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Petition for Modification
Tanager Battery Energy Storage System Project

Data Response Set 1C

Los Esteros Critical Energy Facility
03-AFC-02C

Submitted to
California Energy Commission

Submitted by
Los Esteros Critical Energy Facility, LLC

January 2026

LOS ESTEROS CRITICAL ENERGY FACILITY (03-AFC-02C)
Petition for Modification- Tanager BESS Project
DATA RESPONSE SET 1C

Los Esteros Critical Energy Facility, LLC, on behalf of Tanager Power, LLC, provides the following additional responses to the California Energy Commission ("CEC") Staff's Data Request Set 1. These responses address Data Requests A8 through A10, and supplement *Data Response Set 1A*[1] and *Data Response Set 1B*[2] for the Tanager Battery Energy Storage System ("BESS") Project ("Project").

The responses in *Data Response Set 1A* and *Data Response Set 1B* were grouped by individual discipline or topic area. Within each discipline area, the responses were presented in the same order as presented in CEC Staff's Data Requests Set 1 and were keyed to the Data Request numbers. This *Data Response Set 1C* follows the same structure, except that only one topic area, Thermal Runaway, is covered herein.

THERMAL RUNAWAY

A8. Provide the exact locations (latitude and longitude or UTM coordinates) and dimensions of the BESS enclosures for modeling purposes. Also include the following input parameters for a dispersion modeling analysis of all potential criteria air pollutants, greenhouse gases, and toxic air contaminants (TACs) that could be generated during combustion: emission rates (in grams/second), exhaust temperature, exhaust diameter, pressure, and exhaust gas velocity resulting from battery damage or thermal runaway of the whole project. Note to include the calculation worksheet, if available.

Response: A technical report responding to DR-A8 through DR-A10 is provided as Attachment DR-A8.

A digitized electronic map, in Surfer format or as a digitized georeferenced TIFF file, will be provided to CEC Staff via *Kiteworks* or Sharepoint link, and is where the coordinates in UTM, NAD83, Zone 10 can be determined. This same map was utilized to derive the source location and property boundary locations for use in the AERMOD modeling analyses.

Electronic calculation spreadsheets that are the basis of the emission calculations, AERMOD input/output files and other electronic support data will also be provided to CEC Staff via *Kiteworks* or Sharepoint link. The emissions are presented for criterial pollutants (CO) and the TACs as listed in the technical report in grams/second. Buoyant line source characteristics are also listed in the report and include:

- Enclosure length = 6.058 meters
- Enclosure width = 2.438 meters
- Enclosure height = 2.896 meters
- Exit temperature = 1273.15 Kelvin

[1] TN: 266305.
[2] TN: 267462.

- Exit velocity = 1.0 meters/second

The results of the modeling using five (5) hypothetical locations of thermal runaway events at the Tanager BESS site resulted in no exceedances of the AEGL-1 and ERPG-2 threshold at any sensitive receptor locations. The criteria pollutant impacts of carbon monoxide (CO) were all less than the California Ambient Air Quality Standards (CAAQS) for the 1-hour and 8-hour averaging periods at all sensitive receptor locations.

A9. A copy of the dispersion modeling analysis of all potential criteria air pollutants and TACs for the thermal runaway scenario using a well-validated model (AERMOD preferred).

Response: A technical report responding to DR-A8 through DR-A10 is provided as Attachment DR-A8. As stated above, the AERMOD input/output files will be provided electronically to CEC Staff via *Kiteworks* or Sharepoint link as part of this data response.

A10. A comparison of the modeled fire-related TACs concentrations to the U.S. EPA Acute Exposure Guideline Levels (AEGL) and the OEHHA/CARB acute Reference Exposure Levels (RELs) and demonstrate whether the acute hazard Index (HI) of TACs would be higher than the significance threshold of 1.0 at sensitive receptors. Please demonstrate whether the criteria air pollutant impacts would cause or contribute to any exceedance of ambient air quality standards. If exceedances occur, provide a detailed Emergency Response Plan and outline the applicable regulatory notification requirements.

Response: DR-A10 requests a comparison with the acute hazard index (HI) of TACs to determine if the significance threshold of 1.0 at sensitive receptors (residences) could be exceeded. The data request further asked for a comparison of the data with the United States Environmental Protection Agency's (EPA) Acute Exposure Guideline Levels (AEGL). For the purposes of this analysis, it was assumed that the request was for the AEGL Level 1 thresholds (AEGL-1). AEGLs were developed by an international coalition of government and non-government scientists and are used worldwide by government and private emergency responders.

DR-A10 also requests that the analysis compare the potential concentrations of emitted toxic air contaminants (TACs) to the California Office of Environmental Health Hazard Assessment (OEHHA) and the Air Resources Board (ARB) one-hour (1-hr) Reference Exposure Levels (RELs), which are used in facility health risk assessments conducted for the AB2588 Air Toxics "Hot Spots" Program and intended for stationary sources to report the types and quantities of certain substances routinely released into the air. Because the thresholds are used as a standard for routine or workplace exposure scenarios, these thresholds are not suitable for evaluating emergency conditions. A REL is the concentration level at or below which no adverse non-cancer health effects are anticipated for the specified exposure duration. RELs are meant to err on the side of public health protection to avoid underestimation of non-cancer hazards. Notably, exceeding the

REL does not automatically indicate an adverse health impact. Increasing concentrations above the REL value increases the likelihood that the health effect will occur, especially where exposure could occur repeatedly over time. Moreover, as EPA and other agencies have acknowledged, RELs were not designed to evaluate acute one-time exposure settings.[3]

The more applicable and appropriate threshold for emergency conditions would be the use of Emergency Response Planning Guidelines (ERPGs), which the Bay Area Air District (Air District) currently recommends (at exposure level 2) for use when evaluating the significance of potential air quality impacts. Specifically, in their 2022 CEQA Guidelines Thresholds of Significance, the Air District advised lead agencies to use ERPG levels in administering the Risk Management Prevention Program. Unlike RELs, ERPG levels are used for emergency response planning, risk assessment, and decision-making in chemical release incidents and provide accurate thresholds to support emergency responders in protecting public health without overly conservative measures. Sensitive members of the public (e.g., elderly, sick, young) may experience effects below these levels during limited, discrete events, but impacts are not lasting.

In light of the forgoing, the analysis in Attachment DR-A8 provides a comparison to the Air District CEQA Guidelines, the ERPG exposure level 2 ("the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action") to demonstrate that the Project is not likely to have significant air impacts.

For substances without ERPG thresholds, AEGLs were used. In areas that exceed AEGL-1, the general population could experience transient and reversible discomfort or irritation. In areas with concentrations below AEGL-1, no members

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[3] EPA has explained that CA-RELs are "general public reference values" that "tend to over-estimate . . . potential risks from exposures" and are designed to analyze situations where the general public has "potential for a repeat exposure." *See* EPA, Graphical Arrays of Chemical-Specific Health Effect Reference Values for Inhalation Exposures 5, 16 (Sept. 2009), https://nepis.epa.gov/Exe/ZyPDF.cgi/P100N7UV.PDF?Dockey=P100N7UV.PDF. In contrast, "Emergency Response values" like AEGL and ERPG have the "more specific purpose" of addressing "a rare 'once-in-a-lifetime' exposure scenario." *Id.* at 3, 16. Other agencies likewise recognize that RELs are designed to address risks to the general public from routine exposures, not for emergency planning and response. *See, e.g.*, FEMA, Planning and Decision Framework for Chemical Incident Consequence Management 113–14 (July 2022), https://www.fema.gov/sites/default/files/documents/fema_planning-framework-for-chemical-incident-consequence-management-2022.pdf ("In contrast [to AEGLs or ERPGs], the acute CA-RELs developed by the State of California address continuous or short-term emissions of airborne toxicants to which the public living or working in communities surrounding industrial facilities is at risk of being exposed."); OEHHA, Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels 81 (Dec. 2008), https://oehha.ca.gov/sites/default/files/media/downloads/crnr/noncancertsdfinal.pdf (noting that emergency planning guidelines such as AEGL are "seldom comparable to the acute RELs," because the latter are intended for "routine emissions and exposure").

of the general population, including susceptible individuals, are expected to experience any health effects.

As described more fully in Attachment DR-A8, all modeled results indicated values below respective ERPG or AEGL thresholds for the release of substances studied by the supplier in their Large-Scale Fire Test. There were no exceedances of the AEGL-1 or the Air District ERPG-2 levels throughout the study area, including at the sensitive receptor sites.

LOS ESTEROS CRITICAL ENERGY FACILITY (03-AFC-02C)
Petition for Modification- Tanager BESS Project
DATA RESPONSE SET 1C

ATTACHMENT DR-A8

Attachment DR-A8

Technical Report

Tanager Battery Energy Storage System Project

Santa Clara County, California

Submitted to

California Energy Commission

Submitted by

Los Esteros Critical Energy Facility, LLC

Tanager Power, LLC

January 2026

I. EXECUTIVE SUMMARY

Project Description and Model Inputs

Tanager Power, LLC plans to construct and operate an up to 200-megawatt (MW) lithium-ion containerized battery energy storage system (BESS) at the former laydown and construction parking area for the Los Esteros Critical Energy Facility (LECEF) located at 800 Thomas Foon Chew Way, San Jose, California in Santa Clara County (the Tanager BESS or the Project). The Project will utilize a containerized BESS employing Lithium Iron Phosphate (LFP) technology. Thermal runaway events utilizing this technology are highly unlikely during normal operations and are even difficult to simulate during laboratory settings (See, Safety of Lithium-Ion batteries - PowerTech Systems).

This technical report responds to California Energy Commission (CEC) Staff Data Requests Set 1, Data Requests (DR) A8 through A10. These data requests asked for a dispersion modeling analysis including potential criteria air pollutants, greenhouse gases, and toxic air contaminants (TACs) that could potentially result from battery damage or thermal runaway of the whole project.

This evaluation assumes that the Tanager BESS Project will utilize battery technology built and supplied by Xiamen HiTHIUM Energy Storage Technology Co., LTD or similar technology. The HiTHIUM battery technology is based on Lithium-Iron Phosphate chemistry. Emissions test data are conservatively based on best estimates of pollutants emitted during the UL 9540A gas composition and release dynamics cell/module/unit levels tests conducted by HiTHIUM in May 2025. Because the location of the fire within the facility analyzed may affect the modeled concentrations of emissions in the adjacent areas, the modeling examined a potential fire at five (5) different battery locations within the Tanager BESS Project site.

The HiTHIUM 5-MWh Block Large Scale Fire Test (LSFT) conducted in May 2025 indicated that, with the manufacturer specified distances between battery enclosures, a thermal runaway event within one enclosure would not propagate to adjacent enclosures, even with complete combustion of all the cells within the enclosure. For purposes of modeling the potential offsite impacts, the analysis assumed that the maximum credible fire event presented at the proposed BESS is the combustion of one full container (enclosure) of 48 modules, made up of 4,992 cells, over an approximate 16.25-hour period. Five (5) hypothetical locations were assessed at enclosure locations in close proximity to the Project boundary, which typically would have the potential for maximum ambient impacts. See figure 5.

Criteria for Evaluation

CEC Staff's Data Requests A8 through A10 requested information to assist in the review of the potential air quality and public health impacts during a potential battery thermal runaway event or fire. In response, this analysis provides a comparison of the data with the Emergency Response Planning Guidelines (ERPGs) developed by the American Industrial Hygiene Association (AIHA) Guideline Foundation and United States Environmental Protection Agency's (EPA) Acute Exposure Guideline Levels (AEGLs) Level 1 thresholds (AEGL-1).

The Bay Area Air District (Air District) currently recommends in their 2022 California Environmental Quality Act (CEQA) Guidelines Thresholds of Significance that lead agencies, in consultation with the agency administering the Risk Management Prevention Program (RMPP), use ERPG exposure level 2 (ERPG-2) standards to evaluate the significance of potential air quality impacts. In addition, the California Accidental Release Prevention Program (CalARP) Guidelines recommend ERPG-2 as the toxic endpoint to be used in a worst-case analysis to define a zone of vulnerability for determining the impacts of an accidental release. ERPG exposure level 2 is defined as "the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serious health effects or symptoms which could impair an individual's ability to take protective action."

In areas that exceed AEGL-1, the general population could experience transient and reversible discomfort or irritation. In areas with concentrations below AEGL-1, no members of the general population, including susceptible individuals, are expected to experience any health effects. AEGLs were developed by an international coalition of government and non-government scientists and are used worldwide by government and private emergency responders.

ERPGs and AEGLs were expressly developed to be used with dispersion and release models to delineate “vulnerable zones,” i.e., the geographic area where a given concentration might be exceeded during an accidental or once-in-a-lifetime exposure lasting 10 minutes to 8 hours. ERPGs and AEGLs provide tiered concentration levels (typically three tiers) tied to specific severities of acute health effects from a single, short-duration airborne exposure. These tiers correspond to increasing effects (notable discomfort, serious/irreversible effects, and life-threatening or lethal effects) and are intended for emergency planning and response to accidental chemical releases in the general population, including sensitive subgroups. Because CEC Staff’s request for modeling data is intended to quantify and to assess the potential impacts of, to the extent feasible, potential emissions of criteria pollutants and TACs, and the ground level concentrations and hazard footprint, from a hypothetical fire at the Tanager BESS Project site, ERPG thresholds are the most relevant metric. For substances without ERPG thresholds, AEGLs were used in the analysis.

Conclusions

This modeling analysis utilized conservative assumptions regarding emissions, meteorology, and plume characteristics to calculate ground-based concentrations given the complexities associated with accurately predicting the circumstances of a real-world event.

Using five (5) hypothetical locations of thermal runaway events at the Tanager BESS site, the modeling resulted in no exceedances of the AEGL-1 and ERPG-2 threshold at any sensitive receptor locations. The potential criteria pollutant impacts of carbon monoxide (CO) were all less than the California Ambient Air Quality Standards (CAAQS) for the 1-hour and 8-hour averaging periods at all sensitive receptor locations.

II. BACKGROUND AND METHODOLOGY

Accidental releases during a battery storage thermal runaway fire incident have the potential to affect surrounding populated areas. The purpose of this dispersion modeling assessment was to determine the worst-case magnitude and areal extent of potential emissions of hazardous air pollutants under a full range of site representative meteorological conditions at the Tanager BESS Project site. The modeling assessment and summary report is based on the best estimates of pollutants emitted during laboratory testing of the HiTHIUM 5-MWh Block unit batteries and similarly designed batteries.

The modeled emissions and subsequent potential public exposure to criteria pollutants and known chemical substances or hazardous air pollutants (HAPs), were converted into potential health risks, which were assessed in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA 2015) and the California Air Resources Board (CARB).

The U.S. EPA AERMOD (**A**merican Meteorological Society/**E**nvironmental Protection Agency **R**egulatory Model Improvement Committee's Dispersion **Mod**el) was used to calculate the areal extent of the release such that predictive estimates of potential impacts to human health and safety to the general public could be assessed. Model outputs were based on a five (5) year range of site atmospheric conditions to approximate conditions during an accidental release of pollutants during a thermal runaway event. The model outputs were then input into the Hotspots Analysis and Reporting Program (HARP), which is based on the 2015 Air Toxics Hotspots Program Guidance Manual for Preparation of Health Risk Assessments. This procedure follows OEHAA guidance, which is designed to improve estimates of potential lifetime cancer and noncancer risks from air toxics by refining data for individuals of all ages, and with adjustments based on new science about the increased childhood sensitivity to air toxics.

Methodology and Limitations of the Dispersion Modeling Assessment

The results of this analysis were based on a potential release scenario using data from cell-, module, and unit-level UL9540A thermal runaway fire propagation testing and large-scale fire testing. To derive meaningful modeling results about this specific event, several conservative assumptions were made for the inputs in order to provide an overprediction of concentrations as there is currently no standardized regulatory method to conduct the analysis. These include the quantification of emissions, the total mass released during the flaming portion of the fire, and the plume characteristics during the active fire portion.

The cell level UL9540A test involved the thermal runaway of a single cell. Gas composition data from the cell test was extrapolated to a module scenario, and then to a unit scenario. The large-scale test fire involved a HiTHIUM 5-MWh Block unit comprised of 6 internal racks, with 8 modules per rack, and 104 cells per module, i.e., 4992 cells.

Section 3.0, subsection 3.1, Table 10 of the LSFT report presents a detailed timeline for the test burn which is summarized as follows:

- 00:00:00 - Test start time – 18:38:54 on May 26, 2025
- 00:42:45 - first initiating cell venting
- 00:46:11 – cell runaway initiated
- 01:08:00 – catch fire
- 01:23:20 – flame propagation

- 03:21:06 – flame propagation peak
- 04:30:00 – flame propagation decreasing
- 07:01:06 – visible fire end
- 17:22:00 – complete unit combustion (test ended)

During the test, no fire propagation from unit-to-unit was observed and the internal cells of adjacent units did not exceed any of the UL9540A requirements as presented in Section 4, Table 10.2 of the LSFT Report. Post test examination confirmed that all battery modules in the initiating unit burned completely, and no significant damage was seen in the interior of the adjacent units. This analysis represents one of the first steps to identify and assess the necessary data required to create an emissions profile and subsequent dispersion pattern for a BESS thermal runaway event.

Typically, uncontrolled fire events do not burn as a steady state process. Uncertainties in the fluctuations in temperature and mass burn rates can produce differences in plume rise and mass emissions. CEC Staff requested the use of the air quality model, AERMOD, which is a steady-state Gaussian dispersion model. The use of this model requires the use of 1-hour steady state assumptions on meteorology, plume temperature and the mass emission rates.

The modeled emissions and resultant concentrations in this assessment are based on estimates and assumptions from the data available at the time this report was generated. The AERMOD model is considered conservative in that it is designed to overpredict impacts. It is important to recognize that the ability to judge the accuracy of dispersion models is limited by data scarcity: because only a few field experiments have been conducted in which hazardous gases were released and their concentrations measured, there is limited data to measure models against.[1]

In summary, due to the inherent uncertainties in both the cell and large-scale burn tests, the modeling analysis accommodated these uncertainties by employing and utilizing conservative assumptions regarding emissions, meteorology, and plume characteristics in order to calculate ground-based concentrations.

AERMOD Model Description

To estimate ambient air concentrations, the latest version of the AERMOD (Version 24142) dispersion model was used. AERMOD is the U.S. EPA's and CARB's preferred dispersion model for use in assessing health risk when air is the predominant pathway. OEHHA has also adopted the AERMOD model as the preferred model for assessing health risk impacts from sources of toxic emissions. AERMOD is a steady-state dispersion model that uses planetary boundary layer (PBL) theory to model air pollutant concentrations. The planetary boundary layer is the breathable portion of the atmosphere that is influenced by contact with the ground surfaces or friction. AERMOD was chosen for this assessment as it is a regulatory method for providing conservative

[1] Note that other factors affect the ability for any particular release to be accurately predicted, including the inability of computer programs to completely capture all potential events that may happen; given the complexities and multiple permutations of circumstances that may give rise to a release, the need to make simplifying assumptions about the circumstances of a release; and the combination of modeling, exposure estimates, and health effect thresholds involves multiple assumptions and probabilistic elements that contribute to uncertainty in the final risk characterization.

(overestimates) of ground-based concentrations from combustion source types (and because Commission Staff requested its use). AERMOD requires the pre-processing of surface characteristics in order to then calculate the effects of meteorology and terrain on air pollutant concentrations. Surface characteristics and meteorological data such as wind speed/direction, temperature, cloud cover, etc. are combined with upper air data to compute planetary boundary parameters used by AERMOD to estimate vertical and horizontal pollutant dispersion. Terrain data is also processed to allow the influence of terrain on modeled concentrations. AERMOD currently contains improved algorithms for:

- Dispersion in both the convective and stable boundary layers,
- Plume rise and buoyancy,
- Plume penetration into elevated inversions, such that can occur during foggy conditions,
- Treatment of elevated, near-surface, and surface level sources,
- Computation of vertical profiles of wind, turbulence, and temperature,
- Treatment of receptors on all types of terrain (from the surface up to and above the plume height) and complex terrain modeling computations, and
- Incorporation of the Plume Rise Model Enhancements (PRIME) building downwash algorithms.

The AERMOD modeling system consists of two pre-processors and the dispersion model. The meteorological preprocessor (AERMET) provides AERMOD with the meteorological information it needs to characterize the PBL. The terrain pre-processor (AERMAP) both characterizes the terrain and generates receptor grids for the dispersion model (AERMOD).

Model Input Options

Site Urban/Rural Classification

The Land Use/Land Classification (LULC) data from 2023 were analyzed within a three (3) km radius around the project site. The LULC data shows that within the three (3) km radius around the Project site, the region can be characterized as urban, made up largely of commercial, industrial, transportation and mid to high density residential. Figure 1 presents the results of this analysis. In accordance with the Auer land use classification methodology (USEPA's "*Guideline on Air Quality Models*"), land use within the area circumscribed by a three (3) km radius around the facility is greater than 50 percent urban. Therefore, in the AERMOD modeling analyses, urban coefficients were assigned.

The AERMOD Implementation Guide (June 2022) provides the following recommendations for assigning an urban population number in AERMOD.

> *For urban areas adjacent to or near other urban areas, or part of urban corridors, the user should attempt to identify that part of the urban area that will contribute to the urban heat island plume affecting the source(s). If this approach results in the identification of clearly defined MSAs, then census data may be used as above to determine the appropriate population for input to AERMOD. Use of population based on the Consolidated MSA*

> *(CMSA) for applications within urban corridors is not recommended, since this may tend to overstate the urban heat island effect. Similarly, for application sites that are in isolated areas of dense population but are not representative of the larger MSA, care should be taken to determine the extent of the urban area that will contribute to the urban heat island plume affecting the source(s).*
>
> *For situations where MSAs cannot be clearly identified, the user may determine the extent of the area, including the source(s) of interest, where the population density exceeds 750 people per square kilometer. The combined population within this identified area may then be used for input to the AERMOD model.*

Dispersion within urban environments has different characteristics than that occurring in a rural environment. The urban boundary layer will behave in a more convective, turbulent manner during the hours just after sunset due to the urban heat island effect.

Using the Project site as general center point, the following 2020 census areas were used to establish the urban population values as inputs into AERMOD. The four (4) cities also represent a continuous urban/developed corridor.

• Milpitas	80,273
• Sunnyvale	155,805
• North San Jose	35,478
• Santa Clara	127,647
Total	**399,203**

Based on the combined population of 399,203, this value is proposed to be used for the population input into AERMOD. This combined population would present a conservative and appropriate magnitude of the urban heat island effects within the impact areas surrounding both sites.

Meteorology

Five years of surface meteorological data (2013-2017) collected at the Moffett Field Airport, located 9.8 kilometers (km) west of the Project site, along with five (5) years of upper air data from Oakland International Airport were processed in AERMET (version 22112) and provided by the Air District. This is the identical data set that was used to assess the Project construction impacts in the petition for modification submitted for the Tanager BESS Project.[2] Figure 2 presents an annual windrose for the meteorological data period.

Receptors and Terrain

Receptor and source base elevations were determined from United States Geological Survey (USGS) National Elevation Dataset (NED) data. The NED data was processed with the EPA-model AERMAP for the receptor locations selected. All coordinates (both sources and receptors)

[2] TN: 261280.

are referenced to UTM North American Datum 1983 (NAD83, Zone 10). AERMAP is capable of interpolating the elevation data in the NED data for both receptor elevations and hill height scales.

The NED data are available in 1/3arc-second (about 10 meter) and 1arc-second (about 30 meter) grid node spacing. Areas that contain receptor grids with 100-meter spacing or less between adjacent receptors will use 10-meter NED data. Other areas that contain only receptor grids of greater than 100-meter spacing utilized 30-meter NED data. For purposes of determining hill height scales, the NED datasets used were extended 5-km past the outside of the coarse receptor grid described below for 30-meter NED data and 2-km past the outside of the close-in receptor grids described below for 10-meter NED data.

Cartesian coordinate receptor grids were used to provide adequate spatial coverage surrounding the project area for assessing ground-level pollution concentrations, to identify the extent of significant impacts, and to identify maximum impact locations. For the full impact analyses, a nested grid was developed to fully represent the initial location and extent of significance area(s) and maximum impact area(s). The nested grid comprises the following and is presented in Figure 3:

- Receptors were placed along the project fence line with a spacing of about 10 meters between adjacent receptors.
- A high resolution receptor grid with a receptor spacing of 20 meters was extended from the project fence line out to 300 meters from the project in all directions.
- An intermediate receptor grid with 50-meter receptor spacing was extended from the fence line receptor grid out to 1,000 meters from the project in all directions.
- A coarse receptor grid with 200-meter receptor spacing was extended from the intermediate receptor grid outwards to five (5) kilometers (km) from the project in all directions.
- When maximum impacts occur in areas outside any of the existing receptor grids, additional refined receptor grids with 20-meter resolution will be placed around the maximum impacts and extended as necessary to determine maximum impacts.
- Concentrations within the facility fence line were not calculated.

The nearest residence (sensitive receptors) from one of the hypothetical release points is approximately 500 meters towards the south-southeast. There are multiple sensitive receptors in this area. The second set of sensitive receptors is approximately 822 meters towards the west-southwest with multiple sensitive receptors. The areas where the sensitive receptors are located are presented in the green areas in Figure 4.

Source Locations

Given that the hypothetical thermal runaway event and resulting fire could occur at any of the battery containers located within the approximately 44,100 square meter project site, five (5) line source locations were selected based on the proximity to sensitive receptors and roadways. These locations were selected in part to determine the potential for worst case off-site modeled concentrations. Figure 5 presents the locations of the five (5) line source locations.

III. Procedure to Determine the Emissions

The HiTHIUM unit is comprised of six (6) in-line vertical racks, each containing eight (8) modules. Each module contains 104 cells, resulting in 4,992 cells per unit. A single cell weighs approximately 5,600 g, or 12.35 lbs. The total weight of the internal mass potentially subject to thermal runaway, i.e., consumption via combustion, is approximately 60,553 lbs.

The large-scale test (UL Solutions, Large Scale Fire Test, May 26, 2025) identified that during the testing period, combustion occurred for approximately 16.25 hours and all of the battery cells were consumed. Based upon these hourly values, the mass consumed per hour would be approximately 3,726 pounds per hour (lbs/hr). This weight is likely an over-estimate since the cells and modules contain numerous non-combustible components.

The early stage of battery failure is associated with the accumulation of gases, which is the product of the heating and volatilization of the liquid electrolyte. After ignition, the battery will continue to emit substances, which are then subject to thermal oxidation. The final speciation of the vented gases and battery constituents will depend on various factors.

Gas composition data is based on the single cell thermal runaway test as shown in Table 1 below.

Table 1 Gas Composition (Cell basis)		
Gas Name	**Chemical Structure**	**% Measured**
Carbon Monoxide	CO	14.507
Carbon Dioxide	CO2	23.0
Hydrogen	H2	45.167
Methane	CH4	4.868
Acetylene	C2H2	0.148
Ethylene	C2H4	1.804
Ethane	C2H6	0.805
Propylene	C3H6	2.256
Propane	C3H8	1.379
Iso-butane	C4 (total)	2.029
Pentane	C5 (total)	0.447
Hexane	C6 (total)	0.021
1-Heptene	C7H14	0.004
Styrene	C8H8	0.0
Benzene	C6H6	0.018
Toluene	C7H8	0.001
Dimethyl Carbonate	C3H6O3	3.34
Ethyl Methyl Carbonate	C4H8O3	0.198
Propadiene	C3H4	0.006
Total		**100**

The measured volumetric percentages for each compound was converted into a mass emission rate by first utilizing the total gas volume of 171.2 liters from the test report and then adjusting each compound by the measured percentage. Based on the molecular weight of each substance in Table 1, the gas density in kilograms/liter was calculated. Noting that there was an assumed number of 4,992 battery cells in thermal runaway, the gas density was used to calculate the mass emissions per cell and mass per total cells consumed in the fire for each compound. A source test duration of approximately 16.25 hours in thermal runaway was used in the conversion to pounds per hour. This data is presented in Table 2.

Table 2 BESS Fire Emissions Conversions and Calculations (Per cell extrapolated to all modules and cells in the enclosure)

Site Evaluated: Tanager (Hithium LSFT)

Volume % Calculation

Substance	CAS	Measured Vol %	Sample Volume Gas, L	Gas Molecular Weight	Gas Density kg/m3 *	Gas Density kg/L	Mass per Total Cells Consumed kg	Mass per Total Cells Consumed lbs	Mass per Total Cells Consumed lbs/hr	Mass per Cell kg	Mass per Cell lbs	Mass per Cell lbs/hr	Total Cells Modeling g/sec
Methane	74828	4.868	8.334	16.04	0.667	0.00067	2.774E+01	6.115E+01	3.763E+00	5.557E-03	1.225E-02	7.539E-04	4.746E-01
Acetylene	74862	0.148	0.253	26.04	1.082	0.00108	1.369E+00	3.018E+00	1.857E-01	2.742E-04	6.045E-04	3.720E-05	2.342E-02
Ethylene	74851	1.804	3.088	28.05	1.166	0.00117	1.797E+01	3.962E+01	2.438E+00	3.600E-03	7.937E-03	4.885E-04	3.075E-01
Ethane	74840	0.805	1.378	30.07	1.250	0.00125	8.598E+00	1.895E+01	1.166E+00	1.722E-03	3.797E-03	2.337E-04	1.471E-01
Propadiene	463490	0.006	0.010	40.06	1.665	0.00167	8.538E-02	1.882E-01	1.158E-02	1.710E-05	3.771E-05	2.320E-06	1.461E-03
Propene (Propylene)	115071	2.256	3.862	42.08	1.749	0.00175	3.372E+01	7.434E+01	4.575E+00	6.755E-03	1.489E-02	9.164E-04	5.769E-01
Propane	74986	1.379	2.361	44.10	1.833	0.00183	2.160E+01	4.762E+01	2.930E+00	4.327E-03	9.538E-03	5.870E-04	3.695E-01
Butane (C4 total)	106978	2.029	3.474	58.12	2.415	0.00242	4.189E+01	9.234E+01	5.683E+00	8.391E-03	1.850E-02	1.138E-03	7.166E-01
Pentane (C5 total)	109660	0.447	0.765	72.15	2.999	0.00300	1.146E+01	2.525E+01	1.554E+00	2.295E-03	5.059E-03	3.113E-04	1.960E-01
Hexane (C6 total)	110543	0.021	0.036	86.18	3.582	0.00358	6.428E-01	1.417E+00	8.721E-02	1.288E-04	2.839E-04	1.747E-05	1.100E-02
Heptene	592767	0.004	0.007	98.19	4.081	0.00408	1.395E-01	3.075E-01	1.893E-02	2.795E-05	6.161E-05	3.791E-06	2.387E-03
CO	630080	14.507	24.836	28.00	1.164	0.00116	1.443E+02	3.181E+02	1.957E+01	2.890E-02	6.372E-02	3.921E-03	2.468E+00
CO2	124389	23.000	39.376	44.01	1.829	0.00183	3.595E+02	7.926E+02	4.878E+01	7.202E-02	1.588E-01	9.771E-03	6.151E+00
Hydrogen	1333740	45.167	77.326	2.02	0.084	0.00008	3.234E+01	7.130E+01	4.388E+00	6.479E-03	1.428E-02	8.790E-04	5.533E-01
Benzene	71432	0.018	0.031	78.11	3.246	0.00325	4.994E-01	1.101E+00	6.775E-02	1.000E-04	2.205E-04	1.357E-05	8.544E-03
Toluene	108883	0.001	0.002	92.14	3.829	0.00383	3.273E-02	7.215E-02	4.440E-03	6.556E-06	1.445E-05	8.894E-07	5.599E-04
Styrene	100425	0.000	0.000	104.15	4.328	0.00433	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
Dimethyl Carbonate	616386	3.340	5.718	90.08	3.744	0.00374	1.069E+02	2.356E+02	1.450E+01	2.141E-02	4.719E-02	2.904E-03	1.828E+00
Ethylmethyl Carbonate	623530	0.198	0.339	104.10	4.326	0.00433	7.321E+00	1.614E+01	9.932E-01	1.467E-03	3.233E-03	1.990E-04	1.253E-01
	Check Sums	*100.0*	*171.2*										

	Total Gas Vol, L	171.2	*from test report*	
# of Racks in Enclosure	6			
# of Modules per Rack	8			
# of Cells per Module	104		* based on the ratio of molecular weights to Air and the Specific Wt of Air	
Test Duration, hours	16.25		Mol Wt. AIR=	28.97
# Cells in Thermal Runaway	4992		Specific Wt of Air at 20C =	1.204 kg/m3

Ref: Hithium LSFT Report, 5 MWh Block-Liquid Cooled BESS, Test Dates 5/26-28/2025, Xiamen Hithium EST Co, LTD., 7/10/2025.

AERMOD Emission Source Inputs

Reviewing the HiTHIUM LSFT Report (May 2025) and the design information with regards to the spacing of the battery enclosures, the source characteristics focused on a single enclosure thermal runaway fire. While the HiTHIUM LSFT summarized the fire progression throughout the test, the maximum burn rate of materials was during the period when the enclosure was fully engulfed starting at approximately hour three (3) of the test and ending at approximately hour five (5). Here, the fire and associated combustion gases were emitted through the entire series of side electrical cabinet doors that run the length of the enclosure. Based on this linear release characteristic, a single buoyant line source of approximately 6.06 meters in length (the length of the enclosure) was used to represent the release of combustion gases. AERMOD can simulate concentrations from these types of releases by utilizing the buoyant line source option within the model. Using techniques from the Buoyant Line and Point (BLP) Source Dispersion Model (Schulman and Scire, 1980), AERMOD assesses buoyant line source attributes in the BLP algorithm to define the geometry of one or more linear structures associated with the emission releases. BLP was originally developed to model linear source releases from aluminum smelters. The coordinates of the beginning and ending locations of the line source were used to determine the geometry of the release as well as the orientation of the line source.

To utilize the BLP option in AERMOD, source inputs also include calculating the buoyancy parameter F, which includes identifying an initial vented plume temperature and exit velocity. Since the modeling focused on the maximum one (1) hour active flame portion of the event, the exit temperature was assumed to be approximate to the temperature of an open flame. Data provided in the HiTHIUM LSFT demonstrated that vented gases from a battery cell can exceed 600^{o} Celsius prior to ignition and flame temperatures within combustion sources can typically be in the range of 800- 2000^{o} Celsius during the maximum flame progression (typically between 90 and 180 minutes). The exit temperature was conservatively assumed to be towards the lower end at 1000^{o} Celsius, which would limit the amount of thermal plume rise and tend to increase the ground level concentrations.

The exit velocity was assumed to be one (1) meter per second (m/s) to conservatively limit the amount of plume rise due to momentum effects. Burn study testing data did not provide any velocity data. Recognizing that the release of pollutants during the fire portion of the event along the length of open cabinet doors would have minimum vertical mechanical momentum, the focus on plume rise was based upon buoyancy effects. Since limiting momentum rise would cause an increase in the ground level concentrations by restricting the side vented plume rise to a lower elevation, a small exit velocity was used at 1.0 meter per second (m/s).

The buoyancy parameter equation (F) takes the form of the following:

Average Buoyancy Parameter (m^4/s^3)

$$F = [g\ L\ Wm\ w\ (Ts - Ta)]/Ts$$

where:

F = average line source buoyancy parameter (45.745 m^4/s^3)

g = acceleration of gravity (9.81 m/s^2)

L = average line source length (6.06 m)

Wm = average line source width (1.0 m)
w = exit velocity (1.0 m/s)
Ts = exit temperature (1073.15 K)
Ta = ambient air temperature (293.15 K)

Significance Criteria and Short-Term (Acute) Health Effects

The modeling results were compared with the AEGL-1. Additional comparisons were made with the ERPG-2, which the Air District has established as their preferred CEQA significance threshold.

EPA developed AEGLs for accidental releases of airborne chemicals. AEGLs represent threshold exposure limits for the general public and are applicable to emergency exposures ranging from 10 min to 8 hours. Three levels—AEGL-1, AEGL-2, and AEGL-3—are developed for each of five exposure periods (10 min, 30 min, 1-hour, 4-hourh, and 8-hour) and are distinguished by varying degrees of severity of toxic effects. While the request for use of AEGLs from the CEC was for Level 1, the three levels are presented below for comparison:

- AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure.

- AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

- AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

If conditions do not exceed AEGL-1, then they will not exceed either AEGL-2 or AEGL-3.

The ERPGs were developed by the American Industrial Hygiene Association (AIHA) through its Guideline Foundation and its volunteer Emergency Response Planning (ERP) Committee, and their use is supported by the EPA. The ERPG levels 1, 2, and 3 are Emergency Response Planning Guidelines related to airborne chemical concentrations and their health effects on humans during exposure of up to 1 hour. They are intended for use as tools to assess the adequacy of accident prevention and emergency response plans, including transportation emergency planning, community emergency response plans, and incident prevention and mitigation. For this reason, they are not designed to be overly conservative: no emergency responder wants to evacuate a downtown area to protect a population from a very mild health effect. This is quite a different approach from other groups setting population guidelines, for example, drinking water, residue tolerances in food, air quality guidelines, etc. ERPG values need to be exactly on target to support emergency responders to predict the frequency and severity of health effects that may result from the emergency exposure.

- ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient adverse health effects or without perceiving a clearly defined objectionable odor.

- ERPG-2 is 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 is 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.

These AEGL and ERPG levels are used for emergency response planning, risk assessment, and decision-making in chemical release incidents. Sensitive members of the public (e.g., elderly, sick, young) may experience effects below these levels. ERPG values provide accurate thresholds to support emergency responders in protecting public health without overly conservative measures like unnecessary evacuation.

Airborne concentrations below AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and nondisabling odor, taste, and sensory irritation or certain asymptomatic, nonsensory effects. With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for each corresponding AEGL. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL. AEGLs were assessed for the Level 1 (AEGL-1) 1, 4 and 8-hour averaging periods based on the limits of the AERMOD model, which limits the averaging period to no less than 1-hour.

Table 3 presents AEGLs (Level 1, 2 and 3) and ERPGs (Level 1, 2 and 3) for the 1-hour averaging periods in micrograms per cubic meter (ug/m^3). Note that some of the TACs presented in Tables 1 and 2 do not have an AEGL or ERPG but are presented in Table 3 for completeness.

Table 3 Health Impact Thresholds (1-hr average)							
Substance	**CAS**	**AEGL 1 ug/m³**	**AEGL 2 ug/m³**	**AEGL 3 ug/m³**	**ERPG 1 ug/m³**	**ERPG 2 ug/m³**	**ERPG 3 ug/m³**
Hexane (C6 total)	110543	10,222	10,000,000	-	-	-	-
CO	630080	-	-	-	229,040	400,820	572,600
Benzene	71432	170,000	2,600,000	-	159,735	480,000	3,194,699
Toluene	108883	250,000	2,100,000	-	565,279	1,100,000	3,768,526
Butane (C4 total)	106978	13,074	-	-	-	-	-
Propene	115071	-	-	-	-	-	-
Propane	74986	9920	-	-	-	-	-

Notes:
AEGL values – 1 Hr ppm values converted to ug/m³
ERPG values – AIHA ERP Guideline Values, 2022 (ppm values converted to ug/m³) except for ERPG-2 values are converted from mg/m3 to ug/m³.

Concentrations of these pollutants in air associated with the emissions were calculated using the AERMOD dispersion model. With respect to the potential for long-term chronic and cancer exposure, chronic exposure is typically based on annual average concentrations. For cancer, the increased risk periods are based on 30 years of exposure. In this case, a potential thermal runaway event would not result in either chronic exposure or 30 years of exposure because the UL 9540 report indicates that a potential thermal runaway event would result in a short (less than a day) duration of exposure. Therefore, long term chronic and cancer (annual) exposure estimates were not assessed as the exposure periods for this event were less than a single day.

Model Results and Summary of Impacts

The modeling results based on the HiTHIUM LSFT provided emissions inventory are presented in Table 4. This table presents the results of the acute exposure concentrations (AEGL-1 and ERPG-2) at the maximum impacted sensitive receptors (residence) for the thermal runaway scenario as defined earlier.

The results of the modeling from any of the five (5) hypothetical locations of thermal runaway did not identify any sensitive receptor locations that equaled or exceeded the AEGL-1. In addition, the Air District ERPG-2 CEQA significance threshold was not exceeded at any of the receptors within and along the Highway 237 corridor. The criteria pollutant impacts of carbon monoxide (CO) were all less than the California Ambient Air Quality Standards (CAAQS) for the 1-hour and 8-hour averaging periods at all sensitive receptor locations.

Table 4 1-Hour Modeling Results				
Substance	**CAS**	**Modeled Concentration ug/m^3**	**AEGL-1 ug/m^3**	**ERPG-2 ug/m^3**
Hexane (C6 total)	110543	0.924	10,222	-
CO	630080	207.51	-	400,820
Benzene	71432	0.718	170,000	480,000
Toluene	108883	0.047	250,000	1,100,000
Butane (C4 total)	106978	60.25	13,074	-
Propene	115071	48.51	-	-
Propane	74986	31.07	9920	-

Notes:
AEGL values – 1 Hr ppm values converted to ug/m^3
ERPG values – AIHA ERP Guideline Values, 2022 (ppm values converted to ug/m3) except for ERPG-2 values are converted from mg/m3 to ug/m^3.

Table 5 presents the results of the criteria pollutant modeling at the location of the maximum impacted sensitive receptor.

Table 5 Modeled Concentrations and Ambient Air Quality Standards					
Pollutant	**Averaging Period**	**Maximum Concentration (µg/m^3)**	**Back-ground (µg/m^3)**	**Total (µg/m^3)**	**Ambient Air Quality Stand-ards (µg/m^3)**
					CAAQS
CO	1-hour maximum	207.51	1,495.0	1,702.5	23,000
	8-hour maximum	141.47	1,418.3	1,559.8	10,000

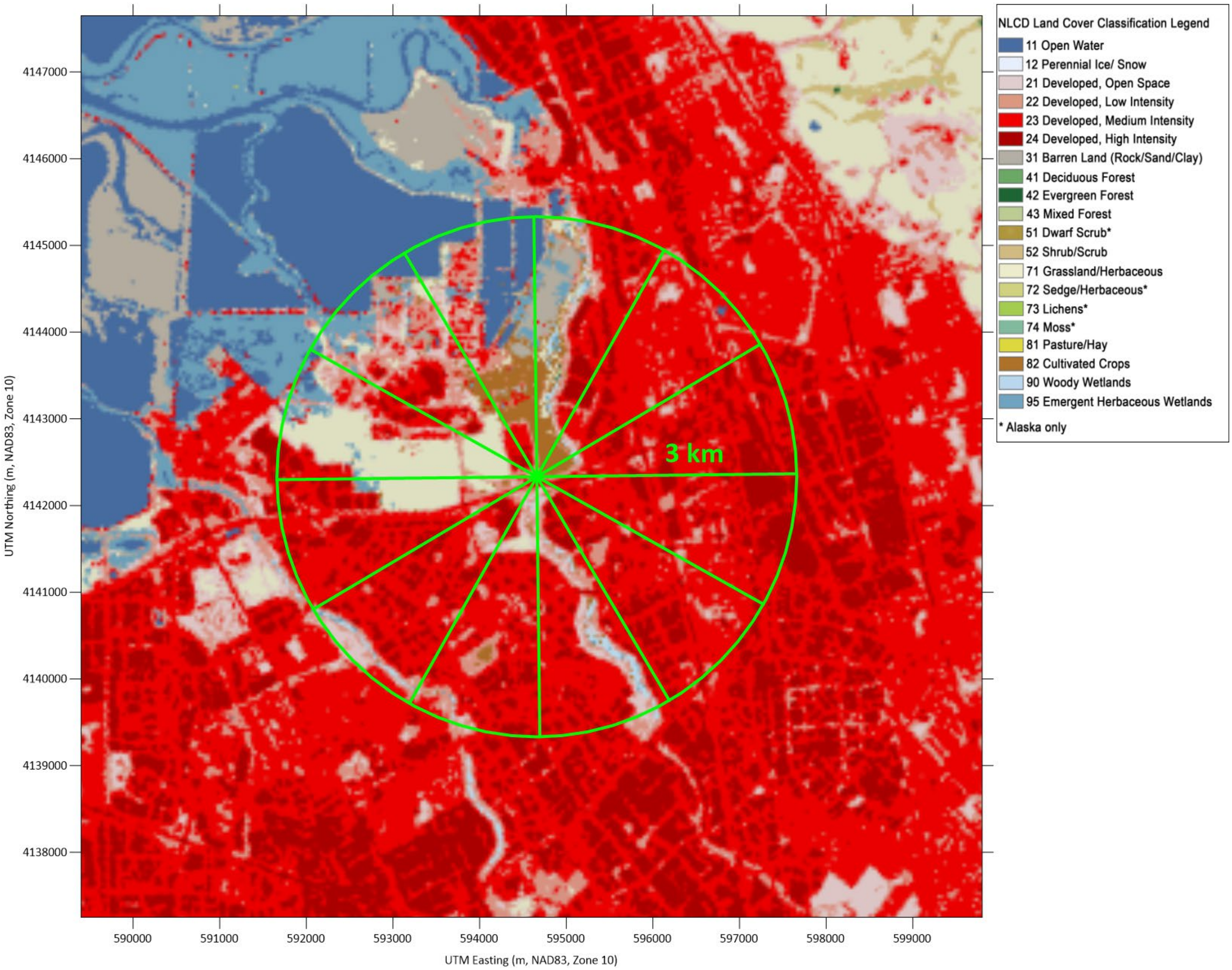
Maximum receptor location in UTM NAD83, Zone 10: 594850.0, 4141850.0.

The criteria pollutant impacts were under the CAAQS for all modeled criteria pollutants.

Conclusions

The results of the modeling demonstrate that there were no exceedances of the AEGL-1 or the Air District ERPG-2 levels throughout the entire study area, including all sensitive receptor sites. The modeling also demonstrates that the California Ambient Air Quality Standards for 1- and 8-hour CO were not exceeded.

Figure 1
Land Use/Land Cover within 3 km of the Project Site

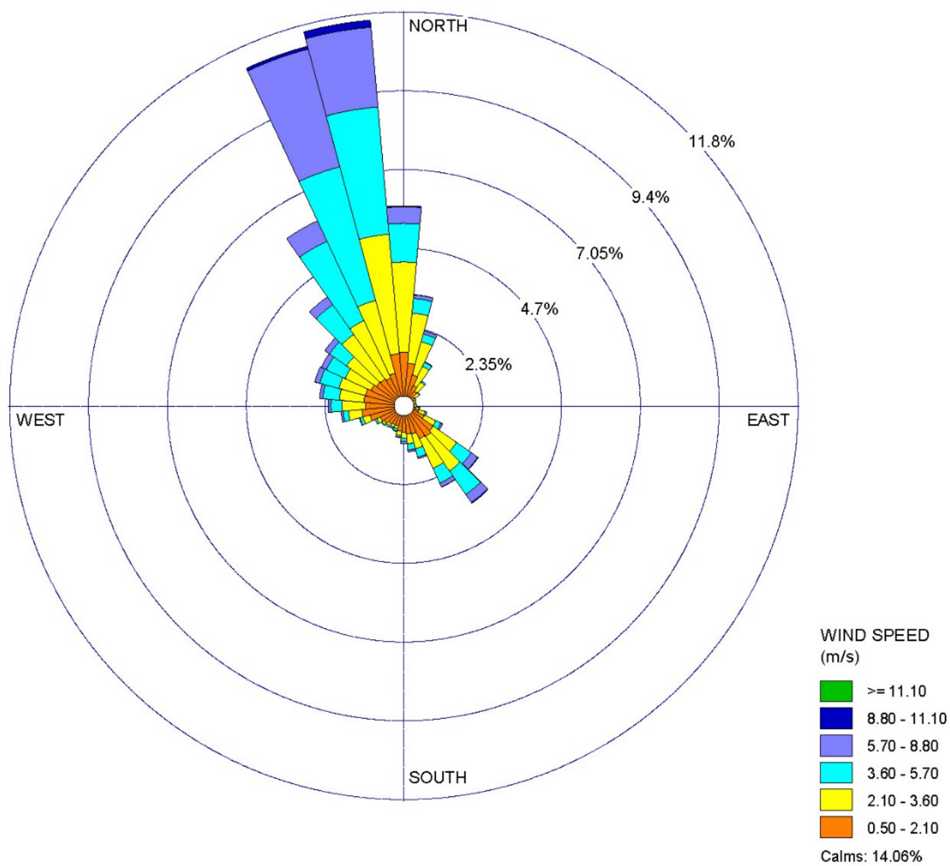


WIND ROSE PLOT:

Figure 2
5-Year Moffit Field Airport Wind Rose (2013-2017)

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:		
	Start Date: 1/1/2013 - 00:00 **End Date: 12/31/2017 - 23:59**		
	CALM WINDS: **14.06%**	TOTAL COUNT: **43669 hrs.**	
	AVG. WIND SPEED: **2.75 m/s**	DATE: **12/22/2025**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 3
Nested Grid Receptors

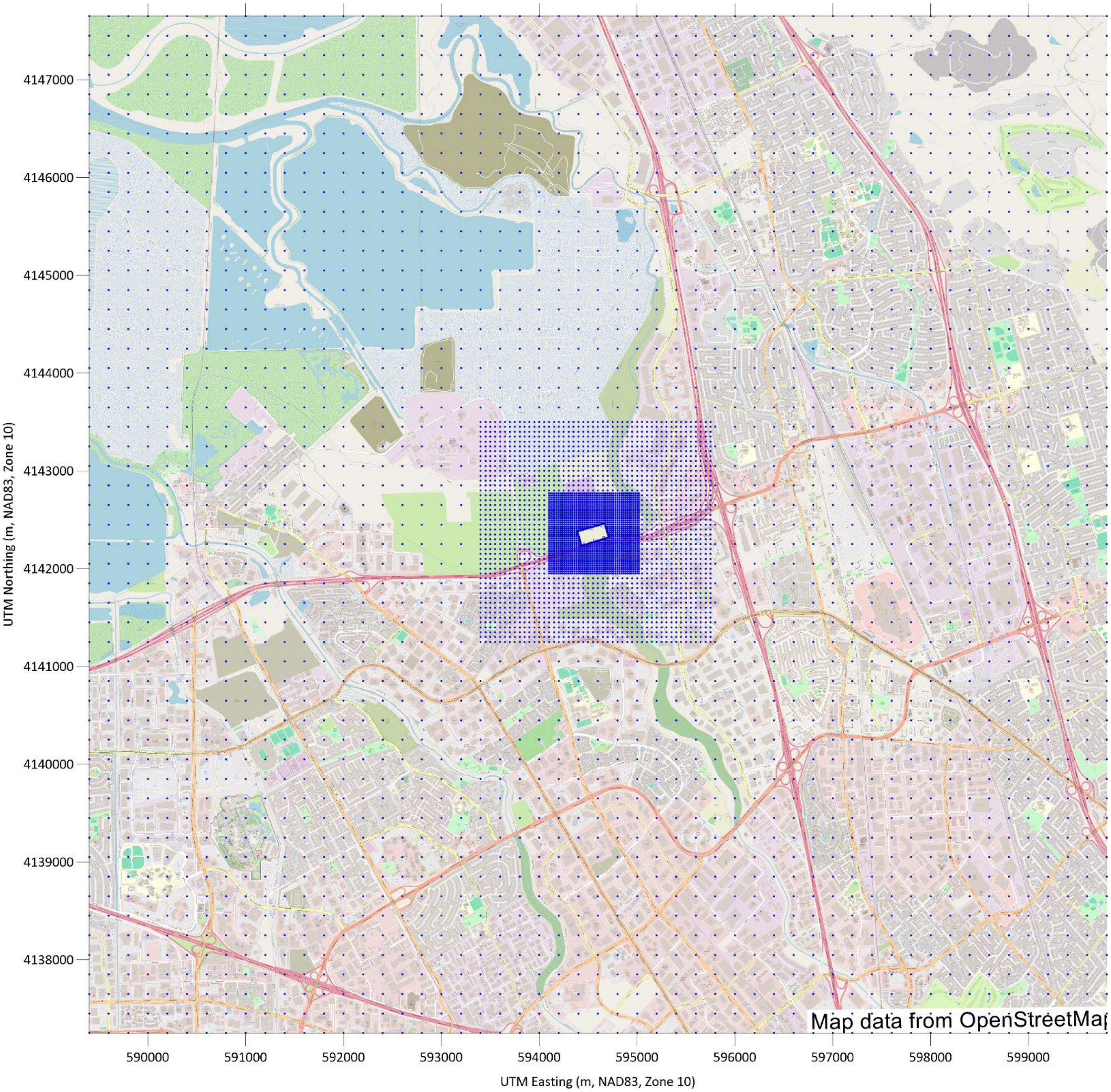


Figure 4
Sensitive Receptor Locations

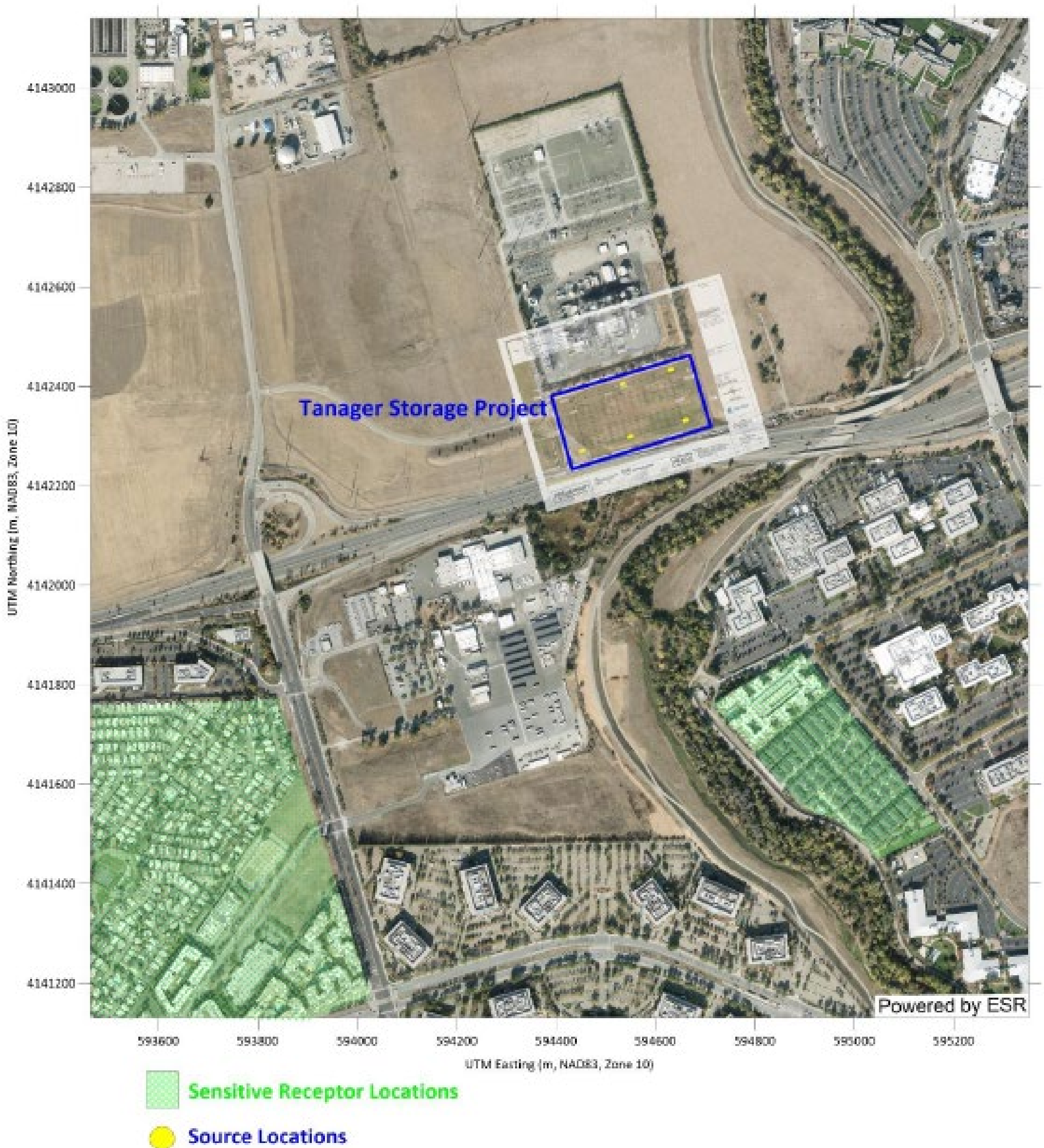


Figure 5
Modeled BLP Source Locations