFD during the building permit process.

- Fire Suppression Systems: Current standards require a dry standpipe connection to the BESS containers. A standpipe is a port in the BESS container that allows a fire hose to be connected to the container. With the provision of a dry standpipe, the local fire department can contain the fire by flooding the system with water, if determined to be the best firefighting option.
- Installation: Each module is tested at the manufacturer's facility and inspected for damage at the Project Site. Once installed and in operational mode, the battery management system (BMS) is calibrated for specific use at the site. The BMS protects the battery cells, modules, and racks from current, voltage and temperature design limit deviations by performing an emergency shutdown, when needed.

## 2.3 SUPPLEMENTAL EVALUATION

This evaluation is intended to supplement the results of the *Marici Plume Study* prepared for the Sungrow PowerTitan 2.0 battery modules and units. The *Marici Plume Study* evaluated the distance at which hazardous conditions would occur for incidents involving toxic gas plumes, flammable vapor clouds, fires, and the release of carbon monoxide. The study used a computer program called Fire Dynamics Simulator, which is a computational fluid dynamics (CFD) software developed for modeling fires and smoke plumes. The results determined that the potential toxic concentrations of carbon monoxide and flammable gas concentrations during a thermal runaway scenario would not extend beyond the boundaries of the Project Site and therefore would not impact off-site receptors (Hazard Dynamics 2025).

To supplement this information, PlaceWorks prepared additional air dispersion modeling and risk determinations for pollutants not evaluated in the *Marici Plume Study*. The smoke generated during a BESS fire may result in fine particulate matter ($PM_{2.5}$) emissions.

It has been previously reported that acidic gases, such as hydrogen fluoride, hydrogen cyanide, and hydrogen chloride, can be released during a thermal runaway event involving lithium-ion battery systems (Consolidated Edison 2017; Claasen 2024). However, the Sungrow PowerTitan 2.0 are LFP batteries, which are a newer battery technology than the nickel-manganese-cobalt (NMC) lithium-ion batteries that had been primarily used over the previous decade. The Sungrow PowerTitan 2.0 battery cells were laboratory-tested to determine the gas composition of the vent gases emitted during a combustion event (Hazard Dynamics 2025).

The only reported TAC emitted from the Sungrow PowerTitan 2.0 battery cells during thermal runaway testing was carbon monoxide (CO) (Hazard Dynamics 2025). Although other gases were released during the testing, such as carbon dioxide, hydrogen, methane, ethylene, ethane, and propane, these gases are not classified as TACs. They are primarily flammable gases and were evaluated further in the Hazard Dynamics report as part of the flammable plume modeling. Although the testing protocol did not specifically evaluate the presence of acidic gases, such as hydrofluoric acid (HF), hydrogen cyanide (HCN) or hydrogen chloride (HCl), studies conducted for similar LFP batteries did not detect these acidic gases during module level testing (Fisher 2023). The emission rate and chemical weight fraction in the cell vent gas for CO was determined from the *Marici Plume Study* (Hazard Dynamics 2025). The calculations are provided in Attachment A.

There is also the potential for hazardous $PM_{2.5}$ emissions (i.e., smoke) from an emergency fire scenario. For due diligence, $PM_{2.5}$ emissions were also evaluated from a potential thermal runaway reaction. The $PM_{2.5}$ emission factor was determined from lithium-ion batteries tested for thermal runaway reactions (Claasen 2024). The calculations are provided in Attachment A.

## 2.4 METHODOLOGY

The modeling evaluated TAC and $PM_{2.5}$ emissions from a thermal runaway event resulting from the failure and combustion of all 48 modules within a single battery enclosure and for a 4-hour release period. This is a more conservative assumption than was used in the *Marici Plume Study*, which assumed a fire duration of two hours. The Consolidated Edison study assumed a 30-minute release period to indicate how long a fire event would burn uncontrolled before first responders would arrive (Consolidated Edison 2017). As previously stated, the BESS would not emit TACs during normal operations and a full health risk assessment (HRA) is not required. However, as a precautionary measure, potential acute risks were determined for nearby sensitive receptors in the case of a battery cell malfunction and thermal runaway event.

The Consolidated Edison study also notes that the failure probability of multiple battery racks (or modules) from a thermal runaway event is low due to fire detection and venting systems and recommends limiting TAC emission estimates to the failure of 1.5 modules. Therefore, the use of a 4-hour release period and the involvement of all 48 modules is conservative. The emission rate calculations are provided in Attachment A.

Air dispersion modeling was performed using the AERMOD atmospheric dispersion model (Lakes AERMOD View, version 13.0). The model is a steady-state Gaussian plume model and is approved by South Coast Air Quality Management District (South Coast AQMD) for estimating ground-level impacts from point and fugitive sources in simple and complex terrain. The model's hour-of-day variable emissions option was invoked to predict ground-level concentrations for a 4-hour release. A unit emission rate of 1 gram per second (g/s) was used for modeling. The battery enclosures were modeled as point sources with the following parameters:

» Stack Release Height = Height of enclosure = 9.5 feet
» Effective Stack Diameter = 14.23 ft (rectangular area of battery enclosure roof, converted to an effective diameter)
» Stack Temperature = 240 Celsius (Fisher Engineering 2023)
» Flow Rate = 2.5 m/s (Tetra Tech 2023)

Two stacks were modeled, with one placed at the southwest corner of the Project Site and one placed at the southeast corner, nearest to the residential area to the south of the Project Site. A 25-meter by 25-meter receptor grid was used to determine potential impacts to residential receptors to the south. The results confirmed that the maximum exposed individual resident (MEIR) was located at a residence approximately 120 feet south of the Project Site.

Short-term (1-hour and 24-hour) ground-level concentrations were determined using AERMOD. The maximum AERMOD concentrations from the output files were then multiplied by the calculated pollutant emission rates to obtain the maximum ground-level concentrations at the MEIR. The AERMOD model output is presented in Attachment B. The maximum ground-level concentrations at the MEIR are provided in Attachment A.

To determine the significance of air emissions, the 1-hour and 24-hour pollutant concentrations were compared to the Acute Emergency Guideline Levels (AEGLs) for CO. The United States Environmental Protection Agency (USEPA) promulgates AEGLs to be used by emergency planners and responders as guidance for accidental releases of chemicals into the air (USEPA 2024a). AEGLs represent threshold values for the general public and are determined for short exposure periods (e.g., 10 min, 30 min, 1 hour, 4 hours, 8 hours) and are presented in parts per millions (ppm) for 3 levels based on severity of the chemical in air:

» AEGL Level 1. This concentration level shows notable discomfort and irritation but is not disabling.
» AEGL Level 2. This concentration level shows irreversible or serious, long-lasting adverse health effects.
» AEGL Level 3. This concentration level shows life-threatening health effects or death.

Concentrations below AEGL-1 represent exposure levels that could produce mild and non-disabling irritation, or asymptomatic, non-sensory effects.

Potential hazardous $PM_{2.5}$ emissions would only occur for a limited period-of-time from an emergency event. Therefore, for $PM_{2.5}$, the 24-hour $PM_{2.5}$ ground-level concentrations were compared to the corresponding Air Quality Index (AQI) value.

## 2.5 RESULTS AND CONCLUSIONS

The results of the emergency air toxics evaluation are provided in Table 1, *Emergency Air Toxics Analysis Results – Maximum Exposed Individual Resident*. Based on the AERMOD receptor grid, the MEIR was determined to be a single-family residence approximately 120 feet south of the Project Site. As demonstrated in Table 1, the maximum 1-hour ground-level concentration for CO did not exceed the AEGL levels for any of the averaging times (i.e., 10 minutes to 8 hours). The maximum 24-hour $PM_{2.5}$ concentration was calculated to be 145 µg/m$^3$ at the MEIR. The resulting AQI for a concentration of 145 µg/m$^3$ would be 220, which is between 201 and 300, and the air would be categorized as very unhealthy (USEPA 2024b). For this AQI category, USEPA recommends that children, active adults, and people with respiratory diseases, such as asthma, should avoid outdoor exertion and all others should limit prolonged outdoor exertion.

The AQI is a measure of ambient outdoor air concentrations. Studies conducted during wildfire events in California with high $PM_{2.5}$ concentrations showed that indoor air concentrations were 73 percent lower than outdoor air concentrations due to measures taken to reduce infiltration, such as closing doors and windows, reducing ventilation, and active air filtration (Liang et al 2021). In the unlikely event of a thermal runaway, precautions should be taken to limit outdoor activities and stay inside.

TABLE 1 EMERGENCY AIR TOXICS ANALYSIS RESULTS – MAXIMUM EXPOSED INDIVIDUAL RESIDENT

| Air Pollutant | Emission Rate for Enclosure (g/s) | 1-Hour Ground-Level Concentration (ppm) | Threshold: 1-hr AEGL (ppm) | Exceeds Threshold? |
|---|---|---|---|---|
| Carbon Monoxide | 269.0 | 7.2 | AEGL-1: n/r<br>AEGL-2: 83<br>AEGL-3: 330 | No, it does not exceed AEGL-2 or 3 for any averaging time |

Notes: n/r = not recommended due to insufficient data (USEPA 2024a).

It should also be noted that this evaluation is a worst-case emergency scenario. There are no reported failures that would cause thermal runaway to occur in all 4,992 cells that make up a battery enclosure (Hazard Dynamics 2025). Also, there have been no reported incidents for fires associated with Sungrow PowerTitan 2.0 battery enclosures (North American Clean Energy 2025; EPRI 2025). The PowerTitan 2.0 also uses a closed-loop liquid cooling system to maintain optimal operating temperatures. Impacts associated with $PM_{2.5}$ emissions resulting from smoke would be transient in nature and not likely to last more than 24 hours.

# 3. Conclusions

In summary, PlaceWorks conducted a supplementary evaluation of air toxics and fine particulate matter ($PM_{2.5}$) emissions from a worst-case thermal runway scenario associated with the proposed BESS facility. The results indicate that the BESS facility would not expose nearby sensitive receptors (i.e., residents) nor adjacent industrial land uses to TAC concentrations in the event of a thermal runaway event and impacts are considered less than significant.

However, there is potential for nearby sensitive receptors and adjacent industrial land uses to be exposed to hazardous $PM_{2.5}$ emissions for this emergency scenario. Short-term smoke emissions in the immediate vicinity of a potential fire are predicted to result in an AQI between 201 and 300. USEPA's main recommendation for very unhealthy hazardous smoke events is to avoid or limit outdoor activities. Additionally, the Project Site is within 0.15-mile of LACoFD Station No. 43, which would ensure a prompt response in the event of a fire at the Project Site.

In recent years, public concern for BESS facilities has increased due to catastrophic fires such as the Moss Landing, CA BESS fire in January 2025. However, it should be noted that the Moss Landing BESS differs from the proposed project in several ways. First, the Moss Landing BESS placed large numbers of battery racks in a single enclosed indoor space, which is conducive to the rapid spread of flames (Battery Technology 2025). Second, the Moss Landing BESS used the older NMC lithium-ion cells, which have a higher risk of overheating and combustion when compared to LFP cells. LACoFD's recent expanded requirements for BESS facilities have reduced the likelihood of thermal runaway and fire scenarios. Finally, each Sungrow PowerTitan 2.0 battery enclosure includes a liquid coolant system which provides superior temperature control and extended battery life as compared to air cooled systems. Each enclosure also contains a ventilation system to exhaust vent gases in case of cell failure, heat and smoke detectors, and flammable gas detectors. The battery enclosures will be located outdoors and properly spaced to reduce the potential for thermal runaway scenarios by dissipating any generated heat. Therefore, the design of the proposed project would result in a reduction in the potential for fire propagation as compared to older BESS facilities.

Respectfully submitted,

PlaceWorks

Steve Bush, PE
Senior Engineer

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## Attachment A – Emission Rate and Risk Calculations

## Thermal Runaway Reaction

Receptor: MEIR 120 feet South of the facility

| Pollutant | g/Wh | g/cell | g/enclosure | g/s | AERMOD OUTPUT 24-hour (unit ER) | 24-hr GLC µg/m3 | AQI | AQI, USEPA Recommendation |
|---|---|---|---|---|---|---|---|---|
| PM2.5 | 0.14 | 140.65 | 7.02E+05 | 48.76 | 2.974 | 145.0 | 220 | 201-300, limit prolonged outdoor exertion |

Reference: Claasen et al, "Characterization of Lithium-Ion Battery Fire Emissions - Part 2: Particle Size Distribution and Emission Factors", Published Oct 16, 2024, in Batteries 2024.

| | MW (g/mol) | Fraction | g/s/cell | g/s | AERMOD OUTPUT 1-hour (unit ER) µg/m3 | 1-hour GLC µg/m3 | 1-hour GLC ppm | Exceeds AEGLs? |
|---|---|---|---|---|---|---|---|---|
| FRA Modeling | | | | | | | | |
| Total Vent Gas | | 1.00 | 0.387 | | | | | |
| Carbon Monoxide | 28 | 0.14 | 5.39E-02 | 269.0 | 30.47 | 8195 | 7.2 | < below AEGL 2, 3 for ALL time averages (10 min to 8 hr)* |

Reference: Hazard Dynamics, Marici Plume Study (August 14, 2025). Gas Composition based on UL 9450A Cell Level Testing, conducted by CSA Group - Kunshan Branch 11/17/2023 for LFP cells.

NOTE: Assumes 4-hour fire duration

* AEGL 1 for CO not made available from EPA

104 cells per module (Sungrow 2025)

48 modules per container

4992 cells per container

480 number of containers/enclosures

Total Power 5.015 MWh capacity for single enclosure (Sungrow 2025, User Manual PowerTitan 2.0)

1,005 Wh/cell

14,400 seconds/4-hour fire

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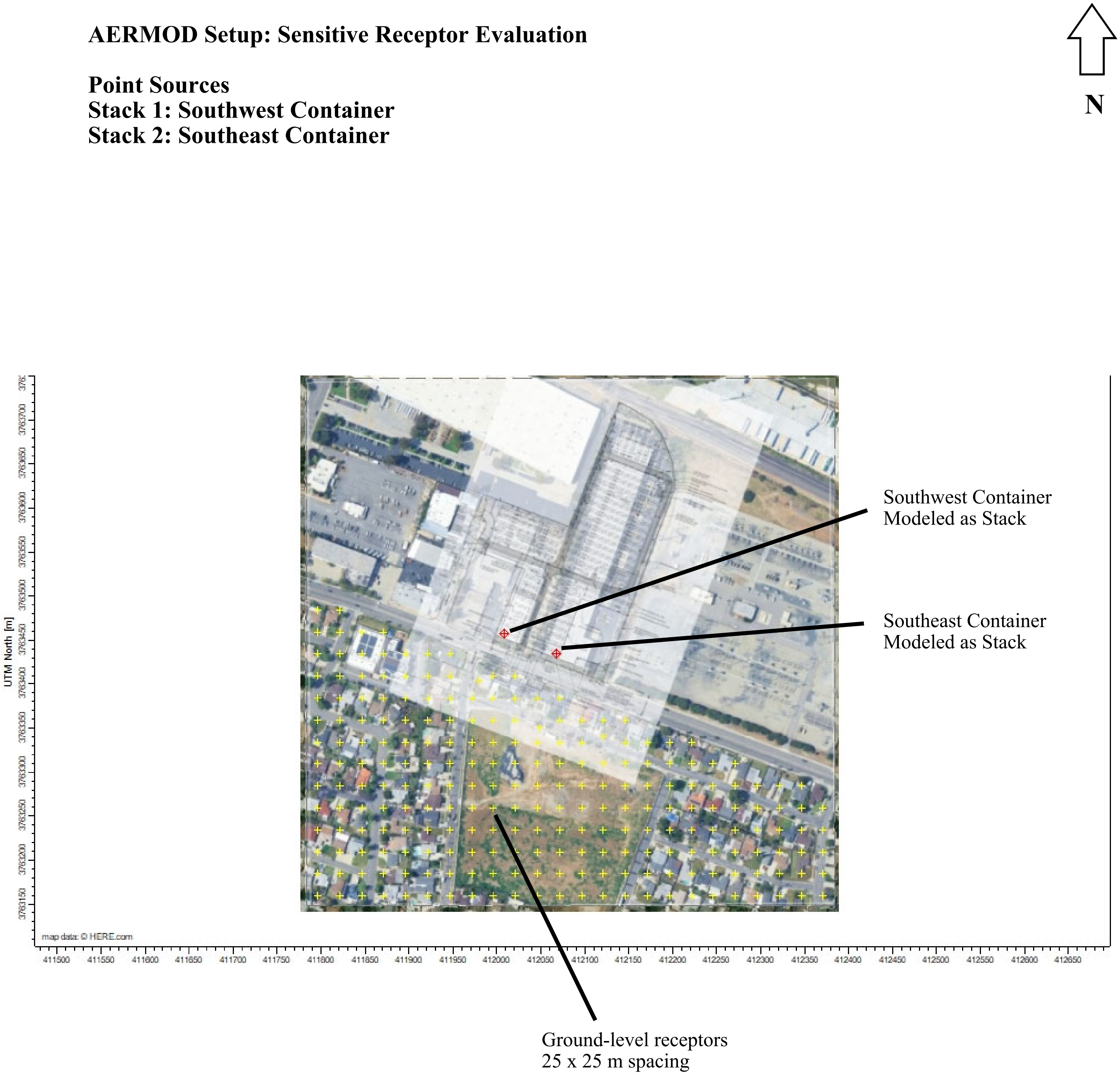
## Attachment B – Air Dispersion Model Output

**AERMOD Setup: Sensitive Receptor Evaluation**

**Point Sources**
**Stack 1: Southwest Container**
**Stack 2: Southeast Container**



# Control Pathway

AERMOD

## Dispersion Options

**Titles**

Marici BESS
Emergency Thermal Runaway Reaction Analysis

### Dispersion Options

- [x] Regulatory Default
- [ ] Non-Default Options

### Dispersion Coefficient

Urban

Population:
Name (Optional):
Roughness Length:

### Output Type

- [x] Concentration
- [ ] Total Deposition (Dry & Wet)
- [ ] Dry Deposition
- [ ] Wet Deposition

### Plume Depletion

- [ ] Dry Removal
- [ ] Wet Removal

### Output Warnings

- [ ] No Output Warnings
- [ ] Non-fatal Warnings for Non-sequential Met Data

## Pollutant / Averaging Time / Terrain Options

### Pollutant Type

### Averaging Time Options

Hours

| 1 | 2 | 3 | 4 | 6 | 8 | 12 | 24 |
|---|---|---|---|---|---|---|---|
| [x] | [ ] | [ ] | [ ] | [ ] | [ ] | [ ] | [x] |

- [ ] Month
- [ ] Period
- [ ] Annual

### Exponential Decay

Half Life of 4 hrs will be used
Option not available

### Terrain Height Options

- [ ] Flat
- [x] Elevated

SO: Meters
RE: Meters
TG: Meters

### Flagpole Receptors

- [ ] Yes
- [x] No

Default Height = 0.00 m

## Optional Files

| | | | | |
|---|---|---|---|---|
| ☐ Re-Start File | ☐ Init File | ☐ Multi-Year Analyses | ☐ Event Input File | ☒ Error Listing File |

### Detailed Error Listing File

Filename: IND22.err

# Source Pathway - Source Inputs

AERMOD

## Point Sources

| Source Type | Source ID | X Coordinate [m] | Y Coordinate [m] | Base Elevation (Optional) | Release Height [m] | Emission Rate [g/s] | Gas Exit Temp. [K] | Gas Exit Velocity [m/s] | Stack Inside Diameter [m] |
|---|---|---|---|---|---|---|---|---|---|
| POINT | WEST | 412008.45<br>southwest container | 3763457.23 | 107.10 | 2.90 | 1.00000 | 513.15 | 2.50 | 4.34 |
| POINT | EAST | 412068.22<br>southeast container | 3763434.16 | 108.05 | 2.90 | 1.00000 | 513.15 | 2.50 | 4.34 |

## Building Downwash Information

Option not in use

## Emission Rate Units for Output

**For Concentration**

| | |
|---|---|
| Unit Factor: | 1E6 |
| Emission Unit Label: | GRAMS/SEC |
| Concentration Unit Label: | MICROGRAMS/M**3 |

## Source Groups

| Source Group ID: WEST | List of Sources in Group (Source Range or Single Sources) |
|---|---|
| | WEST |

| Source Group ID: EAST | List of Sources in Group (Source Range or Single Sources) |
|---|---|
| | EAST |

## Variable Emissions

### Hourly Emission Rate Variation

**Scenario: 4Hour**

| Source ID: WEST | | | | | | |
|---|---|---|---|---|---|---|
| 1 to 6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7 to 12 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 13 to 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 to 24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| Source ID: EAST | | | | | | |
|---|---|---|---|---|---|---|
| 1 to 6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7 to 12 | 0.00 | 0.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 13 to 18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 to 24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

## Receptor Networks

Note: Terrain Elavations and Flagpole Heights for Network Grids are in Page RE2 - 1 (If applicable)
Generated Discrete Receptors for Multi-Tier (Risk) Grid and Receptor Locations for Fenceline Grid are in Page RE3 - 1 (If applicable)

## Discrete Receptors

### Discrete Cartesian Receptors

| Record Number | X-Coordinate [m] | Y-Coordinate [m] | Group Name (Optional) | Terrain Elevations | Flagpole Heights [m] (Optional) |
|---|---|---|---|---|---|
| 1 | 411796.07 | 3763159.23 | UCART1 | 110.50 | |
| 2 | 411821.07 | 3763159.23 | UCART1 | 110.40 | |
| 3 | 411846.07 | 3763159.23 | UCART1 | 110.15 | |
| 4 | 411871.07 | 3763159.23 | UCART1 | 110.57 | |
| 5 | 411896.07 | 3763159.23 | UCART1 | 111.06 | |
| 6 | 411921.07 | 3763159.23 | UCART1 | 110.80 | |
| 7 | 411946.07 | 3763159.23 | UCART1 | 110.64 | |
| 8 | 411971.07 | 3763159.23 | UCART1 | 111.48 | |
| 9 | 411996.07 | 3763159.23 | UCART1 | 111.46 | |
| 10 | 412021.07 | 3763159.23 | UCART1 | 111.28 | |
| 11 | 412046.07 | 3763159.23 | UCART1 | 111.37 | |
| 12 | 412071.07 | 3763159.23 | UCART1 | 111.53 | |
| 13 | 412096.07 | 3763159.23 | UCART1 | 111.74 | |
| 14 | 412121.07 | 3763159.23 | UCART1 | 111.95 | |
| 15 | 412146.07 | 3763159.23 | UCART1 | 111.70 | |
| 16 | 412171.07 | 3763159.23 | UCART1 | 112.08 | |
| 17 | 412196.07 | 3763159.23 | UCART1 | 112.57 | |
| 18 | 412221.07 | 3763159.23 | UCART1 | 112.56 | |
| 19 | 412246.07 | 3763159.23 | UCART1 | 112.60 | |
| 20 | 412271.07 | 3763159.23 | UCART1 | 112.63 | |
| 21 | 412296.07 | 3763159.23 | UCART1 | 112.60 | |
| 22 | 412321.07 | 3763159.23 | UCART1 | 112.53 | |
| 23 | 412346.07 | 3763159.23 | UCART1 | 112.66 | |
| 24 | 412371.07 | 3763159.23 | UCART1 | 112.74 | |
| 25 | 411796.07 | 3763184.23 | UCART1 | 109.61 | |
| 26 | 411821.07 | 3763184.23 | UCART1 | 109.56 | |
| 27 | 411846.07 | 3763184.23 | UCART1 | 109.63 | |
| 28 | 411871.07 | 3763184.23 | UCART1 | 110.07 | |
| 29 | 411896.07 | 3763184.23 | UCART1 | 110.46 | |
| 30 | 411921.07 | 3763184.23 | UCART1 | 110.55 | |

| | | | | |
|---|---|---|---|---|
| 31 | 411946.07 | 3763184.23 | UCART1 | 109.98 |
| 32 | 411971.07 | 3763184.23 | UCART1 | 110.42 |
| 33 | 411996.07 | 3763184.23 | UCART1 | 110.63 |
| 34 | 412021.07 | 3763184.23 | UCART1 | 110.89 |
| 35 | 412046.07 | 3763184.23 | UCART1 | 111.01 |
| 36 | 412071.07 | 3763184.23 | UCART1 | 111.14 |
| 37 | 412096.07 | 3763184.23 | UCART1 | 111.32 |
| 38 | 412121.07 | 3763184.23 | UCART1 | 111.59 |
| 39 | 412146.07 | 3763184.23 | UCART1 | 111.51 |
| 40 | 412171.07 | 3763184.23 | UCART1 | 111.52 |
| 41 | 412196.07 | 3763184.23 | UCART1 | 111.68 |
| 42 | 412221.07 | 3763184.23 | UCART1 | 111.85 |
| 43 | 412246.07 | 3763184.23 | UCART1 | 111.79 |
| 44 | 412271.07 | 3763184.23 | UCART1 | 111.76 |
| 45 | 412296.07 | 3763184.23 | UCART1 | 112.16 |
| 46 | 412321.07 | 3763184.23 | UCART1 | 112.63 |
| 47 | 412346.07 | 3763184.23 | UCART1 | 112.71 |
| 48 | 412371.07 | 3763184.23 | UCART1 | 112.29 |
| 49 | 411796.07 | 3763209.23 | UCART1 | 109.26 |
| 50 | 411821.07 | 3763209.23 | UCART1 | 109.79 |
| 51 | 411846.07 | 3763209.23 | UCART1 | 109.58 |
| 52 | 411871.07 | 3763209.23 | UCART1 | 109.53 |
| 53 | 411896.07 | 3763209.23 | UCART1 | 110.03 |
| 54 | 411921.07 | 3763209.23 | UCART1 | 110.22 |
| 55 | 411946.07 | 3763209.23 | UCART1 | 109.63 |
| 56 | 411971.07 | 3763209.23 | UCART1 | 110.10 |
| 57 | 411996.07 | 3763209.23 | UCART1 | 110.32 |
| 58 | 412021.07 | 3763209.23 | UCART1 | 110.50 |
| 59 | 412046.07 | 3763209.23 | UCART1 | 110.63 |
| 60 | 412071.07 | 3763209.23 | UCART1 | 110.78 |
| 61 | 412096.07 | 3763209.23 | UCART1 | 110.95 |
| 62 | 412121.07 | 3763209.23 | UCART1 | 111.20 |
| 63 | 412146.07 | 3763209.23 | UCART1 | 111.27 |
| 64 | 412171.07 | 3763209.23 | UCART1 | 110.93 |
| 65 | 412196.07 | 3763209.23 | UCART1 | 111.06 |
| 66 | 412221.07 | 3763209.23 | UCART1 | 111.27 |
| 67 | 412246.07 | 3763209.23 | UCART1 | 111.69 |
| 68 | 412271.07 | 3763209.23 | UCART1 | 112.10 |

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|---|---|---|---|---|
| 69 | 412296.07 | 3763209.23 | UCART1 | 112.33 |
| 70 | 412321.07 | 3763209.23 | UCART1 | 112.27 |
| 71 | 412346.07 | 3763209.23 | UCART1 | 112.19 |
| 72 | 412371.07 | 3763209.23 | UCART1 | 111.89 |
| 73 | 411796.07 | 3763234.23 | UCART1 | 109.44 |
| 74 | 411821.07 | 3763234.23 | UCART1 | 109.36 |
| 75 | 411846.07 | 3763234.23 | UCART1 | 109.09 |
| 76 | 411871.07 | 3763234.23 | UCART1 | 109.11 |
| 77 | 411896.07 | 3763234.23 | UCART1 | 109.53 |
| 78 | 411921.07 | 3763234.23 | UCART1 | 109.96 |
| 79 | 411946.07 | 3763234.23 | UCART1 | 109.31 |
| 80 | 411971.07 | 3763234.23 | UCART1 | 109.82 |
| 81 | 411996.07 | 3763234.23 | UCART1 | 109.99 |
| 82 | 412021.07 | 3763234.23 | UCART1 | 110.05 |
| 83 | 412046.07 | 3763234.23 | UCART1 | 110.20 |
| 84 | 412071.07 | 3763234.23 | UCART1 | 110.42 |
| 85 | 412096.07 | 3763234.23 | UCART1 | 110.57 |
| 86 | 412121.07 | 3763234.23 | UCART1 | 110.67 |
| 87 | 412146.07 | 3763234.23 | UCART1 | 110.72 |
| 88 | 412171.07 | 3763234.23 | UCART1 | 110.54 |
| 89 | 412196.07 | 3763234.23 | UCART1 | 110.93 |
| 90 | 412221.07 | 3763234.23 | UCART1 | 111.54 |
| 91 | 412246.07 | 3763234.23 | UCART1 | 111.53 |
| 92 | 412271.07 | 3763234.23 | UCART1 | 111.41 |
| 93 | 412296.07 | 3763234.23 | UCART1 | 111.52 |
| 94 | 412321.07 | 3763234.23 | UCART1 | 111.56 |
| 95 | 412346.07 | 3763234.23 | UCART1 | 111.48 |
| 96 | 412371.07 | 3763234.23 | UCART1 | 111.53 |
| 97 | 411796.07 | 3763259.23 | UCART1 | 108.74 |
| 98 | 411821.07 | 3763259.23 | UCART1 | 108.62 |
| 99 | 411846.07 | 3763259.23 | UCART1 | 108.51 |
| 100 | 411871.07 | 3763259.23 | UCART1 | 108.70 |
| 101 | 411896.07 | 3763259.23 | UCART1 | 109.20 |
| 102 | 411921.07 | 3763259.23 | UCART1 | 109.74 |
| 103 | 411946.07 | 3763259.23 | UCART1 | 109.01 |
| 104 | 411971.07 | 3763259.23 | UCART1 | 109.43 |
| 105 | 411996.07 | 3763259.23 | UCART1 | 109.36 |
| 106 | 412021.07 | 3763259.23 | UCART1 | 109.53 |

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|---|---|---|---|---|
| 107 | 412046.07 | 3763259.23 | UCART1 | 109.68 |
| 108 | 412071.07 | 3763259.23 | UCART1 | 109.91 |
| 109 | 412096.07 | 3763259.23 | UCART1 | 110.14 |
| 110 | 412121.07 | 3763259.23 | UCART1 | 110.51 |
| 111 | 412146.07 | 3763259.23 | UCART1 | 110.52 |
| 112 | 412171.07 | 3763259.23 | UCART1 | 110.30 |
| 113 | 412196.07 | 3763259.23 | UCART1 | 110.34 |
| 114 | 412221.07 | 3763259.23 | UCART1 | 110.66 |
| 115 | 412246.07 | 3763259.23 | UCART1 | 110.67 |
| 116 | 412271.07 | 3763259.23 | UCART1 | 110.65 |
| 117 | 412296.07 | 3763259.23 | UCART1 | 110.65 |
| 118 | 412321.07 | 3763259.23 | UCART1 | 110.95 |
| 119 | 412346.07 | 3763259.23 | UCART1 | 111.47 |
| 120 | 412371.07 | 3763259.23 | UCART1 | 111.34 |
| 121 | 411796.07 | 3763284.23 | UCART1 | 108.16 |
| 122 | 411821.07 | 3763284.23 | UCART1 | 108.60 |
| 123 | 411846.07 | 3763284.23 | UCART1 | 108.79 |
| 124 | 411871.07 | 3763284.23 | UCART1 | 108.36 |
| 125 | 411896.07 | 3763284.23 | UCART1 | 108.85 |
| 126 | 411921.07 | 3763284.23 | UCART1 | 109.43 |
| 127 | 411946.07 | 3763284.23 | UCART1 | 108.73 |
| 128 | 411971.07 | 3763284.23 | UCART1 | 109.06 |
| 129 | 411996.07 | 3763284.23 | UCART1 | 109.24 |
| 130 | 412021.07 | 3763284.23 | UCART1 | 110.60 |
| 131 | 412046.07 | 3763284.23 | UCART1 | 109.96 |
| 132 | 412071.07 | 3763284.23 | UCART1 | 109.86 |
| 133 | 412096.07 | 3763284.23 | UCART1 | 109.88 |
| 134 | 412121.07 | 3763284.23 | UCART1 | 110.00 |
| 135 | 412146.07 | 3763284.23 | UCART1 | 109.96 |
| 136 | 412171.07 | 3763284.23 | UCART1 | 109.99 |
| 137 | 412196.07 | 3763284.23 | UCART1 | 109.66 |
| 138 | 412221.07 | 3763284.23 | UCART1 | 109.77 |
| 139 | 412246.07 | 3763284.23 | UCART1 | 109.89 |
| 140 | 412271.07 | 3763284.23 | UCART1 | 110.42 |
| 141 | 412296.07 | 3763284.23 | UCART1 | 110.91 |
| 142 | 412321.07 | 3763284.23 | UCART1 | 111.20 |
| 143 | 412346.07 | 3763284.23 | UCART1 | 110.95 |
| 144 | 411796.07 | 3763309.23 | UCART1 | 108.60 |

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|---|---|---|---|---|
| 145 | 411821.07 | 3763309.23 | UCART1 | 108.74 |
| 146 | 411846.07 | 3763309.23 | UCART1 | 108.48 |
| 147 | 411871.07 | 3763309.23 | UCART1 | 108.04 |
| 148 | 411896.07 | 3763309.23 | UCART1 | 108.66 |
| 149 | 411921.07 | 3763309.23 | UCART1 | 109.13 |
| 150 | 411946.07 | 3763309.23 | UCART1 | 108.52 |
| 151 | 411971.07 | 3763309.23 | UCART1 | 108.76 |
| 152 | 411996.07 | 3763309.23 | UCART1 | 109.08 |
| 153 | 412021.07 | 3763309.23 | UCART1 | 110.47 |
| 154 | 412046.07 | 3763309.23 | UCART1 | 109.70 |
| 155 | 412071.07 | 3763309.23 | UCART1 | 109.84 |
| 156 | 412096.07 | 3763309.23 | UCART1 | 109.70 |
| 157 | 412121.07 | 3763309.23 | UCART1 | 109.50 |
| 158 | 412146.07 | 3763309.23 | UCART1 | 109.39 |
| 159 | 412171.07 | 3763309.23 | UCART1 | 109.25 |
| 160 | 412196.07 | 3763309.23 | UCART1 | 109.48 |
| 161 | 412221.07 | 3763309.23 | UCART1 | 109.98 |
| 162 | 412246.07 | 3763309.23 | UCART1 | 110.22 |
| 163 | 412271.07 | 3763309.23 | UCART1 | 110.38 |
| 164 | 411796.07 | 3763334.23 | UCART1 | 107.95 |
| 165 | 411821.07 | 3763334.23 | UCART1 | 107.89 |
| 166 | 411846.07 | 3763334.23 | UCART1 | 107.86 |
| 167 | 411871.07 | 3763334.23 | UCART1 | 107.78 |
| 168 | 411896.07 | 3763334.23 | UCART1 | 108.28 |
| 169 | 411921.07 | 3763334.23 | UCART1 | 108.90 |
| 170 | 411946.07 | 3763334.23 | UCART1 | 108.29 |
| 171 | 411971.07 | 3763334.23 | UCART1 | 108.46 |
| 172 | 411996.07 | 3763334.23 | UCART1 | 108.73 |
| 173 | 412021.07 | 3763334.23 | UCART1 | 109.08 |
| 174 | 412046.07 | 3763334.23 | UCART1 | 109.01 |
| 175 | 412071.07 | 3763334.23 | UCART1 | 108.83 |
| 176 | 412096.07 | 3763334.23 | UCART1 | 108.77 |
| 177 | 412121.07 | 3763340.59 | UCART1 | 109.07 |
| 178 | 412146.07 | 3763334.23 | UCART1 | 109.37 |
| 179 | 412171.07 | 3763334.23 | UCART1 | 109.60 |
| 180 | 412196.07 | 3763334.23 | UCART1 | 109.71 |
| 181 | 412221.07 | 3763334.23 | UCART1 | 109.46 |
| 182 | 411796.07 | 3763359.23 | UCART1 | 107.40 |

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|---|---|---|---|---|
| 183 | 411821.07 | 3763359.23 | UCART1 | 107.50 |
| 184 | 411846.07 | 3763359.23 | UCART1 | 107.77 |
| 185 | 411871.07 | 3763359.23 | UCART1 | 108.01 |
| 186 | 411896.07 | 3763359.23 | UCART1 | 108.18 |
| 187 | 411921.07 | 3763359.23 | UCART1 | 108.61 |
| 188 | 411946.07 | 3763359.23 | UCART1 | 108.08 |
| 189 | 411971.07 | 3763359.23 | UCART1 | 108.07 |
| 190 | 411996.07 | 3763359.23 | UCART1 | 108.29 |
| 191 | 412021.07 | 3763359.23 | UCART1 | 108.27 |
| 192 | 412048.67 | 3763349.69 | UCART1 | 108.46 |
| 193 | 412071.07 | 3763359.23 | UCART1 | 108.74 |
| 194 | 412096.07 | 3763359.23 | UCART1 | 109.11 |
| 195 | 412121.07 | 3763359.23 | UCART1 | 109.29 |
| 196 | 412146.07 | 3763359.23 | UCART1 | 109.07 |
| 197 | 411796.07 | 3763384.23 | UCART1 | 107.24 |
| 198 | 411821.07 | 3763384.23 | UCART1 | 107.88 |
| 199 | 411846.07 | 3763384.23 | UCART1 | 107.98 |
| 200 | 411871.07 | 3763384.23 | UCART1 | 107.86 |
| 201 | 411896.07 | 3763384.23 | UCART1 | 107.68 |
| 202 | 411921.07 | 3763384.23 | UCART1 | 108.30 |
| 203 | 411946.07 | 3763384.23 | UCART1 | 107.98 |
| 204 | 411971.07 | 3763384.23 | UCART1 | 107.69 |
| 205 | 411996.07 | 3763384.23 | UCART1 | 108.20 |
| 206 | 412021.07 | 3763384.23 | UCART1 | 108.52 |
| 207 | 412046.07 | 3763384.23 | UCART1 | 108.79 |
| 208 | 412071.07 | 3763384.23 | UCART1 | 108.74 |
| 209 | 411796.07 | 3763409.23 | UCART1 | 106.90 |
| 210 | 411821.07 | 3763409.23 | UCART1 | 107.29 |
| 211 | 411846.07 | 3763409.23 | UCART1 | 107.55 |
| 212 | 411871.07 | 3763409.23 | UCART1 | 107.72 |
| 213 | 411896.07 | 3763409.23 | UCART1 | 107.72 |
| 214 | 411921.07 | 3763409.23 | UCART1 | 107.96 |
| 215 | 411946.07 | 3763409.23 | UCART1 | 108.00 |
| 216 | 411978.87 | 3763404.32 | UCART1 | 107.78 |
| 217 | 411996.07 | 3763409.23 | UCART1 | 108.12 |
| 218 | 412021.07 | 3763409.23 | UCART1 | 107.94 |
| 219 | 411796.07 | 3763434.23 | UCART1 | 107.01 |
| 220 | 411821.07 | 3763434.23 | UCART1 | 106.83 |

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|---|---|---|---|---|---|
| 221 | 411846.07 | 3763434.23 | UCART1 | 107.82 | |
| 222 | 411871.07 | 3763434.23 | UCART1 | 107.82 | |
| 223 | 411896.07 | 3763434.23 | UCART1 | 107.53 | |
| 224 | 411921.07 | 3763434.23 | UCART1 | 107.53 | |
| 225 | 411946.07 | 3763434.23 | UCART1 | 107.64 | |
| 226 | 411796.07 | 3763459.23 | UCART1 | 106.85 | |
| 227 | 411821.07 | 3763459.23 | UCART1 | 106.49 | |
| 228 | 411846.07 | 3763459.23 | UCART1 | 107.74 | |
| 229 | 411871.07 | 3763459.23 | UCART1 | 107.44 | |
| 230 | 411796.07 | 3763484.23 | UCART1 | 106.98 | |
| 231 | 411821.07 | 3763484.23 | UCART1 | 106.38 | |

## Plant Boundary Receptors

## Receptor Groups

| Record Number | Group ID | Group Description |
|---|---|---|
| 1 | UCART1 | Receptors generated from Uniform Cartesian Grid |

# Meteorology Pathway



## Met Input Data

### Surface Met Data

Filename: ..\22.14_AERMOD\IND_BESS\AZUS_V11_trimmed.sfc

Format Type: Default AERMET format

### Profile Met Data

Filename: ..\22.14_AERMOD\IND_BESS\AZUS_V11_trimmed.PFL

Format Type: Default AERMET format

### Wind Speed

☐ Wind Speeds are Vector Mean (Not Scalar Means)

### Wind Direction

Rotation Adjustment [deg]:

### Potential Temperature Profile

Base Elevation above MSL (for Primary Met Tower): 187.00 [m]

### Meteorological Station Data

| Stations | Station No. | Year | X Coordinate [m] | Y Coordinate [m] | Station Name |
|---|---|---|---|---|---|
| Surface | | 2017 | | | |
| Upper Air | | 2017 | | | |
| On-Site | | 2017 | | | |

## Data Period

### Data Period to Process

Start Date: 1/1/2017 Start Hour: 1 End Date: 12/31/2021 End Hour: 24

## Wind Speed Categories

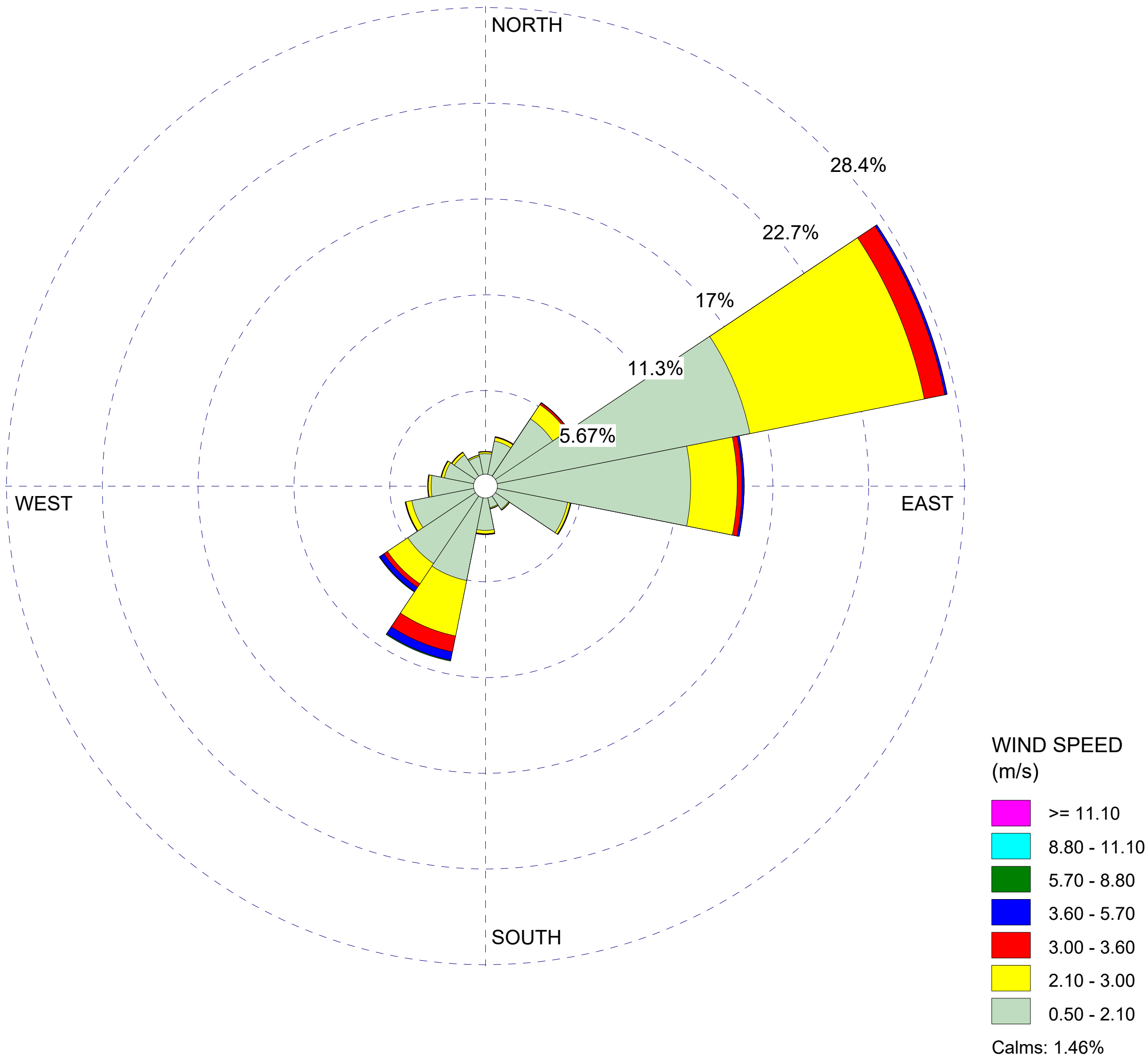
| Stability Category | Wind Speed [m/s] | Stability Category | Wind Speed [m/s] |
|---|---|---|---|
| A | 1.54 | D | 8.23 |
| B | 3.09 | E | 10.8 |
| C | 5.14 | F | No Upper Bound |

WIND ROSE PLOT:

**Azusa Meteorological Station**
**2017-2021**

DISPLAY:

**Wind Speed**
**Flow Vector (blowing to)**




COMMENTS:

All Hours

DATA PERIOD:

**Start Date: 1/1/2017 - 00:00**
**End Date: 12/31/2021 - 23:59**

COMPANY NAME:

**PlaceWorks**

MODELER:

**SB**

CALM WINDS:

**1.46%**

TOTAL COUNT:

**43824 hrs.**

AVG. WIND SPEED:

**1.61 m/s**

DATE:

**9/5/2025**

PROJECT NO.:

**IND-22.17**

WRPLOT View - Lakes Environmental Software

# Results Summary

Marici BESS
Emergency Thermal Runaway Reaction Analysis

**Concentration - Source Group: EAST**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| 1-HR | 1ST | 30.46513 | ug/m^3 | 412021.07 | 3763384.23 | 108.52 | 0.00 | 108.52 | 10/15/2018, 12 |
| 24-HR | 1ST | 2.83702 | ug/m^3 | 412046.07 | 3763384.23 | 108.79 | 0.00 | 108.79 | 10/15/2018, 24 |

**Concentration - Source Group: WEST**

| Averaging Period | Rank | Peak | Units | X (m) | Y (m) | ZELEV (m) | ZFLAG (m) | ZHILL (m) | Peak Date, Start Hour |
|---|---|---|---|---|---|---|---|---|---|
| 1-HR | 1ST | 27.31357 | ug/m^3 | 411978.87 | 3763404.32 | 107.78 | 0.00 | 107.78 | 10/15/2018, 10 |
| 24-HR | 1ST | 2.97444 | ug/m^3 | 411978.87 | 3763404.32 | 107.78 | 0.00 | 107.78 | 10/15/2018, 24 |