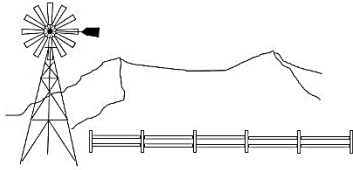


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Supplemental comment letter from Save Our Rural Town

Additional submitted attachment is included below.



SAVE OUR RURAL TOWN

Renee Longman
Project Manager
California Energy Commission
715 P Street, MS-40
Sacramento, CA 95814

September 14, 2026

Subject: Comments by Save Our Rural Town (SORT) Pertaining to the Public Safety Impact Analysis Prepared for the Proposed Corby Project.

Reference: California Energy Commission Docket Number 24-OPT-05.
Staff Assessment/Environmental Impact Analysis Issued July 15, 2026.

Dear Ms. Longman;

Save Our Rural Town (SORT) respectfully offers the following supplemental comments on the Staff Assessment and included Environmental Impact Report (EIR) prepared for the Corby Battery Energy Storage System (Corby or Corby BESS). The following comments focus on errors and deficiencies noted in the “Public Safety” impact analysis presented in Section 5.10 and Appendix D. Among other things, noted deficiencies include the underestimation of highly toxic compound emission rates and the application of inappropriate significance thresholds. Because these deficiencies pertain to very real and very significant public safety matters and not mere hypotheticals, it is essential that they be corrected; the public merits nothing less and can afford nothing less. Accordingly, SORT respectfully requests that the Commission consider the comments provided herein and pursuant thereto, substantially revise the EIR/Staff Assessment.

INTRODUCTION

The “Public Safety” Impact analysis (Section 5.10) of the Staff Assessment is short (only 26 pages) and relies on information and analysis provided in “Appendix D” which discusses toxic release profiles of two different BESS failure scenarios (“Non Fire” and “Fire”); it also discusses the frequency with which the Corby BESS is expected to fail and analyzes metal deposition resulting from a Corby BESS failure. Based on these “Appendix D” analyses and additional assessments of previous BESS failures and state and local regulations, Section 5.10 concludes that the Corby BESS will not result in any significant public safety impacts. SORT respectfully disagrees.

Save Our Rural Town

SORTActon@gmail.com

The hope of a secure and livable world rests with disciplined non-conformists...

Martin Luther King, Jr.

DEFICIENCIES IN THE ANALYSIS OF THE NON-FIRE SCENARIO.

SORT notes numerous deficiencies in the Staff Assessment’s analysis of public safety risks posed during a “Non Fire” BESS failure scenario described in Appendix D; these deficiencies are enumerated below.

Deficiencies In Toxic Emission Assumptions for the Non Fire Scenario.

The Non Fire scenario analysis provided in Appendix D is based on toxic release rates reported in Table 2 which were taken directly from a document published in 2025 by the “Society of Fire Protection Engineers”¹ (referred to as the “SFPE document”). SORT notes that the SFPE document was never peer reviewed or publicly vetted, and it does not appear to have been subject to any external technical scrutiny. Nevertheless, the Staff Assessment relies exclusively on the SFPE document as the source of all toxic release rates and adopts them without question. Accordingly, the toxic concentrations reported in Table 12 of the SFPE document were incorporated directly into Table 2 of Appendix D. Unfortunately, the SFPE document does not show how these values were calculated or even explain how they were derived. In fact, the only justification offered by the SFPE document for these assumed toxic emission factors is a vague statement on page 38 that “Data on constituent gas yields was pulled from the peer reviewed studies identified in the literature review”. This is highly problematic because SORT is unable to validate any of the toxic concentration values reported in the SFPE document.

Take for instance the 2.7% by volume HF concentration value that is reported in Table 12 for the “Non Fire LFP” BESS failure and repeated in Table 2 of Appendix D. According to Table 37 of the SFPE document, the only “peer reviewed” study that analyzed LFP cells and reported HF in units of “% volume” was performed by Gully, et al; however, there appears to be no connection between the Gully study results and the 2.7% value reported in Table 12². Worse yet, the HF results reported in the Gully study were obtained using a “Fourier Transformer Infrared” (FTIR) analyzer³ which is intrinsically incapable of accurately measuring HF concentrations and ***always*** substantially underreports HF emissions (as we have previously explained to the Commission⁴). The SFPE document openly acknowledges that FTIR sampling methodologies do not accurately measure HF concentrations because it states on page 7

¹ *Environmental and Health Impacts of Thermal Runaway Events in Outdoor Lithium-Ion Battery Energy Storage System Installation*. June 2025 Society of Fire Protection Engineers. doi.org/10.64167/3d04-pax1

² SORT has tried unsuccessfully to reconcile the results of the Gully study that are reported in Table 37 in a manner that reproduces the 2.7% concentration value reported in Table 12.

³ Table 37 of the SFPE document.

⁴ SORT letters submitted in Docket 25-OPT-02 on April 6 and March 4, 2026; these letters are incorporated herein by reference.

that “FTIR can underreport concentrations of reactive gases, such as HF, which can deposit out of the air before reaching the measurement equipment”. Yet, Tables 37-40 show that the SFPE document relied almost exclusively on studies that utilized FTIR analytical methodologies for measuring HF. Accordingly, by its own admission, the SFPE document does not report accurate HF emission rates.

The SPFE Document only discusses one “peer reviewed” study that analyzed HF emissions from large format LFP batteries; the discussion is found on page 28 and it pertains to a study conducted in 2019 by Sturk et al⁵. However, the Sturk Study results are in units of g/kWh and not in % Volume and are thus not relatable to the 2.7% volume HF release rate reported in Table 12; worse yet, the SFPE document fails to explain how it modified Sturk’s g/kWh results and incorporated them into the 2.7 % HF value reported in Table 12. Additionally, the 2019 Sturk study measured HF using two different methodologies (FTIR and a “wash bottle” procedure) and found that the “wash bottle” results were more than 2.3 times higher than the FTIR results. This makes sense, given the significant HF bias introduced by the FTIR sampling methodology; in fact, Sturk et al. actually caution readers that the FTIR results are questionable⁶. Despite the substantial bias introduced by the FTIR sampling methodology, the SFPE document *averaged* the Sturk study’s FTIR results with the “wash bottle” results⁷ and thus substantially discounted the more accurate “wash bottle” data using inferior FTIR results. In other words, not only is there no explanation provided by the SFPE

⁵ The Sturk Study is too large to include in these comments. [mdpi.com/2313-0105/5/3/61](https://doi.org/10.3390/2313-0105/5/3/61).

⁶ The Sturk study states on page 12 that “One has to be cautious about drawing too far-reaching conclusions about the composition of venting gases from Li-ion cells and batteries based on the results of this type of test”. It also acknowledges that the FTIR results were skewed because the sample line was very long and HF is highly reactive; for example, Page 6 states that FTIR methodologies “underreport concentrations of reactive gases, such as HF, which can deposit out of the air before reaching the measurement equipment”. Additionally, page 11 states that “Another important reason for the lower amount detected by the FTIR is that the gas has to travel longer before reaching the detection system. HF is a very reactive substance, and it is not unlikely that some reacted with other species in the gas or with the surfaces in the (externally insulated) gas ducts on the way to the FTIR spectrometer”. The Sturk study also admits that the FTIR analyzed an artificial test environment which was constrained to a dry inert atmosphere and that the lack of moisture in the inert carrier gas artificially suppressed HF formation. Specifically, page 12 states “The measurements are made on gas emissions from Li-ion cells in a dry inert atmosphere. While it is desirable to create a test environment where the vented gases do not ignite, the lack of oxygen may significantly impact on what species will form, and it is not unlikely that chemical substances form in oxygen-starved systems would not be stable in a normal atmosphere. The lack of moisture in the nitrogen carrier gas may also have limited formation of HF. Yang et al. have shown that HF formation from a Li-ion electrolyte will be limited in case the humidity is too low. Their results show that no HF is formed at 10 ppm water content while significant production occurs at 300 ppm water vapor. They also show that the survival time for the intermediate PF₅ increased significantly when the humidity was very low. The humidity in the nitrogen carrier gas in the current study was 40 ppm, or <10% RH. HF was detected by both FTIR and water-filled wash bottles. If large amounts of intermediate PF₅ did not react due to lack of humidity in the test environment, one would expect that the detected amount would be much higher for the water bottles, where there is an abundance of available moisture”.

⁷ Footnote 1 of Table 38 states “Average of results produced by FTIR and wash bottle methods”.

document regarding how the 2.7% HF value was calculated; it is also a certainty that this value is substantially biased and significantly underrepresents actual HF emissions because it is based on inaccurate and skewed FTIR measurement results. Accordingly, there is *no evidentiary basis* for the 2.7% HF concentration assumption that is used in the Staff Assessment's Non Fire Scenario public safety analysis.

Another concern with the SFPE document is that most of the LFP "peer reviewed" studies it analyzed were based on cylinder and prismatic battery formats⁸ rather than the pouch format used by the Corby BESS⁹. This is highly problematic given that pouch batteries *consistently emit more HF* than other formats because of the large quantities of electrolyte they contain; in fact, a 2017 study by Larsson et al reports that pouch cells can release three times more HF per Wh than cylindrical cells¹⁰. A copy of the Larsson study is provided in Attachment 1. Note that the HF emission rates are based on FTIR analytical results; this means they are heavily underestimated and actual HF emissions were much higher than what the Larsson study reports.

This analysis demonstrates that the 2.7% volume HF release rate reported by the SFPE document and assumed by the Staff Analysis is substantially underpredictive not only because it is based on biased FTIR analytical methodologies¹¹ but also because it is based on studies that only analyzed non-pouch battery formats which emit substantially less HF than the pouch format batteries proposed for the Corby BESS. The only thing that is certain about the 2.7% volume HF release rate assumed by the Staff Assessment is that it substantially underestimates actual HF emission rates; SORT estimates that the 2.7% value is "off" by at least a factor of three because FTIR results tend to undermeasure HF concentrations by at least a factor of two (as the 2019 Sturk study demonstrates) and because pouch batteries contain far more electrolyte and thus produce much higher HF when venting.

⁸ SORT reviewed all the peer studies considered in the SFPE 2025 document (all of which are summarized in Section 7.1) and found that 13 of the studies involving LFP cells analyzed non-pouch formats. Only six study teams (Larsson et al, Sturk et al, Peng et al, Bergstrom, Lecocq et al, and Liu et al) considered LFP pouch formats and most of them were based exclusively on FTIR methodologies, so their results are substantially skewed.

⁹ According to page 7 of the UL9540A Cell Test Report filed in the Docket on January 30, 2026 titled "Project Description Update #2, Part 1, Appendix 2-C" (TN # 268368), Corby uses pouch format batteries.

¹⁰ Larsson, F, et al; *Toxic fluoride gas emissions from lithium-ion battery fires*. August 30, 2017. Table 2 reports that HF release rates measured for LFP pouch cells (identified as batteries B and C) range from 43-198 mg/Wh while HF release rates measured for LFP cylindrical cells (identified as batteries D and E) range from 12-52 mg/Wh.

¹¹ SORT's review of the peer studies considered in the SFPE 2025 document found that, among those which analyzed pouch format LFP cells for HF emissions, all used FTIR analytical methodologies. Only two study teams (Larsson et al and Sturk et al) used other HF sampling methodologies (specifically, bottle wash methods) in addition to FTIR concentrations. All the results from these two study teams consistently showed that HF concentration measurements were substantially higher with the bottle wash methodology than the FTIR methodology.

The fact that the Staff Assessment simply accepts the 2.7% volume HF value listed in Table 12 of the SFPE document and utilizes it in the Corby BESS public health impact analysis without question and without even understanding how it was derived or what errors it embodies is *shocking*. The 2.7% value is clearly inaccurate, heavily biased, and substantially underpredictive due to its reliance on inaccurate FTIR analytical methodologies and non-representative cell formats which tend to produce lower HF emissions. These facts demonstrate that there is no evidentiary basis for the 2.7% volume HF release rate that was used in the Staff Assessment to determine the significance of public safety impacts posed by the Corby BESS; accordingly, the Staff Assessment violates CEQA¹².

The proper way to assess HF emissions from BESS cell venting failures is to obtain manufacturer information pertaining to the amount of electrolyte and fluorinated salt that is present in each battery cell¹³ because the salt in the electrolyte is the principal source of fluorine emissions¹⁴ particularly during venting (because there is no flame, no vinyl casings are burned). Typically, this is done by reviewing the Safety Data Sheet (SDS) provided by the manufacturer which, by law, must identify all the constituents in the product (particularly those that are hazardous, flammable, or toxic). Because this methodology relies on information provided by the manufacturer, it yields a more accurate basis for estimating HF release rates and it is not skewed by biased sampling methodologies or non-representative cell formats.

Unfortunately, the SDS provided by the applicant does not identify the type or amount of fluorinated salt that is dissolved in the electrolyte or how much of it is present¹⁵; in fact, the “ingredients” section of the SDS suggests that there is no fluorine in the BESS other than a tiny amount of homopolymer. This is odd, given that page 3 of the SDS warns that HF will be emitted if the cell ignites and given that the LG website states the electrolyte present in their BESS devices contains fluorine¹⁶. It is not clear how this SDS even complies with federal Hazard Communication Standards which require disclosure of chemical names and concentrations (i.e., exact percentages) of all ingredients¹⁷. Given these circumstances, SORT recommends that the Commission contact LG and

¹² As explained in more detail below, CEQA requires Lead Agencies to establish the significance of an impact based on substantial evidence, and it expressly states that substantial evidence does not include evidence that is “clearly inaccurate”. Pub. Resources Code, § 21082.2(c)

¹³ SORT has explained how to calculate HF emissions based on manufacturer data in comments submitted in the Prairie Song BESS project in Docket 25-OPT-02 (TN # 269416 at page 13)

¹⁴ Mrozik, W, et al; *Comparative safety analysis of current and next-generation battery technologies*; February, 2026

¹⁵ The SDS for the LG Energy Solution JF2 Lithium-Ion Battery Cell is found in “Project Description Update #2, Part 1, Appendix 2-C” listed in the Corby Docket as TN # 268368.

¹⁶ lgensol.com/en/etc/cs-safetyguide-caution-tab2#navigation

¹⁷ [osha.gov/sites/default/files/publications/OSHA3514.pdf](https://www.osha.gov/sites/default/files/publications/OSHA3514.pdf). Page 2.

obtain a complete and accurate SDS which lists the type and amount of fluorinated salt present in the batteries that will be used for the Corby BESS; the Commission should then use this information to accurately estimate HF emissions during cell venting.

SORT is also troubled by the NO₂ concentration assumptions made by the Staff Assessment which, according to Table 2 in Appendix D, is based on a presumed 7.9 “mole percent” that was taken from Table 12 of the SFPE document. However, Table 37 of the SFPE document indicates that only one “peer reviewed” study actually measured NO₂ emissions from venting LFP cells (the “Gully 2019” study); SORT has reviewed the Gully study and found that it only considered cylinder format cells. Moreover, the NO₂ results from the Gully study range from 1.3% to 9.7%¹⁸ with an average value of 5.3%; these values differ substantially from the 7.9% reported in Table 12 and adopted by the Staff Assessment in Table 2 of Appendix D. Because the SFPE document does not explain where the 7.9% value came from, it cannot be corroborated. Yet, the Staff Assessment simply adopts this 7.9% NO₂ emission factor into the Corby BESS public safety impact analysis without evaluating it or assessing its veracity. Because the 7.9% NO₂ emission factor is not clearly supported by evidence, it is not an appropriate basis for assessing public safety impacts.

SORT has similar concerns regarding the other toxic emission factors listed in Table 2 of Appendix D (all of which were taken directly from Table 12 of the SFPE document) but we do not have the bandwidth to analyze them all. In any event, we anticipate that the Commission will revise the EIR/Staff Assessment and thoroughly vet the toxic emission assumptions (and all other assumptions) adopted therein and then recirculate the document for public review.

SORT also disagrees with the conclusion set forth in Appendix D that it would take 10 hours to “vent” two of the six racks in a Corby BESS unit. Ostensibly, this conclusion is based on the SFPE document, and Table 3 of Appendix D actually claims that the SFPE document reports that it would take 10 hours to vent a single rack. However, the SFPE document draws no such conclusion¹⁹. Moreover, the SFPE document assumes that 10% of the cells in a hypothetical BESS module will vent simultaneously and that a “peak venting” time interval of 265 seconds should also be assumed²⁰; however, the document does not describe the basis for the 10% value or explain how it was derived. In fact, the 10% assumption appears to have been conjured from thin air²¹.

¹⁸ See Table 37 of the SFPE document.

¹⁹ The SFPE document analyzes a hypothetical BESS container and, according to page 32, the authors decided it would take 6.6 hours to vent a single bay of this hypothetical BESS.

²⁰ These assumptions are discussed on page 32 of the SFPE 2025 document.

²¹ Id.

Nonetheless, Appendix D uses these assumptions, and Table 3 states that it would take 10 hours to vent two racks (or 3,360 battery cells). There is no derivation provided for this 10 hour assumption, and SORT has been unable to reproduce it. The closest we could get is a 10.3 hour estimate, but it is predicated on unrealistic assumptions that presume only a small number of cells within each rack are venting simultaneously in a very limited and particular pattern²². For instance, it implausibly assumes that each module vents sequentially and that all the cells within a module must complete venting before any of the cells in the adjacent module begin venting. These assumptions are highly implausible, particularly given how tightly the modules are packed in together (as shown in Appendix D Figure 1).

If we apply the 10% simultaneous venting assumption and the 265 second venting interval assumption to the Corby BESS system, the first rack would be fully vented after approximately 45 minutes²³, and the second rack would require an additional 45 minutes. In other words, a 10% venting assumption and the 265 second vent interval assumption suggest that two racks of the Corby BESS would vent much more quickly than 10 hours.

Even if we assume that only 3% of the cells in the rack vent simultaneously with a 265 second “peak venting” interval (meaning 50 cells are venting simultaneously), the first rack of 1680 cells would be depleted in 145 minutes and the second rack of cells would be depleted after 290 minutes (or 4.8 hours). This venting scenario is consistent with the scenario posited by the Applicant in which 832 cells are vented in 75 minutes²⁴. In short, the 10 hour venting assumption adopted by the Staff Assessment for the Non-Fire Scenario is not properly supported because 1) it is based on a 10% value that is not documented anywhere and appears to be nothing more than pure conjecture; and 2) it can only be approximated by making implausible assumptions. Therefore, the 10 hour venting conclusion is not legitimate and cannot be relied upon to assess public safety impacts of the Corby BESS. A more plausible venting scenario (and one which the applicant also posits) is one in which two racks vent within 290 minutes.

SORT also disputes the toxic release rates reported in Table 10 of Appendix D which were taken from a spreadsheet analysis on page Att 1-5. SORT notes that this analysis is based on the 2.7 % value taken from the SFPE 2025 document²⁵. This fact alone renders

²² Specifically, the assumptions are that, within each rack, 10% of the cells within a single module (or 12 cells) are vented simultaneously, but each module in each rack vents sequentially and no module begins venting until the adjacent module is finished venting.

²³ If it takes 4.4 minutes to vent 168 cells, it will take ten times longer (or 44 minutes) to vent 1680 cells because 1680 is ten times more than 168.

²⁴ Page 47 of “Data Request Responses Set #2 Part 1” filed on May 23, 2025 (TN #263281).

²⁵ The 27000 ppm HF value reported in column 2 is consistent with a 2.7% by volume concentration.

the assumed HF release rate highly suspicious the 2.7 % value upon which it is based is unsupported, lacks evidentiary basis, and is heavily biased (as explained above). Additionally, the spreadsheet asserts that each cell emits 1.53 grams of HF (which is derived from the 2.7% assumption), but then it asserts that a single cell emits HF at a rate of 0.00095 g/s. This seems to be inconsistent with the 265 second venting interval that is discussed above and used to assess emissions; specifically, if each cell contains only 1.53 grams of HF (a point which SORT *does not* concede) and if this amount of HF is released over a 265 second venting interval, then the HF emission rate from a single cell is 0.00577 g/s²⁶ and not 0.00095 g/s as reported in the spreadsheet; this suggests that HF emissions in the spreadsheet are “off” by *at least a factor of 6*. Finally, SORT is unable to reproduce the 0.14 g/s HF emission rate that is assumed for the public safety impact analysis, and because Appendix A fails to provide the derivation for this assumed value or explain how it was calculated, the assumption itself is lacking in evidentiary basis and is impermissible under CEQA.

Moreover, reproducing the HF emission analysis with more reasonable assumptions demonstrates that HF concentrations emitted from the Corby BESS during a Non-Fire Scenario will be much higher than what is reported in the Staff Assessment:

Assumptions

- 1) The HF molar percent in the vent exhaust is 5.4% (twice the value reported in Table 2)
- 2) Each cell vents 64 liters of exhaust gas (from UL 9540A)
- 3) The venting interval is 265 seconds
- 4) 50 cells are venting simultaneously (3% of the cells in a rack).
- 5) At “Standard Conditions”, 1 liter of vent gas contains 0.0446 moles of vent gas
- 6) The molecular weight of HF is 20 grams/mole

$$50 \text{ cells} \times \frac{64 \text{ liters vented/cell}}{265 \text{ seconds}} \times \frac{0.0446 \text{ moles vented}}{\text{liter vented}} \times \frac{5.4 \text{ moles HF}}{100 \text{ moles vented}} \times \frac{20 \text{ g HF}}{\text{mole HF}} = 0.58 \text{ g/sec}$$

These result indicate that the Staff Assessment’s HF emission rate for the Non-Fire Scenario is “off” by *at least a factor of 4*.

Deficiencies In the “Thresholds of Significance” for the Non Fire Scenario.

SORT is particularly troubled by the “Thresholds of Significance” that the Staff Assessment applies to the public safety impact analysis presented in Appendix D for a number of reasons, not the least of which is that they are not based on state-adopted health exposure standards. Specifically, the State of California has formally adopted mandatory thresholds for assessing acute toxic exposure impacts; these thresholds

²⁶ 1.53 g ÷ 265 seconds = 0.00577 g/s.

(referred to as “Reference Exposure Limits” or “RELs”) were developed by the Office of Environmental Health Hazard Assessment (OEHHA) and are required for health risk assessments that are conducted pursuant to California law. For example, the HF health risk threshold adopted by OEHHA²⁷ is 240 µg/m³. Yet, the Staff Assessment does not use California’s adopted OEHHA exposure standards as the “Thresholds of Significance” for assessing public safety impacts of Corby BESS operations; instead, it uses much more lenient federal “guidelines” published by the U.S. Environmental Protection Agency (EPA).

These federal guidelines are referred to as “Acute Exposure Guideline Levels” (AEGL) and they are substantially higher than OEHHA’s adopted health exposure standards. For example, the AEGL guideline for HF is 818 µg/m³ which is more than 3 times higher than OEHHA’s adopted HF REL. The EPA characterizes this concentration as “not disabling” in its effects²⁸. Notably, an acute health effect (such as an asthma attack) is still “significant” even if it is not “disabling”; this fact alone renders AEGL levels entirely inappropriate for use as CEQA “Thresholds of Significance”. SORT notes that Section 15064.7(d) of the CEQA Guidelines requires the Commission to demonstrate that compliance with the AEGL ensures that health impacts of a Corby BESS failure will be “Less than Significant”; no such showing can be made because a “non-disabling” health effect (such as an asthma attack) can still be significant.

The Staff Assessment does not justify the use of lenient EPA guidelines rather than adopted OEHHA exposure standards as “Thresholds of Significance” other than to state that a BESS fire is merely an “episodic accidental release” event which produces only “transitory exposure” and is not a “routine emission source”²⁹. These arguments are not persuasive because OEHHA *has* developed exposure RELs that are specifically intended to address “transitory exposure” scenarios; they are referred to as “Acute” standards and they are entirely applicable to BESS failure events. Nothing in the Staff Assessment controverts this fact and the Staff Assessment itself fails to demonstrate that OEHHA RELs are either inapplicable to, or inappropriate for, assessing health impacts of BESS fires. Accordingly, the choice to use AEGLs rather than OEHHA RELs is inconsistent with CEQA which requires thresholds of significance to have evidentiary support.

As if to “prop up” the decision to use AEGLs rather than OEHHA RELs for assessing public safety impacts, the Staff Assessment asserts that OEHHA’s Technical Support Document provides references to other “guidance levels” that can be used for

²⁷ oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

²⁸ *Acute Exposure Guideline Levels for Selected Airborne Chemicals - Volume 4*. Table 3-11. epa.gov/sites/default/files/2014-11/documents/tsd53.pdf

²⁹ Page 5.10-9.

“addressing accidental chemical releases”³⁰. This suggests that OEHHA recommends the use of non-REL “guidance levels” (such as AEGLs) to protect the public from accidental releases; however, *nothing could be further from the truth*. In fact, the OEHHA Technical Support Document clearly explains that emergency guidelines like EPA AEGLs do not guarantee public protection. For example, page 81 states:

- “these guidelines are designed to identify tolerable conditions for emergency first responders such as firefighters or military personnel, *rather than to protect the general population*” (emphasis added);
- “standard margins of safety are not incorporated” in emergency guidelines; and
- AEGLs were developed “to provide information to incident commanders in an emergency”

The plain language of the OEHHA Technical Support Document *does not* recommend the use of EPA AEGLs to assess the public safety impacts of toxic release events such as BESS fires and it certainly *does not* provide evidentiary support to justify a decision to use AEGLs rather than OEHHA RELs as “Thresholds of Significance” for assessing the public safety impacts resulting from BESS failures.

Furthermore, EPA itself states clearly that AEGLs are supposed to be “used by emergency planners and responders”³¹; there is no evidence that they were intended for use in making land use decisions such as whether to approve the Corby BESS. EPA clearly recognizes that there are situations in which AEGLs do not apply, and recommends that decisionmakers consider “other organizations” that have “recommended levels of exposure that more appropriately apply to the scenarios under evaluation”³². The record does not show that the Commission did as EPA recommends and consulted OEHHA regarding the applicability of RELs for BESS failure scenarios, and the Staff Assessment provides *no* record evidence to support the use of AEGLs as “Thresholds of Significance” rather than OEHHA RELs; there is merely declarative claims³³ and uncorroborated statements *which are not even supported by the documents that are cited*.

It appears that the real reason AEGLs were chosen as the “Thresholds of Significance” for assessing public safety impacts of the Corby BESS is found on page 5.10-14 of the

³⁰ Id.

³¹ epa.gov/aegl/about-acute-exposure-guideline-levels-aegls

³² Id.

³³ For example, page 15 of Appendix D states: “the AEGL levels are used as the significance thresholds for public exposure since they are intended for emergency planning, accidental chemical releases, public protection, and assessing risks”. This uncorroborated declarative statement is not evidentiary. It alleges what AEGLs are but does not justify why they should be used to assess Corby BESS public safety impacts.

Staff Assessment which quotes a line from a document published in 2025 by the American Clean Power Association³⁴ (referred to as the ACP document) stating “For an analysis of the health impact of exposure of individuals located in a nearby community, AEGLs are often cited by the EPA”; the Staff Assessment then goes on to say “Consistent with this approach, staff used AEGLs to determine the significance of BESS thermal runaway and fire impacts on public health in this assessment”. In other words, the Staff Assessment adopts AEGLs as CEQA “Thresholds of Significance” simply because that is what is recommended in the ACP document. Notably, this ACP quotation that is parroted in the Staff Assessment and which is the basis for adopting AEGLs as CEQA “Thresholds of Significance” ***has no evidentiary value*** because the ACP document fails to corroborate it with facts or support it with citations or references. Thus, ACP’s unsubstantiated opinion that AEGLs are appropriate for assessing public safety impacts for BESS failure scenarios is inadequate for the purposes of CEQA, and it is certainly an inappropriate basis upon which to establish CEQA “Thresholds of Significance”.

SORT has reviewed the ACP document³⁵ and we note that it was never peer reviewed or publicly vetted, and it does not appear to have been subject to any technical scrutiny. We also note that it was prepared at the behest of the American Clean Power Association, which is a consortium of BESS developers, transmission system owners, and energy speculators whose policy and principal interest is to remove barriers and expedite BESS projects and other energy developments³⁶. Given that the likely intent of the ACP document is to further such policies (and not necessarily in an unbiased manner that furthers the public interest), it is singularly inappropriate for the Commission to rely on it for CEQA purposes (and in particular, for establishing “Thresholds of Significance” pertaining to public safety impacts). Nonetheless, it appears that the Staff Assessment *does* rely heavily on the ACP document³⁷ which only further undermines the legitimacy of the Staff Assessment.

Aside from the fact that ACP declarations are nothing more than unsubstantiated opinion, there are other reasons why AEGLs are not appropriate as “Thresholds of Significance” for assessing public health risks. For instance, AEGLs are only intended to address “single release” events that involve only one chemical³⁸; they do not account for

³⁴ The document is titled “Assessment of Potential Impacts of Fires at BESS Facilities”. [cleanpower.org/wp-content/uploads/gateway/2025/03/Assessment-of-Potential-Impacts-of-Fires-at-BESS-Facilities_FINAL_Sep-2025.pdf]

³⁵ SORT is in the process of preparing a detailed engineering analysis of the ACP document; we will provide a copy of this analysis to the Commission when it is completed.

³⁶ Their policy is to remove barriers and expedite BESS and other energy developments to achieve decarbonization goals. cleanpower.org/policy/

³⁷ Several portions of Section 5.10 of the Staff Assessment appear to mirror the information presented in the 2025 ACP publication (such as the discussions of previous BESS failure incidents).

³⁸ Page 20 of Appendix D states “AEGLs are stand-alone values” designed for “single-chemical release”.

the presence of multiple toxic compounds and, as explained above, they provide no “margin of safety”. Accordingly, they **cannot** be used to assess public exposure risks for BESS failure scenarios which always involve multiple toxic compound releases that have additively adverse health effects and may even be synergistic in their impacts (meaning their interactive effects are more than just additive³⁹). Conversely, OEHHHA’s exposure standards *are* intended to accommodate multiple chemical exposure scenarios and they *do* have “margins of safety”; therefore, OEHHHA’s exposure RELs are the appropriate standards for establishing “Thresholds of Significance” to assess public safety risks posed by the Corby BESS.

Page 5.9-10 of the Staff Assessment makes numerous claims regarding the purpose and intent of AEGL guidelines. However, these claims are not supported by citations or evidence and (more importantly) none of them substantively support the decision to rely on AEGLs for assessing the significance of Corby BESS public safety impacts:

Claim 1: AEGLs “provide guidance for rare, short-term exposures to airborne chemicals to help protect the public in emergency situations”. Fact: AEGLs were developed in response to the Bhopal methyl isocyanate release event in 1984 and their purpose is to guide emergency response actions in the face of an imminent individual toxic release or *after* it occurs⁴⁰. AEGLs were not developed to make land use decisions such as whether to approve a BESS in a populated area.

Claim 2: AEGLs are “used by emergency responders when dealing with events like chemical spills to help determine the severity of the hazard”. Fact: AEGLs *are* used by emergency responders to address single chemical release events that are either imminent or *after* they initiate because that is their purpose⁴¹. The purpose of AEGLs is not to make land use decisions such as whether to approve a BESS in a populated area.

Claim 3: AEGLs “help identify areas where the concentration of a hazardous gas could cause discomfort, serious health effects, or life-threatening conditions, allowing for protective actions like evacuation or sheltering in place”. Fact: AEGLs are used by emergency responders to address single chemical release emergency events that are either imminent or after they occur. Furthermore, the decision to “shelter in place” rather than “evacuate” is *not* a function of AEGL; rather, it is a function of the speed at which the chemical reaches the receptor and the level of protection provided by the shelter⁴².

³⁹ OEHHHA *Guidance Manual for Preparation of Health Risk Assessments*. January 2015. Page 1-5.

⁴⁰ epa.gov/aegl/history-acute-exposure-guideline-levels-aegls

⁴¹ *Id.*

⁴² fema.gov/cbrn-tools/key-planning-factors-chemical-incident/ kpf4/4/4- 1

Claim 4: AEGLs “help in assessing the potential health effects on the general public, including sensitive populations like children and the elderly, from a one-time exposure to a chemical”. Fact: AEGLs are used during toxic release events in combination with actual, real time meteorological data, known single chemical release rates, actual topography, and actual population data to establish an appropriate emergency response to an *ongoing* public safety threat. AEGLs are not used for making land use decisions such as whether to approve a BESS in a populated area.

AEGLs are inapplicable to BESS venting scenarios which 1) involve multiple toxic compounds that are released quickly and **before** emergency responders appear; 2) can be so quiet and so visibly imperceptible to individuals located on the outside of a walled BESS yard that such individuals will not even know that they are supposed to retreat to shelter; and 3) create circumstances in which individuals experience immediate and inexplicable breathing problems before emergency response is present. And, because the Staff Assessment substantially underestimates HF emission rates from Corby BESS failures (as discussed above), actual toxic emission rates will be substantially greater than what the Staff Assessment projects. Therefore, a significant “margin of error” is warranted for the Corby BESS public safety impact analysis. However, AEGLs do not incorporate *any* safety margins and thus provide no “margin of error”; accordingly, they are wholly inappropriate for assessing public safety impacts of Corby BESS failures.

SORT appreciates that the Staff Assessment does not claim the use of AEGLs as CEQA “Thresholds of Significance” will protect public health. However, a number of claims made by the Staff Assessment indicate that the Commission does not have a clear understanding of the actual implications of the AEGL levels; in fact, the presentation given by Commission staff on September 1, 2026 included a slide which actually states that health effects are considered “mild” up until the AEGL 2 concentration is reached and that, until AEGL 2 is reached, no “action” needs to be “taken” (See Attachment 2). ***Nothing could be further from the truth.*** AEGL 2 is the concentration at which severely adverse health effects become long term or irreversible⁴³; therefore, the health effects that occur when concentrations are less than AEGL 2 are still quite significant and even disabling; the only difference is that they are reversible or short term.

It appears the Commission does not understand that a continuum of health effects occurs across the concentration spectrum and that the AEGLs merely identify the transition points at which certain health characteristics are revealed. As explained in EPA’s AEGL development procedures⁴⁴, the concentration of a single chemical below

⁴³ epa.gov/aegl/about-acute-exposure-guideline-levels-aegls

⁴⁴ Figure 1-1 of EPA’s *Operating Procedures for Developing Acute Exposure Guideline Levels* epa.gov/sites/default/files/2015-09/documents/sop_final_standing_operating_procedures_2001.pdf

AEGL Level 1 creates sensory irritation and non-sensory or asymptomatic impacts; however, AEGL 1 is the transition point at which severe (though reversible) health effects occur. Between AEGL 1 and AEGL 2 is a continuum of substantial health effects that increase in severity as concentrations increase until the health effects are irreversible and long lasting (which is the transition point that defines AEGL 2). In a similar manner, there is a continuum of severe health effects between AEGL 2 and AEGL 3 which increase in severity as concentrations increase until the health effect is death (which is the transition point that defines AEGL 3). The presentation given by the Commission ignores all of this, and erroneously asserts that, at concentrations below AEGL 2, health effects are “mild” and that one only needs to “take action” when AEGL 2 levels are reached. Clearly, this is erroneous because EPA itself says that, at AEG 2 is the point at which severe impacts are irreversible. Similarly erroneous statements are found in the Staff Assessment; for instance, page 5.18-18 minimizes the health effects of concentrations above AEGL 1 and describes them as merely causing discomfort or irritation. This is incorrect. Descriptors such as “discomfort” and “irritation” apply only to concentrations that are well below AEGL 1; at AEGL 1, the effects are much more severe and the severity increases as the concentration approaches AEGL 2.

What is particularly odd about Staff’s choice to utilize AEGL guidelines for “Thresholds of Significance” rather than adopted OEHHA RELs is that the Commission has throughout this proceeding consistently *required* the applicant to assess the public safety impacts of Corby BESS failures based on OEHHA exposure limits. For example, in the Data Request sent by the Commission on July 31, 2025, the applicant was directed to use OEHHA RELs to assess health impacts of a BESS fire, and to only use AEGL values if an OEHHA REL is not available⁴⁵. In the applicant’s response to this data request submitted on October 3, 2025, OEHHA RELs were used when available⁴⁶. A subsequent data request and responsive submittal filed in January, 2026 also relied on OEHHA REL values and only utilized AEGLs when RELs were not available⁴⁷. In March, 2026, a data request response reaffirmed the use of OEHHA RELs for assessing BESS fire impacts⁴⁸. Despite the consistent use of OEHHA RELs throughout this proceeding, Staff reverse course and base the Staff Assessment on AEGLs to analyze public health impacts of Corby BESS failure scenarios; the record does not explain why. What is certain is that, by using AEGL values, the Staff Assessment is able to conclude that public safety impacts of HF concentrations are “Less than Significant” under the Non-Fire Scenario; had OEHHA RELs been used, Staff would be compelled to affirm that HF concentrations at sensitive receptor locations were “Significant”. In fact, Table

⁴⁵ TN # 265205 page 11.

⁴⁶ TN # Appendix 3-A. Page 13.

⁴⁷ See response filed January 30, 2026 (TN # 268433). Appendix 3.9-A page 1

⁴⁸ See response filed March 13, 2026 (TN # 269192). Page 38.

1-15 of Appendix D reports that HF concentrations exceed the OEHHA REL at two different receptor locations (“North 1” and “South 1”). SORT is not suggesting that specific thresholds were “cherry picked” by Staff to deliver a “Less than Significant” finding for HF concentrations; however, it is quite convenient for the applicant that the Staff Assessment switched to AEGLs to assess public safety impacts rather than the OEHHA RELs that had been the centerpiece of Commission data requests.

Finally, SORT contends that Staff’s decision to use EPA AEGLs for “Thresholds of Significance” in assessing BESS failure impacts does not comply with CEQA. CEQA compels the Commission to rely on substantial evidence in making findings regarding the significance of environmental impacts, and CEQA clearly establishes what constitutes “substantial evidence”: “Substantial evidence shall include facts, reasonable assumptions predicated upon facts, and expert opinion supported by facts” (CEQA Guidelines Section 15384(b)). CEQA is also clear on what is *not* substantial evidence: “Argument, speculation, unsubstantiated opinion or narrative” and “evidence which is clearly erroneous or inaccurate” (CEQA Guidelines Section 15384(a)). Uncorroborated claims, declaratory statements, unsupported CPA citations, and erroneous suppositions imbedded in Commission presentations *do not* constitute evidence (let alone “substantial” evidence) that AEGLs are appropriate CEQA “Thresholds of Significance” for assessing the public safety impacts of toxic BESS failure events. To the contrary, they are mere narrative and unsupported argument which falls well outside the ambit of “substantial evidence”.

Furthermore, SORT has provided substantial evidence demonstrating that AEGLs are entirely inappropriate as “Thresholds of Significance” for assessing public safety impacts of Corby BESS failures. This evidence includes the fact that AEGLs are only applicable to “single chemical release” events (and are thus inapplicable to BESS fires) and that the OEHHA Technical Support Document does not demonstrate that AEGLs are appropriate to protect the public. This substantial evidence facially invalidates the Staff Assessment’s uncorroborated claims regarding the appropriateness of using AEGL guidelines as Thresholds of Significance”. Accordingly; CEQA precludes the use of AEGLs as “Thresholds of Significance” for assessing Corby BESS public safety impacts.

SORT’S ASSESSMENT OF THE ASSUMPTIONS AND THRESHOLDS OF SIGNIFICANCE ADOPTED FOR THE FIRE SCENARIO.

SORT notes numerous deficiencies in the Staff Assessment’s analysis of public safety risks posed during a BESS failure scenario that involves an ignition of the entire BESS unit as described in Appendix D; these deficiencies are enumerated below.

Deficiencies In Toxic Emission Assumptions for the Fire Scenario.

Page 8 of Appendix D states “the selection of the emission rates, and source terms selected, are conservative, ensuring that a maximum reasonable value of impact distance is generated”, and Table 5 identifies the toxic constituents that were considered for the Fire Scenario. However, Table 5 does not actually identify the emission rates assumed for the Fire Scenario and it certainly does not explain how they were derived. Instead, Table 5 merely identifies various studies that were considered by Staff. Moreover, SORT has evaluated each of the studies identified in Table 5 and we note that they do not reflect the circumstances presented by the Corby BESS:

SFPE 2025: A compilation document that provides substantially skewed HF emission data (as explained above) because it is sourced from studies that relied on FTIR analytical methodologies (which significantly underreport HF concentrations) and predominantly analyzed non-pouch battery formats (which produce substantially less HF emissions than the pouch battery format that will be used by the Corby BESS). Therefore, the SFPE 2025 document is not a reliable source for estimating toxic emissions from the Corby BESS.

Ramboll 2024: A compilation document that does not involve any measurements, sampling, or analytical procedures. Because Ramboll 2024 reviews the same studies considered in the SFPE 2025 document, the HF emission data it provides are just as skewed and biased as those presented in the SFPE 2025 document. Therefore, Ramboll 2024 is not a reliable source for estimating toxic emissions from the Corby BESS.

EPRI 2020: A compilation study that does not involve any measurements, sampling, or analytical procedures. Because EPRI 2020 reviews the same studies considered in the SFPE 2025 document, the HF emission data it provides are just as skewed and biased as those presented in the SFPE 2025 document. Therefore, EPRI 2020 is not a reliable source for estimating toxic emissions from the Corby BESS.

Franqueville 2023: A compilation document that uses published studies to estimate toxic emission rates from BESS fires and applies them in a computational fluid dynamics simulations to predict toxic concentrations. Because Franqueville 2023 reviews the same studies considered in the SFPE 2025 document, the HF emission data it provides are just as skewed and biased as those presented in the SFPE 2025 document. Therefore, Franqueville 2023 is not a reliable source for estimating toxic emissions from the Corby BESS.

DNVGL 2019: A lab study that measured toxic emissions from burning lithium batteries. According to page 10, only cylindrical format LFP batteries were tested and an FTIR was used to quantify toxic emissions. Because FTIR analytical methodologies significantly underreport HF concentrations, and because a cylindrical battery format

does not represent the pouch type of battery that will be installed in the Corby BESS (and which produces significantly higher HF emissions), DNVGL 2019 is not a reliable source for estimating toxic emissions from the Corby BESS.

Because all the studies identified in Table 5 of Appendix D are biased by inappropriate HF sampling methodologies and non-representative battery formats, they do not provide an adequate basis for assessing HF emissions or public safety impacts.

Although Appendix D does not identify the toxic emission factors that were assumed in the Fire Scenario, there is a spreadsheet in an attachment included with Appendix D that does lists toxic emission factors in units of mg/kg (see page Att 1-6 of Appendix D). However, no information is provided regarding where these toxic emission factors came from, how they were calculated, or the basis upon which they were derived. It does appear as though most of the emission factors were normalized to a parameter described as “total emissions”; a note below the spreadsheet states that the “total emission” is “17,119 kg calculated, from battery (not including air)”. It appears as though “total emissions” is a calculated value, but no information is provided regarding how it was calculated or the source of the data used in the calculation. This lack of supporting information makes it impossible to evaluate (or even understand) the toxic release assumptions that form the basis of the Staff Assessment’s public safety impact analysis for the Fire Scenario. Because the “total emissions” assumption and the normalized toxic emission factors reported on page 1-6 are not explained or supported by *any* evidence (let alone substantial evidence), they do not comply with CEQA. That is not to say that SORT disagrees (or agrees) with the final toxic emission rates reported in Table 1-5; no opinion regarding their veracity can be formed until information is provided which explains where they came from and how they were derived.

Finally, and as explained above, the proper way to assess HF emissions from a BESS fire is to obtain manufacturer information pertaining to the amount of electrolyte and fluorinated salt that is present in each battery cell because that is the principal source of fluorine; this is particularly true during the early stages of a BESS fire when most of the material that is combusted is electrolyte. SORT recommends that the Commission prepare such an analysis, which will necessarily require the battery manufacturer to produce an SDS that fully discloses all constituents in the Corby BESS.

Deficiencies In The “Thresholds of Significance” For The Fire Scenario.

The Staff Assessment adopts the same AEGL “Thresholds of Significance” for the Fire Scenario as were adopted for the Non-Fire Scenario; however, there is nothing unique about the Fire Scenario that would render AEGL “Thresholds of Significance” to be more appropriate for the Fire Scenario than they are for the Non-Fire Scenario. Accordingly,

for the reasons set forth above, the AEGL “Thresholds of Significance” adopted by the Staff Assessment for the Fire Scenario are inappropriate, unsupportable, and impermissible under CEQA.

DEFICIENCIES IN THE EIR PERTAINING TO THE SIGNIFICANCE OF PUBLIC SAFETY IMPACTS.

A principal deficiency noted in the Staff Assessment’s analysis of public safety impacts is that it is based on toxic emission factors which are substantially lacking in evidentiary support and on AEGL “Thresholds of Significance” that do not comply with CEQA (as explained above). However, additional deficiencies beyond those enumerated above have also been found in the EIR/Staff Assessment; these deficiencies are set forth below.

Conclusions Regarding the Significance of Public Safety Impacts Do Not Comply with CEQA.

CEQA requires Lead Agencies to identify any and all significant effects on the environment (Guidelines 15126.2); it also requires the Lead Agency to identify any and all mitigation measures that could avoid or reduce these significant impacts (Guidelines 15126.4). Given this framework, EIR conclusions regarding the significance of project impacts are typically rooted in the thresholds of significance that are adopted therein and, in general, EIRs conclude that any impact which exceeds the established threshold is “Significant”. Then, EIRs typically apply mitigation measures and draw conclusions pertaining to each significant impact regarding whether the collective mitigation measures are capable of reducing the impact to a level below the “Threshold of Significance” and thus “Less than Significant”. If yes, then the EIR concludes that the impact is “Less than Significant” with mitigation. If no, then the EIR concludes that the impact is “Significant and Unavoidable” and the mitigation measures are applied to the project anyway to reduce the significant impact to the greatest extent feasible. A good example of properly crafted conclusions regarding the significance of project impacts is found in the EIR prepared by the California Public Utilities Commission for the “South Orange County Reliability Enhancement Project”; the relevant excerpt is provided in Attachment 3⁴⁹. Importantly, Pub. Resources Code, § 21002 requires all feasible mitigation measures to be implemented to reduce significant impacts even if the measures are not capable of reducing the impact to a level that is “Less than Significant” because doing so will still reduce the severity of the impact.

⁴⁹ The excerpt is from page 4.3-13 of the SOCREP EIR which found that air quality impacts were significant because emissions exceeded promulgated air quality standards used as “Thresholds of Significance”. The EIR then identified various mitigation measures, but acknowledged these measures would not reduce emissions below the “Thresholds of Significance”. Finally, the EIR concluded that air quality impacts were “Significant and Unavoidable”.
ia.cpuc.ca.gov/environment/info/ene/socre/socredraftEIR.html.

Unfortunately, the Corby BESS EIR departs substantially from this obligatory regulatory pattern:

- The EIR adopts toxic “Thresholds of Significance” for assessing public safety impacts of Corby BESS failures and finds that these thresholds are exceeded at receptor locations; yet, the EIR does not acknowledge that the Corby BESS will create “Significant” public safety impacts⁵⁰.
- The EIR identifies mitigation measures to address the public safety impacts of Corby BESS failures; however, it fails to show that the mitigation measures do not reduce toxic concentrations to levels that are below the adopted “Thresholds of Significance” at receptor locations⁵¹. SORT contends that *no such showing can be made* because the proposed mitigation measures have no effect on toxic concentrations released by Corby BESS failures (as explained in detail below).
- The EIR does not articulate that, because mitigation measures will not reduce toxic concentrations below adopted “Thresholds of Significance”, the public safety impacts of Corby BESS failures remain “Significant and Unavoidable”. Worse yet, the EIR erroneously states that the mitigation measures reduce “impacts of any BESS thermal runaway/fire events to less than significant” (page 5.10-19) when in fact the mitigation measures have no effect on toxic concentrations. Because the EIR lacks the facts and analysis required to support the inference that mitigation measures will quantifiably reduce toxic concentrations to levels below the “Thresholds of Significance”; it violates CEQA by claiming that mitigation measures render public safety impacts to be “Less than Significant”. *Sierra Club v. County of Fresno* (2018) 6 Cal.5th 502.

The EIR neglects to affirm that BESS failure events will result in significant public safety impacts, it fails to demonstrate how mitigation measures reduce toxic concentrations, and it fails to assert that public safety impacts of Corby BESS failures remain “Significant and Unavoidable” even with mitigation; thus, it violates CEQA. These deficiencies must be remedied by revising the EIR to reflect the obligatory regulatory pattern set forth above and incorporate conclusions that the public safety impacts of Corby BESS failures will be “Significant and Unavoidable”.

⁵⁰ For example, page 5.10-18 clearly states that toxic emissions during BESS failure events substantially exceed the AEGL “Thresholds of Significance”; yet, the EIR fails to acknowledge that, because “Thresholds of Significance are exceeded, BESS failures will result in “Significant” public safety impacts.

⁵¹ For example, page 5.10-18 identifies numerous mitigation measures that will be implemented in the event of a BESS failure, but the EIR does not show how these mitigation measures reduce toxic concentrations to levels below AEGLs at receptor locations.

Proposed Mitigation Measures Do Not Reduce Public Safety Impacts to a Level that is “Less Than Significant”.

Pages 5.10-18 to 5.10-19 of the Staff Assessment identify mitigation measures that will be implemented in response to Corby BESS failures. However, these mitigation measures will have no effect on toxic concentrations:

COC PH-1: Requires the preparation of an Emergency Response Plan. However, an Emergency Response Plan will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC PH-2: Requires the Corby BESS developer to conduct air monitoring during BESS failure events. However, monitoring air concentrations will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC WORKER SAFETY-6: Requires that the Corby BESS comply with current NFPA standards. However, complying with adopted standards will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC WORKER SAFETY-7: Requires administrative and engineering controls to prevent or respond to a BESS fire. However, administrative and engineering controls will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC WORKER SAFETY-8: Requires the Corby BESS developer to provide fire training and establish a joint training program. However, fire training and joint training programs will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC WORKER SAFETY-10: Requires the Corby BESS developer to provide a drone that can measure airborne constituents. However, deploying a drone during a BESS failure event will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

COC HAZ-9: Requires the Corby BESS developer to develop and implement a sampling and analysis plan. However, a sampling and analysis plan will not affect toxic concentrations at surrounding residences or reduce them to less than the AEGL.

Because none of these mitigation measures have any effect on toxic concentrations during Corby BESS failure events and will not reduce toxic concentrations to levels that are below the AEGL “Thresholds of Significance” at surrounding receptor locations, they are singularly incapable of reducing public safety impacts to a level that is “Less than Significant”. The EIR errs in claiming otherwise.

When More Representative HF Emission Factors and More Reasonable Significance Thresholds are Applied, Most Receptor Locations Experience “Significant and Unavoidable” Public Safety Impacts.

The AERMOD toxic exposure dispersion modeling analysis prepared for the Staff Assessment is generally described in Section 4 of Appendix D, and projected toxic concentrations at specific receptor locations are provided on page Att 1-15. It is based on these results and the use of AEGLs as “Thresholds of Significance” that the EIR concludes public safety impacts of Corby BESS failures are “Less than Significant” (although this conclusion is controverted by the data on page Att 1-15 which shows NO₂ concentrations at 4 receptor locations exceed the AEGL of 940 µg/m³). However, and as explained above, AEGLs are not appropriate exposure thresholds under CEQA; so, when we replace them with OEHHA RELs, page Att 1-15 clearly shows that HF concentrations exceed the 240 µg/m³ REL at two receptor locations (North 1 and South 1). Accordingly, Corby BESS failures will result in “Significant” public safety impacts attributable to high HF levels at two different receptor locations. And, because no feasible mitigation measures exist to reduce these concentrations or their associated public safety impacts to a level that is “Less than Significant”, these impacts will remain “Significant and Unavoidable”. The EIR should be revised to reflect this fact.

Unfortunately, the dispersion analysis results presented on page Att 1-15 of Appendix A are based on toxic emission factors that are biased, unsubstantiated, and have no evidentiary foundation (as explained above); this fact alone renders the dispersion modeling results insufficient for the purposes of CEQA. However, AERMOD concentration outputs scale linearly with emission rates⁵² so it is possible to derive more representative concentrations at residential receptor locations by using scalar corrections. Specifically, applying the more representative 0.58 g/s HF emission rate derived above rather than the biased and unsubstantiated 0.14 g/s emission rate assumed in the Staff Assessment provides a scalar correction factor of 4.14 (because 0.58 is 4.14 times higher than the 0.14). The results of applying this 4.14 scalar correction to the HF concentration outputs reported on page Att 1-15 are summarized in Table 1, and they demonstrate that at least two receptor locations will exceed the 818 µg/m³ AEGL for HF during a Non Fire Scenario. More importantly, when the “Thresholds of Significance” are properly adjusted to reflect the 240 µg/m³ OEHHA REL for HF, *nearly all receptor locations experience “Significant” public safety impacts.*

⁵² AERMOD utilizes a steady state plume model in which concentration results are linearly dependent on emission rates. See equation 51 on page 64 of EPA’s “AERMOD Model Formulation” document updated July 2026 and found here: gaftp.epa.gov/aqmg/SCRAM/models/preferred/aermod/aermod_mfd.pdf

Table 1. Corrected HF Concentrations at Modeled Receptor Locations.

Receptor Location	HF Concentration from Page Att 1-15 (ug/m3)	Scalar Factor	Corrected HF Concentration (ug/m3)
North 1	377.3	4.14	1562
North 2	162.6	4.14	673.2
North 3	164.7	4.14	681.9
North 4	115.5	4.14	478.2
East 1	92.5	4.14	383.0
East 2	52.7	4.14	218.2
East 3	67.3	4.14	278.6
South 1	322.1	4.14	1333
South 2	105.8	4.14	438.0
South 3	89.7	4.14	371.4
South 4	66.8	4.14	276.6
West 1	215.4	4.14	891.8

A similar methodology can be used to derive more representative “Impact Distance” results for the Non Fire Scenario than those presented on page Att 1-13 of Appendix A. For instance, page Att 1-13 reports that the HF “Impact Distance” based on an AEGL threshold is 519 feet; this means that the maximum HF concentration resulting from a Non-Fire Scenario will occur at 519 feet from the venting BESS and will be 818 $\mu\text{g}/\text{m}^3$ (which is the HF AEGL). However, if the more representative 0.58 g/s HF emission rate is applied rather than the biased and unsubstantiated 0.14 g/s emission rate assumed in the Staff Assessment, then the concentration at 519 feet from the venting BESS will actually be 3,387 $\mu\text{g}/\text{m}^3$ and not 818 $\mu\text{g}/\text{m}^3$; notably, this is more than 14 times higher than the 240 $\mu\text{g}/\text{m}^3$ OEHHA REL for HF.

SORT contends that the most accurate methodology for estimating HF emissions from a BESS failure is to utilize SDS data pertaining to the amount of fluorinated salt present in the electrolyte; however, the Corby BESS manufacturer has inexplicably omitted this information from the SDS. If the Commission is unable to acquire this requisite data by other means, then at the very least, the EIR must be revised to incorporate the more reasonable 0.58 g/s HF emission rate for the Non Fire Scenario rather than the unsubstantiated 0.14 g/s assumption upon which the EIR is currently based.

SORT was unable to ascertain whether a more representative HF emission rate for the Fire Scenario is warranted because we were unable to discern the basis of the 19.65 g/s emission rate that was assumed in the Fire Scenario model.

SIGNIFICANT PUBLIC SAFETY IMPACTS POSED BY THE CORBY BESS ARE ELIMINATED WITH THE LAMBIE PARK ALTERNATIVE.

According to the Staff Assessment's analysis of the Corby BESS Non Fire Scenario, toxic concentrations exceed the AEGL "Threshold of Significance" at multiple receptor locations and no mitigation measures are capable of reducing these concentration levels; thus, the Corby BESS project poses "Significant and Unavoidable" Public Health impacts (although the Staff Assessment erroneously declares otherwise). Additionally, if we assume that the emission factors and AEGL "Thresholds of Significance" adopted by the Staff Assessment are reasonable (a point that SORT *does not* concede), then it is a certainty that the Corby BESS will result in significant air quality and public safety impacts within 2,412 feet (despite contrary claims in the Staff Assessment) because:

- Table 14 of Appendix D establishes that each Corby BESS failure will result in a Hazard Index exceeding 1 at distances up to 2,412 feet; and
- The Yolo-Solano Air Quality Management District establishes that any project with a Hazard Index exceeding 1 poses significant air quality impacts⁵³.

The only way to eliminate these impacts identified in the Staff Assessment is to locate the BESS in a more remote location. For example, and as shown in Figure 1, if the BESS is located in the northeast quadrant of Lambie Park, it will be more than 2,412 feet from any residential receptor and within 2,412 of only two existing industrial uses.

Figure 1. Lambie Park Alternative Showing 2,412 Foot Separation From Receptors.



⁵³ YSAQMD has established that developments which result in a hazard index exceeding 1.0 are deemed to have a significant air quality impact. *YSAQMD Handbook for Assessing and Mitigating Air Quality Impacts*. Page 7. ysaqmd.org/wp-content/uploads/Planning/CEQAHandbook2007.pdf

Because the Lambie Park alternative eliminates the significant air quality and public safety impacts that are revealed by the Staff Assessment, and because the Lambie Park alternative has never been shown to be infeasible, CEQA requires the Commission to reject the proposed Corby BESS location in favor of the Lambie Park location; anything else would violate Section 21081 of the CEQA Statute.

DEFICIENCIES IN THE BESS FAILURE FREQUENCY ANALYSIS.

Two major reasons why the Staff Assessment concludes that public safety risks posed by the Corby BESS are “Less than Significant” is because Staff expect that BESS failures will be infrequent and because ACP claims that “contaminant concentrations beyond the immediate fire scene do not pose a public health risk” based on “air sampling from past incidents”. Neither of these claims are dispositive.

The BESS Failure “Frequency Analysis” is Specious and Irrelevant.

Appendix D of the Staff Assessment devotes several pages to a “frequency analysis” of BESS events, and concludes that the Corby BESS is likely to fail at a frequency ranging from once every 11 to 67 years (Table 16). It also explains that the meteorological conditions under which toxic concentrations exceed the AEGL will only occur approximately 300 hours per year. What the Staff Assessment appears to argue is that a significant public safety impact is not really significant if it only occurs once every 11 years or is likely to happen during only 300 hours in any one year. However, the Staff Assessment fails to corroborate this argument with relevant case law or statutory citations, and SORT is not aware of any such statutes or cases. Perhaps this is because the frequency at which an event occurs has no bearing on whether the event is “Significant”, and because the significance of an impact is not diminished merely because it is infrequent. In other words, the “frequency” argument posited by the Staff Assessment is irrelevant.

SORT also notes that the evidence proffered by the Staff Assessment to support the “frequency analysis” is insubstantial. For example, page 23 of Appendix D states that the analysis relies on “the EPRI BESS Failure Incident Database, other studies’ listings, and online searches” and refers to a table on pages Att 1-10 to Att 1-12. However, a comparison of this table and the EPRI data base shows that all the incidents come from the EPRI database except one event on 4/28/2021 in Florida⁵⁴; this means that the “frequency analysis” is based almost entirely on the EPRI database. However, the EPRI

⁵⁴ For reasons that are not clear, the Table on pages Att 1-10 to Att 1-12 suggests that the EPRI database does not include the McMicken event on 4/19/2019, the Grand Ridge event on 7/19/2021, the Franklin event on 8/10/2016, and the Tualatin event on 4/12/2019 (which actually occurred on 4/11/2019). However, all of these events are in the EPRI data base found here: energystorage.epri.com/hub/public/en/failure-incident-database.html

database is substantially incomplete because EPRI “picks and chooses” the BESS fire incidents that it reports and only includes incidents that are “publicly reported”. In fact, EPRI freely admits that “the database is necessarily limited to public reporting and may have missed incidents with minimal or local-only media coverage” (Attachment 4 provides an excerpt from the EPRI database webpage). SORT members have reported BESS fire incidents to EPRI but EPRI has refused to include them in the list. For example, EPRI was provided copies of local fire department reports of four separate ignition events in 2024 at the massive Sanborn BESS facility in Kern County, but Sanborn appears nowhere on the EPRI database. Fortunately, the Sanborn BESS is located far from residential areas, so these fires did not pose a safety risk (which is probably why they were not “publicly reported”). Because mandatory reporting regulations did not exist until recently, it is a certainty that numerous BESS fires over the last 10 years are not included in the EPRI database because they were not picked up by the media. Accordingly, the Staff Assessment’s “frequency analysis” is specious because it is based on EPRI’s admittedly incomplete BESS fire database.

Another concern with the “frequency analysis” is that it fails to consider the aging characteristics of LFPs or that aging accelerates at low operating temperatures. For example, experiments with fully charged (but not overcharged) LFP batteries show that the protective film that is formed on the anode and which is a key factor in preventing thermal runaway *actually begins to degrade* at only 80 °C⁵⁵. As degradation of this protective film progresses, the anode becomes more exposed and when sufficient degradation occurs, thermal runaway is initiated. Additionally, when LFP batteries become overcharged, the temperature at which they experience thermal runaway is actually *lower* than the temperature at which thermal runaway is initiated in other types of lithium batteries including NMC⁵⁶. This means that LFP BESS are *more* susceptible to thermal runaway than NMC BESS in overcharge conditions, and as a result, LFPs are highly susceptible to failure when battery management systems do not adequately prevent overcharging. At the very least, it is imprudent from an engineering standpoint to “predict” BESS outcomes over a 67 year period based on an incomplete dataset that is only 3 years old. In any event, such predictions do not constitute “substantial evidence”.

⁵⁵ To prevent thermal runaway, lithium ion batteries form a solid electrolyte interphase film (known as an “SEI film”) to prevent thermal runaway; however, charged (but not overcharged) in LFP batteries, the protective SEI film begins to degrade at temperatures as low as 80°C. *Revealing the Thermal Runaway Behavior of Lithium Iron Phosphate Power Batteries at Different States of Charge and Operating Environment*. Tianyi Li, Yinghou Jia. Journal of Electrochemical Science (September 2022) Article Number: 221030 electrochemsci.org/papers/vol17/221030.pdf

⁵⁶ Thermal Runaway can be initiated at only 116 °C in overcharged LFP batteries. *Study on Temperature Change of LiFePO₄/C Battery Thermal Runaway under Overcharge Condition*. Fei Gao et al 2021. Presented at the 3rd International Conference on Air Pollution and Environmental Engineering. IOP Conference Series: Earth and Environmental Science 631. iopscience.iop.org/article/10.1088/1755-1315/631/1/012114/pdf

CLAIMS PERTAINING TO AIR SAMPLING RESULTS FROM PRIOR BESS FAILURES ARE SPECIOUS.

Pointing to the ACP document, page 5.10-14 of the Staff Assessment states that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”. The Staff Assessment appears to blindly accept these claims which, according to Page 4 of the ACP document, are based on “air sampling from past incidents” referenced in Table 1. SORT has carefully evaluated all the “past incidents” identified in Table 1 of the ACP document and found that *none of them* support the claim that toxic air emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”. The results of SORT’s analysis are provided here:

The East Hampton NY 2023 BESS Fire: The ACP document claims in Table 1 that air sampling was conducted during the 2023 BESS fire in East Hampton, NY; however, ACP provides no citations or references pertaining to such air sampling. In fact, the only information cited by ACP that pertains exclusively to the East Hampton BESS fire is an email from an unidentified person to the residents of East Hampton (citation #83). Moreover, SORT has reviewed findings released by the New York State Energy Research and Development Authority (NYSERDA) which indicate that only soil and/or water samples were collected for the East Hampton BESS fire⁵⁷. Apparently, no air samples were collected despite ACP’s claim that they were. Nothing about the East Hampton event supports ACP’s claim that toxic emissions from BESS failures “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”.

The Surprise, AZ 2019 BESS Fire: The ACP document claims in Table 1 that air sampling was conducted for the 2019 BESS Fire in Surprise, AZ but the citation provided (a study prepared for the Arizona Public Service and identified as citation #12) reports that only soil and wipe surface samples were collected. ACP also states on page 15 that “Firefighters from the Palo Verde Nuclear Generating Station with advanced post-failure training were recruited to acquire 3D images of the site and monitor for toxic and flammable gases” but the report provides no information regarding what constituents were sampled or what the measured concentrations were. Nothing about the Surprise, AZ BESS fire or the sampling that was allegedly done pursuant thereto supports ACP’s claim that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”.

⁵⁷ New York State Inter Agency Fire Safety Working Group Air, Soil, And Water Data Findings December 2023 extapps.dec.ny.gov/data/DecDocs/2601953/Report.ER.2601953.2023-12-31.Fire_Safety_Report.pdf

The Chaumont, NY 2023 BESS Fire: NYSERDA reports that, for the 2023 BESS fire event in Chaumont, NY, toxic air monitoring was conducted for CO, H₂S, and HCN, and page 4 indicates that the monitoring was done at 19:41 which is more than 6 hours after the BESS fire began at 13:10. It appears that some monitoring was conducted 200 feet from the burning BESS and also “at the village limits”, but no sampling for HF or NO₂ was conducted even though the Staff Assessment suggests that HF and NO₂ are the toxic compounds that are found in the highest concentrations during a BESS fire. Because monitoring was not conducted until well after the Chaumont BESS fire ignited, and because key toxic constituents were never monitored, the 2023 Chaumont BESS fire does not support ACP’s claim that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”.

The Melba, ID 2023 BESS Fire: The ACP document claims in Table 1 that air sampling was conducted for the 2023 BESS Fire in Melba, ID but ACP provides no citation other than the following phrase on page 58: “CTEH, Air Modeling and Sampling Summary: Melba, ID Fire incident, October 2 – October 6, 2023”. An internet search produced no such document. The only information that SORT was able to find pertaining to this event was a slide deck from a presentation by Idaho Power to the Canyon County Commission⁵⁸ stating that the BESS ignited at 5:20 AM but no air sampling occurred until 6 hours later. There is no information regarding what toxic constituents were monitored or where the sampling was conducted. Because the only publicly available information regarding the Melba BESS fire omits all information regarding where and how air sampling was conducted, nothing about this event supports ACP’s claim that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”.

The Warwick, NY 2023 BESS Fire: NYSERDA reports that air monitoring for CO, H₂S, and HCN was conducted for the 2023 Warwick BESS fire event; page 6 indicates that the monitoring was done on June 28 which is a day after the BESS fire began on June 27. According to pages 9-10, additional monitoring for CO and H₂S was conducted at a nearby school on June 28. It appears that no sampling for HF or NO₂ was conducted. Because monitoring was not conducted until well after the Warwick BESS fire ignited, and because key toxic constituents were never monitored, the NYSERD report does not support ACP’s claim that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”.

The Escondido, CA 2024 BESS Fire: ACP asserts that the 2024 BESS fire in Escondido, CA “showed no detectable hazardous concentrations in nearby communities”. However,

⁵⁸ agenda.canyoncounty.id.gov/SupportDoc/GetSupporting Doc?supportDocID=1526

the monitoring report cited by ACP⁵⁹ reveals that this claim is erroneous. For instance, page 5 of the monitoring report asserts that HCN concentrations 260 feet from the burning BESS were 2 ppm (2,211 µg/m³); that is nearly 10 times higher than the OEHHA REL of 0.31 ppm (340 µg/m³). Oddly enough, this HCN measurement is omitted from the graphs provided in the monitoring report and it is certainly not discussed. Additionally, the three monitors that were utilized for air sampling during the Escondido BESS fire (listed on page 2 as the EAGLE 2 CGI, RedWave XplorIR, and MultiRAE Pro analyzers) cannot detect HF at the part per million level⁶⁰ and were thus incapable of assessing whether HF concentrations even reached the AEGL level (let alone the OEHHA REL). The report does state that the HazMat team used “Fluoride Paper” to measure HF levels (see page 5). It is not known what type of “Fluoride Paper” was used⁶¹; this is important because most types of “Fluoride Paper” are incapable of detecting HF at part per million levels. In fact, manufacturer specifications indicate that “Fluoride Paper” cannot detect HF until it reaches a concentration of 20 mg/L⁶² (or 20,000,000 µg/m³). Finally, the air monitoring conducted for the Escondido BESS fire did not analyze for NO₂, and therefore omitted another critical toxic constituent. Because the Escondido BESS monitoring report cited by ACP actually shows dangerous HCN levels hundreds of feet from a burning BESS, and because it fails to monitor HF at ppm levels and fails to monitor NO₂ at all, the Escondido BESS fire **does not** support ACP’s contention that toxic emissions from BESS failure events “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”; in fact, it controverts these conclusions. The Escondido BESS fire was a very dangerous event in a very populated area and that is why it resulted in lengthy evacuation orders lasting nearly 48 hours.

On pages 5.10-14 to 5.10-16, the Staff Assessment discusses the BESS fires in Surprise, AZ (2019), Warwick, NY (2023), Chaumont, NY (2023), Melba, ID (2023), and Escondido, CA (2024); however, nothing in the Staff Assessment refutes the facts presented above or supports the claim found on page that 5.10-14 toxic emissions from a

⁵⁹ Citation # 84 titled “Air Quality Report” is found here:

escondido.gov/DocumentCenter/View/6716/SDGE-Battery-Fire-Air-Quality-Report-PDF

⁶⁰ Page 2 of the report cited as reference # 84 by ACP (“Air Quality Report: SDG&E Battery Fire”) that the following monitors were used: EAGLE 2 CGI, RedWave XplorIR, and MultiRAE Pro. Unfortunately, the EAGLE 2 CGI only monitors CO, H₂S, O₂, and LEL so it does not monitor HF or NO₂ or other toxics released in a BESS fire. Additionally, Honeywell reports the MultiRAE Pro cannot be used for HF ([sps-support.honeywell.com/s/article/HCl-sensor-Which-RAE-monitors-take-the-HCl-sensor](https://support.honeywell.com/s/article/HCl-sensor-Which-RAE-monitors-take-the-HCl-sensor)) though it can monitor HCN. And, because the RedWave XplorIR utilizes Fourier Transform Infrared Analysis, it is inappropriate for HF monitoring and it has an HF detection limit of 10 ppm or more (academy.webvent.tv/uploads/assets/1240/document/20250424CriticalGapsinGasDetectionMonitoringFINAL.pdf).

⁶¹ “Fluoride Paper” sampling is a non-standard procedure and very few “Fluoride Paper” systems are capable of measuring HF at the ppm level; they also require optical detectors to quantify concentrations.

⁶² ctlscientificsupply.com/flyers/hazmat.df

BESS fire “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”. Notably, the Staff Assessment also discusses two additional BESS fire events (the Moss Landing Fire in 2025 and the Warwick NY fire in 2025); however, neither of these events demonstrate that toxic emissions from a BESS fire “are largely confined to the immediate vicinity of the fire” and “do not pose a public health risk”:

The 2025 Moss Landing BESS Fire: The Staff Report claims on page 5.10-16 “As part of the multi-agency emergency response, U.S. EPA installed the first seven monitors shortly after the fire started on January 17 and later deployed two more.” This statement is not accurate. The fire started on January 16, and EPA did not begin monitoring until January 17 and more than 12 hours after it ignited; therefore, monitoring did not occur “shortly after the fire started”. Furthermore, the Monterey County website⁶³ reports that EPA did not initiate 24-hour HF sampling until January 18 and well after evacuation orders were lifted. And, while a few “spot” sample results are reported for January 17 at locations “Fire North” “Fire East” and “Fire West”⁶⁴, it is not known where these locations are, who collected the samples, what the sampling circumstances were, or what QA/QC was involved. These facts demonstrate that HF was *not monitored* during the most violent and destructive stages of the Moss Landing BESS fire; therefore, no credible conclusions can be drawn regarding toxic concentrations. Worse yet, the Staff Assessment fails to even mention that continuous monitoring conducted by the EPA found HF on January 18⁶⁵, January 19⁶⁶, and January 20⁶⁷. The Staff Assessment does not discuss these monitoring results or acknowledge that they demonstrate toxic emissions from a BESS failure **are not** “largely confined to the immediate vicinity of the fire”; instead, the Staff Assessment claims that sampling “did not detect hazardous compounds (HF, HCl, HCN, CO)” based on reports by a 3rd party consultant who was paid by the BESS owner to conduct quick “spot checks” in the community. Sampling results from the Moss Landing BESS fire prove that toxic emissions from BESS fires extend well beyond “the immediate vicinity of the fire” despite Staff Assessment claims to the contrary.

The 2025 Warwick NY BESS Fire: The 2025 Warwick BESS fire ignited at 10:19 PM on December 19th and just over 2 hours later, an emergency response team began sampling

⁶³ readymontereycounty.org/emergency/2025-moss-landing-vistra-power-plant-fire/testing/air

⁶⁴ countyofmonterey.gov/home/showdocument?id=137861. The website that provides the monitoring data is readymontereycounty.org/emergency/2025-moss-landing-vistra-power-plant-fire/us-environmental-protection-agency-epa-the-monterey-bay-air-resources-district-mbard-and-vistra-air-quality-monitoring-updates

⁶⁵ HF was detected at Station ID 3. countyofmonterey.gov/home/showdocument?id=137865.

⁶⁶ HF was detected at Station ID 3. countyofmonterey.gov/home/showdocument?id=137867

⁶⁷ HF was detected at Station ID 3 and Station ID 5. countyofmonterey.gov/home/showdocument?id=137883

for HCN, CO, NH₃, and CL₂; no HF or NO₂ monitoring was conducted⁶⁸. Notably, HCN levels as high as 1.5 ppm were measured 600 feet from the burning BESS; therefore, the 2025 Warwick BESS fire caused substantial exceedances of 4 hour and 8 hour AEGLs at great distances. Clearly, the 2025 Warwick BESS fire demonstrates that toxic emissions are not confined to the BESS fire area. And, while no HF or NO₂ monitoring was conducted during the 2025 Warwick BESS fire (even though the Staff Assessment indicates that these compounds are far more prevalent and far more dangerous than HCN), the HCN results from the 2025 Warwick BESS fire certainly suggest that HF and NO₂ concentrations were also quite high at substantial distances from the fire. In short, the 2025 Warwick BESS fire clearly controverts the Staff Assessment's quotation from CPA that toxic emissions from a BESS fire "are largely confined to the immediate vicinity of the fire" and "do not pose a public health risk". Furthermore, the 2025 Warwick BESS fire supports SORT's claim that cumulative toxic exposures resulting from Corby BESS fires render the public safety impacts of the Corby BESS project to be significant and unavoidable. Therefore, the Commission must either approve an alternative battery chemistry that does not require a flammable electrolyte with fluoridated salt or reject the proposed Corby BESS location in favor of the Lambie Park alternative (which can be located so that it is more than 2,400 feet from any receptors).

Aside from air monitoring evidence obtained from recent BESS fires, there is anecdotal evidence which demonstrates the very real and very significant public safety risks posed by the Corby BESS. For example, the combustion of a Tesla Model S vehicle in 2025 severely injured unprotected firefighters who were more than 200 feet away. According to the firefighter "Green Sheet" provided in Attachment 5, a compromised EV that was believed to be stable suddenly reignited just as the wind shifted; the white mist emanating from the vehicle wafted toward firefighters who had removed their protective equipment because they were in the "cold zone" and believed themselves to be too far away to suffer exposure. They were mistaken, and became seriously injured. SORT notes that, when fluorine reacts with water, it forms a white mist⁶⁹. If the toxic concentrations generated by the combustion of a single EV battery pack are capable of seriously injuring firefighters who are hundreds of feet away, the much greater toxic concentrations generated by the combustion of a large BESS unit will cause serious injuries at distances much greater than 200 feet.

Finally, SORT disputes the myth that is perpetuated by energy developers, industry shills (like CPA) and paid consultants (like Fire & Risk Alliance) that LFP batteries are "safe" and toxic emissions do not extend beyond the BESS vicinity. Clearly, LFP

⁶⁸ villageofwarwickny.gov/wp-content/uploads/BESS_Fire_Air_Monitoring_Synopsis_Revised.pdf

⁶⁹ americanchemistry.com/content/download/5432/file/Emergency-Preparedness-and-Response-Guidelines-for-Anhydrous-Hydrogen-Fluoride-AHF-and-Hydrofluoric-Acid-HF.pdf.

batteries *are not* intrinsically “safe” given the LFP failure incidents reported in the incomplete EPRI database. As we have explained in previous letters submitted to the Commission⁷⁰ (all of which are incorporated herein by reference and, for the sake of expediency, the contents of which are not repeated here) battery systems can fail for any number of reasons (manufacturing defects, installation errors, human error, glitches, etc.) and because of the flammable electrolytes and fluorinated salts they contain, they release highly toxic compounds that travel great distances from the compromised BESS location. This means that the Corby BESS *does* pose significant and unavoidable public safety impacts, and the Staff Assessment errs substantially in concluding otherwise.

DEFICIENCIES NOTED IN THE DEPOSITION IMPACT ANALYSIS.

Section 6 of Appendix D discusses toxic surface depositions caused by BESS failure events, and it is rife with error. For example, page 26 points to a soil sampling report prepared for the Moss Landing BESS fire by Terraphase Engineering⁷¹ and then dismisses concerns regarding the deposition of toxic metals by asserting that concentrations were within “regional background concentrations in California”. This argument is erroneous because a handful of soil results obtained from across the entire State of California does not in any way establish a credible “background concentration” for any particular area. Furthermore, it does not matter how the Moss Landing soil data “compares” to other areas in California; the only thing that matters how it compares to local background conditions and adopted standards. Notably, the Staff Assessment does not disclose that the Terraphase report found cobalt and manganese levels that significantly exceeded adopted thresholds. The Terraphase report dismisses these results because they were found at the subsurface level (page iv) but that excuse does not account for the significant amount of rain that fell between January, 2025 (when the Moss Landing BESS fire occurred) and May 2025 (when the soil samples were collected) which certainly carried the metals deposited on the surface to the subsurface zone.

The Staff Assessment briefly mentions substantive work done by San Jose State University (the “SR 2025” study) showing that significant quantities of nickel, cobalt, and manganese deposited in patchy areas all around the Moss Landing site, and that such deposits could only be effectively detected using spatial sampling methodologies and would not be detected using the sporadic core sampling method adopted by the Terraphase study⁷².

⁷⁰ The following submittals to Docket 25-OPT-02 are incorporated herein by reference: June 24, 2026 letter (TN #270986); May 21, 2026 letter (TN #270152); April 6, 2026 letter (TN #269416); March 4, 2026 letter (TN #268944, 268943); Letter dated August 18, 2025 (TN#265680).

⁷¹ readymontereycounty.org/home/showpublisheddocument/143458/638990015667570000

⁷² [pmc.ncbi.nlm.nih.gov/articles/PMC12658236/pdf/41598_2025_Article_25972.pdf](https://pubmed.ncbi.nlm.nih.gov/articles/PMC12658236/pdf/41598_2025_Article_25972.pdf)

Page 27 of Appendix D discusses a study conducted by the University of California Agricultural and Natural Resources”⁷³ (the “Cahn Study”) and states that increased metal concentrations measured in the samples were “likely insignificant”. However, the Staff Assessment does not disclose that the samples were collected more than 1.25 miles from the Moss Landing BESS fire and thus do not represent conditions closer to a BESS fire. Accordingly, the Cahn study is not dispositive and it certainly does not prove that agricultural fields adjacent to the Corby BESS will not experience toxic depositions when the Corby BESS ignites.

Next, Appendix D considers an “earthworm toxicity” analysis described in the SFPE document to evaluate toxic metal deposition in soil. SORT has reviewed SFPE’s “earthworm toxicity” analytical approach and found it to be less than reliable. SFPE claims that this analytical approach is based on EPA “ECOSAR” modeling⁷⁴ and that it relies on LC50 and EC50 toxicity values for earthworms⁷⁵. However, ECOSAR assesses toxic concentrations in aquatic environments expressed in terms of mg/L; thus, it is not relevant to soil deposition concerns that results from air toxics and are expressed in terms of mg/kg. And, while ECOSAR does establish an LC50 toxicity relationships between organic compounds and earthworms⁷⁶, insofar as SORT can determine, ECOSAR does not established EC50 or LC50 relationship between toxic metals and earthworms. Nevertheless, the SFPE document asserts on pages 75- 76 that the lithium EC50 value for earthworms is 22.4 mg/L and that this is equivalent to a deposition rate of 51 g/m² and that this corresponds to a 60 meter deposition area around a hypothetical BESS fire. The SFPE document does not identify where the 22.4 mg/L assumption came from, so all conclusions that fall from this assumption are baseless. In fact, virtually nothing in the SFPE document pertaining to “earthworm toxicity” is substantiated or documented

Despite these deficiencies, Appendix D applies the SFPE “earthworm toxicity” analysis to the Moss Landing event and even concludes on page 27 that the Moss Landing BESS fire resulted in “median values for Ni, Mn and Co” that “were below the EC50 for earthworm toxicity” and that “peak values for Ni and Mn were above the EC50 values, indicating that some toxicity could have occurred”. Appendix D does not show how these conclusions were derived or substantiate any EC50 assumptions. Additionally,

⁷³ *Evaluation of Heavy Metals in Agricultural Fields following the Moss Landing Battery Fire*. Table 1. ucanr.edu/blog/salinas-valley-agriculture/article/evaluation-heavy-metals-agricultural-fields-following-moss

⁷⁴ Page 54

⁷⁵ LC50 is the concentration that kills 50% of a test population during a set observation period. EC50 is the concentration which causes a measurable adverse effect in 50% of a test population during a set observation period.

⁷⁶ nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1014 P6X.TXT

page 27 refers to the “deposition of lithium” that is indicated in the San Jose State Study and thereupon concludes that the deposition of lithium “could exceed EC50 values for earthworm toxicity”. However, there is no information provided regarding what the assumed EC50 value is or how it is exceeded. More importantly, there does not appear to be any information pertaining to “deposition of lithium” in the San Jose State Study⁷⁷; in fact, the study appears to focus only on Co, Ni, and Mn. In short, nothing in the Staff Assessment pertaining to “earthworm toxicity” is cited, substantiated, or explained and none of it is relevant to the Corby BESS.

Finally, Appendix D concludes on page 28 that “peak deposition of total particulates at the project boundary range as high as 88.3 g/m² of total particulate to the west of the closest unit to the boundary, with 18.0 g/m² (20.4 percent) being lithium and 3.4 g/m² (3.9 percent) being aluminum”; Appendix D also concludes that these lithium and aluminum deposition impacts are “Less than Significant” based on information presented in Section 5.8. SORT cannot precisely corroborate the claimed 88.3 g/m² deposition rate based on the analytical results presented in Appendix D; however, page Att 2-7 does provide a particulate isoconcentration plot which shows that deposition levels exceed 10 g/m² well beyond the property boundary. SORT has reviewed the relevant portions of Section 5.8 and note some irregularities regarding the conclusion that deposition impacts are “Less than Significant”. For example, page 5.8-24 concludes that the impacts of lithium deposition are “Less than Significant” based on an analysis presented in Appendix LU which reports that a BESS failure will only deposit 0.18 mg of lithium/kg of soil. SORT respectfully disagrees.

Appendix LU asserts that lithium deposition will not penetrate beyond 7.6 cm and that the soil density is 1.3 g/cm³; no citation is provided to substantiate these assumptions. Nonetheless, if we reconcile these values with the 18 g/m² Li deposition rate taken from Appendix D and recognize that 1 m is equivalent to 100 cm, we derive a mass per unit volume lithium concentration value of 237 g lithium/m³ soil:

$$\frac{18 \text{ g}}{1 \text{ m}^2} \times \frac{1}{\left(7.6 \text{ cm} \times \frac{1 \text{ m}}{100 \text{ cm}}\right)} = \frac{237 \text{ g Li}}{\text{m}^3 \text{ soil}}$$

⁷⁷ In fact, the only time that the word “lithium” appears in the referenced San Jose State Study is in the phrase “lithium ion battery”.

Reconciling this value with the assumed density value of 1.3 g/ cm³ and recognizing that 1 m³ is equivalent to 1,000,000 cm³, we derive a lithium concentration of 0.000182 g lithium/g soil:

$$\frac{237 \text{ g Lithium}}{\text{m}^3 \text{ soil}} \times \frac{1 \text{ cm}^3 \text{ soil}}{1.3 \text{ g soil}} \times \frac{1 \text{ m}^3 \text{ soil}}{1,000,000 \text{ cm}^3 \text{ soil}} = \frac{0.000182 \text{ g Lithium}}{\text{g soil}}$$

Reformatting this value into proper units results in a final lithium concentration of 182 mg lithium/kg soil:

$$\frac{0.000182 \text{ g Lithium}}{\text{g soil}} \times \frac{1,000 \text{ g soil}}{\text{kg soil}} \times \frac{1,000 \text{ mg Li}}{\text{g Li}} = \frac{182 \text{ mg Li}}{\text{kg soil}}$$

Given that 182 mg/kg of soil is an order of magnitude higher than the background lithium concentrations (which the Staff Assessment assumes is 15-30 mg/kg), it certainly seems that lithium deposition from a BESS failure event will result in a “Significant” environmental impact on the farmlands surrounding the BESS. Moreover, none of the mitigation measures proposed in the Staff Assessment will reduce the lithium deposition resulting from a BESS fire; therefore, lithium deposition remains a “Significant and Unavoidable” impact. SORT notes that this impact will be substantially reduced by placing the BESS at the Lambie Park alternative location depicted in Figure 1 because at that location, the BESS will be surrounded by industrially zoned land and have little to no effect on agricultural lands.

DEFICIENCIES IN THE REGULATORY CONFORMANCE ANALYSIS

The Staff Assessment concludes on page 5.10-20 that public safety impacts from the Corby BESS development are “Less than Significant” because the Corby BESS conforms with local and state regulations and ordinances. The Staff Assessment also includes Table 5.10-2 which lists the state and local public safety ordinances and laws that apply to the Corby BESS, and provides a brief summary explaining how the Corby BESS conforms to each. SORT has carefully reviewed these laws and ordinances and concluded that the Corby BESS *does not* conform to any of them; therefore, SORT respectfully disagrees with Staff Assessment conclusions. SORT’s analysis of the conformance status of the Corby BESS with respect to applicable state and local laws and ordinances is provided in Table 2.

Table 2. Corby BESS Conformance Status With Respect to State and Local Regulations.

Applicable Regulations	Corby BESS Conformance Status
California Health & Safety Code § 39650 et seq identifies and regulates Toxic Air Contaminants and, through operation of Section 93001 of the California Code of Regulations, establishes HF as a Hazardous Air Pollutant	The Staff Assessment shows that Corby BESS failures will result in toxic HF emissions exceeding the adopted 240 µg/m ³ exposure threshold at nearby residences ⁷⁸ ; therefore, the Corby BESS does not conform to Health & Safety Code § 39650 et seq. While the Staff Assessment claims the Corby BESS complies because “conditions of certification” (COCs i.e., mitigation measures) will be implemented to ensure toxic emissions are not “above regulated threshold quantities”, the analysis provided above proves this claim to be categorically false because proposed COCs will not reduce toxic emissions from a BESS fire and because the HF emitted during a BESS fire will exceed 240 µg/m ³ at nearby residences.
California Health and Safety Code § 41700 prohibits emissions that cause public detriment, nuisance, or annoyance.	Because the Corby BESS will emit toxic concentrations that exceed established OEHHA RELs and because these emissions cannot be mitigated, the Corby BESS will result in emissions that are annoying and detrimental. Thus, it does not conform to Health & Safety Code § 41700. While the Staff Assessment claims the Corby BESS complies because COCs will be implemented to ensure toxic emissions are not “above regulated threshold quantities”, the analysis provided above proves this claim to be categorically false because COCs have no effect on BESS fire emissions and because HF concentrations will exceed 240 µg/m ³ at nearby residences.
Air Toxics Hot Spots Program governs emissions of toxic compounds including HF	Because the Corby BESS will emit toxic concentrations exceeding OEHHA RELs, it does not conform with the Air Toxics Hot Spots Program. While the Staff Assessment claims the Corby BESS conforms because COCs will be implemented to ensure toxic emissions are not “above regulated threshold quantities”, the analysis provided above proves this claim to be categorically false because COCs have no effect on BESS fire emissions and because HF concentrations will exceed 240 µg/m ³ at nearby residences.

⁷⁸ The Table provided on Page 1-15 of Appendix D shows offsite HF concentrations will exceed 240 µg/m³.

Solano County General Plan Goal LU.G-4: Encourage land use development patterns and circulation and transportation systems that promote health and wellness and minimize adverse effects on agriculture and natural resources, energy consumption, and air quality.	The Corby BESS is a land use development that will emit high concentrations of toxic compounds and result in significant air quality impacts due to hazard indices that substantially exceed 1.0 during ignition events, it does not promote health and wellness and does not minimize adverse effects on air quality. Therefore, the Corby BESS does not conform to Solano County General Plan Goal LU.G-4. While the Staff Assessment claims Corby does comply with Goal LU.G-4 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2, the analysis presented above proves these claims to be categorically false because these mitigation measures will not reduce toxic emissions or limit hazard indices to less than one or ensure that toxic concentrations at nearby residences remain below adopted OEHHA thresholds during Corby BESS fires.
Solano County General Plan Goal HS.G-8: Prioritize and support actions that foster public health for all citizens in Solano County	Because Corby BESS fires will emit toxic compounds at concentrations exceeding OEHHA RELs and create hazard indices that substantially exceed 1.0, the Corby BESS is not a project that fosters public health for Solano County citizens and thus does not conform to Solano County General Plan Goal HS.G-8. While the Staff Assessment claims Corby does comply with Goal HS.G-8 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2, none of these mitigation measures will reduce the toxic emissions from Corby BESS fires and thus will not eliminate the characteristics of the Corby BESS project that degrade public health for Solano County citizens.
Solano County General Plan Goal HS.G-9: Maintain equitable and healthy air quality in Solano County through actions that avoid and minimize health risks from localized pollution sources and regional wildfire smoke	Corby BESS fires will emit toxic compounds at levels exceeding OEHHA RELs and create hazard indices that substantially exceed 1.0; therefore, the Corby BESS is not a project that maintains healthy air quality in Solano County and it does not minimize health risks from pollution sources. Accordingly, it does not conform to Solano County General Plan Goal HS.G-9. While the Staff Assessment claims Corby does comply with Goal HS.G-9 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2, none of these mitigation measures will reduce the toxic emissions from Corby BESS fires and thus will not ensure healthy air quality.

Solano County General Plan Policy HS.P-86: Minimize health impacts from sources of toxic air contaminants, both stationary as well as mobile sources	Corby BESS fires will release significant quantities of toxic air contaminants at concentrations that substantially exceed adopted exposure standards; thus, it does not minimize health impacts from sources of toxic air contaminants. Accordingly, the Corby BESS does not conform to Solano County General Plan Policy HS.P-86. While the Staff Assessment claims Corby does comply with Policy HS.P-86 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2, none of these mitigation measures will reduce toxic emissions from Corby BESS fires; thus, they will not minimize health impacts from sources of toxic air contaminants.
Solano County General Plan Implementation Measure HS.I-58: Require developments that introduce new significant sources of toxic air pollutants to prepare a health risk assessment per the Air Toxics “Hot Spots” Act and based thereon, establish appropriate land use buffer zones around those areas posing substantial health risks.	The health risk assessment prepared by the Commission as part of the Staff Assessment clearly shows that toxic emissions during Corby BESS fires will substantially exceed the OEHHHA exposure levels are mandated by the Air Toxics “Hot Spots” Act at all adjacent residences. Accordingly, conformance with Implementation Measure HS.I-58 would require the Commission to establish a sufficiently large buffer around the Corby BESS to ensure toxic concentrations at residential locations remain below the OEHHHA RELs during Corby BESS fires. However, there is not enough room around the proposed Corby BESS site to provide for such buffers; therefore, the Corby BESS does not conform to Implementation Measure HS.I-58. The Staff Assessment claims Corby does comply with HS.I-58 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2; however, the Staff Assessment is incorrect because these mitigation measures will not reduce Corby BESS emission concentrations to levels that are below OEHHHA RELs at residential locations.
YSAQMD Rule 2.5: prohibit emissions that cause public detriment, nuisance, or annoyance (same as California Health and Safety Code § 41700).	The Corby BESS fails to conform to YSAQMD Rule 2.5 for the same reason it fails to conform to California Health and Safety Code § 41700 (see above). The Staff Assessment claims Corby does comply with YSAQMD Rule 2.5 because COC AQ-SC1 through AQ-SC5 will be implemented along with MM AQ-1 and MM AQ-2; however, the Staff Assessment is incorrect because these measures will not reduce toxic emissions to levels below OEHHHA RELs.

Notably, the Solano County General Plan goals, policies, and implementation measures identified in Table 2 are intended to either minimize environmental impacts of development or protect residents from hazards arising from development⁷⁹; thus, they were all adopted for the purpose of mitigating the environmental impacts of land uses. Accordingly, each violation of these goals and policies constitutes a separate and distinct “Significant” environmental impact that must be reduced through feasible alternatives or mitigation measures [*Joshua Tree Downtown Business Alliance v. County of San Bernardino* 1 Cal.App.5th 677, *Pocket Protectors v. City Of Sacramento* (2004) 124 Cal.App.4th 903]. And, because none of the mitigation measures identified in the Staff Assessment will bring the Corby BESS project into conformance with these General Plan goals and policies, these impacts remain “Significant and Unavoidable”.

Finally, SORT notes that the Lambie Park alternative will eliminate most (and probably all) of the significant impacts identified above; therefore, the Commission is compelled by Section 21081 of the CEQA Statute to reject the proposed Corby BESS location in favor of the Lambie Park Alternative location.

DEFICIENCIES IN THE CUMULATIVE PUBLIC SAFETY IMPACT ANALYSIS

The Staff Assessment concludes on page 5.10-20 that cumulative public safety impacts from the operation of the Corby BESS and other nearby projects are “Less than Significant”. SORT respectfully disagrees. As explained above, the public safety impacts resulting from the Corby BESS are “Significant and Unavoidable”; therefore, the cumulative public safety impacts will also be “Significant and Unavoidable”.

ALTERNATE BATTERY CHEMISTRIES MUST BE DILIGENTLY ASSESSED.

The public safety impacts posed by the Corby BESS arise primarily from the developer’s choice to utilize a battery chemistry that requires large quantities of flammable electrolyte in which is dissolved large quantities of fluoridated salt. However, alternative battery chemistries will eliminate these characteristics. The Staff Assessment rejects alternative battery chemistries principally due to “storage duration” and “scalability” concerns⁸⁰. SORT notes that a 50 MW/500 MWh iron flow BESS is slated to come online in Germany in 2027⁸¹. Additionally, a 300 MW/30 GWh iron-air

⁷⁹ Page 4.1-16 of the DEIR states that Goal LU.G-4 was adopted to “minimize the impacts of land use changes and development on adjacent agricultural operations”. Page HS-6 of the General Plan identifies Goals HS.G-8 and HS.G-9 as goals that address “the County’s desire to protect its residents, their property, and the environment from natural and human-caused hazards”. Page HS-96 of the General Plan states that policy HS.P-86 implements Goal HS.G-9, therefore, it was clearly adopted for the purpose of mitigating environmental impacts. Finally, the plain language of Implementation Program HS.I-58 clearly demonstrates that it was adopted for the purpose of minimizing air toxic emission impacts.

⁸⁰ Pages 8-13 to 8-15.

⁸¹ cen.acs.org/energy/energy-storage/-ESS-Tech-plans-major-iron/101/i27

BESS is slated for development in Minnesota⁸². These developments certainly suggest that alternative battery chemistries are indeed “scalable” in a manner that is consistent with the Corby BESS; additionally, the 30 GWh capacity provided by the Minnesota development suggests that the “storage duration” which can be achieved by alternate battery chemistries is superior to the 4 hour storage duration delivered by the Corby BESS. Accordingly, SORT respectfully disagrees with Staff’s conclusion that BESS systems relying on alternative battery chemistries are not scalable and have storage duration limitations.

THE EIR MUST BE RECIRCULATED PER CEQA

Numerous deficiencies have been noted in the Staff Assessment/EIR, including, but not limited to, unsubstantiated toxic emission factors, inappropriate “Thresholds of Significance”, and omitted “Significant and Unavoidable” public safety, air quality, and land use impacts. The EIR must be substantially revised to address these deficiencies and, consistent with Section 15088.5 of the CEQA Guidelines, the revised EIR will have to be recirculated and subject to additional public review.

CONCLUSION

SORT respectfully requests that the Commission consider the comments submitted herein and pursuant thereto, made substantial revisions to the Staff Assessment and included EIR.

Respectfully submitted;

/S/ Jacqueline Ayer

Jacqueline Ayer, Director
Save Our Rural Town

⁸² A new Google Data Center planned in Minnesota will include a 300MW/ 30 GWh iron-air BESS. eepower.com/news/google-builds-data-center-with-worlds-largest-iron-air-bess/

ATTACHMENT 1.

Toxic Fluoride Gas Emissions From Lithium Ion Battery Fires.

Fredrik Larsson, Petra Andersson, Per Blomqvist & Bengt-Erik Mellander.

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Toxic fluoride gas emissions from lithium-ion battery fires

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Lithium-ion battery fires generate intense heat and considerable amounts of gas and smoke. Although the emission of toxic gases can be a larger threat than the heat, the knowledge of such emissions is limited. This paper presents quantitative measurements of heat release and fluoride gas emissions during battery fires for seven different types of commercial lithium-ion batteries. The results have been validated using two independent measurement techniques and show that large amounts of hydrogen fluoride (HF) may be generated, ranging between 20 and 200 mg/Wh of nominal battery energy capacity. In addition, 15–22 mg/Wh of another potentially toxic gas, phosphoryl fluoride (POF₃), was measured in some of the fire tests. Gas emissions when using water mist as extinguishing agent were also investigated. Fluoride gas emission can pose a serious toxic threat and the results are crucial findings for risk assessment and management, especially for large Li-ion battery packs.

Lithium-ion batteries are a technical and a commercial success enabling a number of applications from cellular phones to electric vehicles and large scale electrical energy storage plants. The occasional occurrences of battery fires have, however, caused some concern especially regarding the risk for spontaneous fires and the intense heat generated by such fires^{1–5}. While the fire itself and the heat it generates may be a serious threat in many situations, the risks associated with gas and smoke emissions from malfunctioning lithium-ion batteries may in some circumstances be a larger threat, especially in confined environments where people are present, such as in an aircraft, a submarine, a mine shaft, a spacecraft or in a home equipped with a battery energy storage system. The gas emissions has however only been studied to a very limited extent.

An irreversible thermal event in a lithium-ion battery can be initiated in several ways, by spontaneous internal or external short-circuit, overcharging, external heating or fire, mechanical abuse etc. This may result in a thermal runaway caused by the exothermal reactions in the battery^{6–10}, eventually resulting in a fire and/or explosion. The consequences of such an event in a large Li-ion battery pack can be severe due to the risk for failure propagation^{11–13}. The electrolyte in a lithium-ion battery is flammable and generally contains lithium hexafluorophosphate (LiPF₆) or other Li-salts containing fluorine. In the event of overheating the electrolyte will evaporate and eventually be vented out from the battery cells. The gases may or may not be ignited immediately. In case the emitted gas is not immediately ignited the risk for a gas explosion at a later stage may be imminent. Li-ion batteries release a various number of toxic substances^{14–16} as well as e.g. CO (an asphyxiant gas) and CO₂ (induces anoxia) during heating and fire. At elevated temperature the fluorine content of the electrolyte and, to some extent, other parts of the battery such as the polyvinylidene fluoride (PVdF) binder in the electrodes, may form gases such as hydrogen fluoride HF, phosphorus pentafluoride (PF₅) and phosphoryl fluoride (POF₃). Compounds containing fluorine can also be present as e.g. flame retardants in electrolyte and/or separator¹⁷, in additives and in the electrode materials, e.g. fluorophosphates^{18,19}, adding additional sources of fluorine.

The decomposition of LiPF₆ is promoted by the presence of water/humidity according to the following reactions^{20,21}:



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Battery	Numbers of batteries per test	Type	Nominal capacity per battery (Ah)	Nominal voltage per battery (V)	Cell packaging
A	5–10	LCO (LiCoO ₂)	6.8	3.75	Prismatic hard Al-can
B	2	LFP (LiFePO ₄)	20	3.2	Pouch
C	5	LFP (LiFePO ₄)	7	3.2	Pouch
D	9	LFP (LiFePO ₄)	3.2	3.2	Cylindrical
E	5	LFP (LiFePO ₄)	8	3.3	Cylindrical
F	2	NCA-LATP (LiNiCoAlO ₂ -LiAlTiPO ₄)	30	2.3	Pouch
G	2	Laptop pack*	5.6	11.1	Cylindrical

Table 1. Details of the tested Li-ion battery cells. *Each laptop battery pack has 6 cells of type 18650; arranged 2 in parallel and 3 in series.

Of these PF₅ is rather short lived. The toxicity of HF and the derivate hydrofluoric acid is well known^{22–24} while there is no toxicity data available for POF₃, which is a reactive intermediate²⁵ that will either react with other organic materials or with water finally generating HF. Judging from its chlorine analogy POCl₃/HCl²⁴, POF₃ may even be more toxic than HF. The decomposition of fluorine containing compounds is complex and many other toxic fluoride gases might also be emitted in these situations, however, this study focuses on analysis of HF and POF₃.

Although a number of qualitative and semi-quantitative attempts have been made in order to measure HF from Li-ion batteries under abuse conditions, most studies do not report time dependent rates or total amounts of HF and other fluorine containing gases for different battery types, battery chemistries and state-of-charge (SOC). In some measurements reported, HF has been found, within limited SOC-variations, during the abuse of Li-ion battery cells^{15,16,26}, as well as detected during the abuse of battery packs²⁷. However, time-resolved quantitative HF gas emission measurements from complete Li-ion battery cells undergoing an abusive situation have until now only been studied to a limited extend; for a few SOC-values, including larger commercial cells^{28,29}, a smaller-size commercial cell³⁰ and a research cell (i.e. non-commercial cell)³¹. Time-resolved quantitative HF measurements on the gas release from complete electric vehicles including their Li-ion battery packs during an external fire have also been performed³². Other types of gas emissions from Li-ion cells during abuse have been the subject of a somewhat larger number of investigations^{33–41}. Since the electrolyte typically is the primary source of fluorine, measurements of fluorine emissions from battery type electrolytes have been studied. For example, fire or external heating abuse tests have been performed on electrolytes^{42–46} and the quantitative amounts of HF and POF₃ have been measured in some cases^{45,46}. Other studies of electrolytes exposed to moderate temperatures, 50–85 °C, show the generation of various fluorine compounds^{20,21,47–49} and some studies include both electrolyte and electrode material^{50,51,52}.

Our quantitative study of the emission gases from Li-ion battery fires covers a wide range of battery types. We found that commercial lithium-ion batteries can emit considerable amounts of HF during a fire and that the emission rates vary for different types of batteries and SOC levels. POF₃, on the other hand, was found only in one of the cell types and only at 0% SOC. The use of water mist as an extinguishing agent may promote the formation of unwanted gases as in eqs (2)–(3) and our limited measurements show an increase of HF production rate during the application of water mist, however, no significant difference in the total amount of HF formed with or without the use of water mist.

Lithium-ion battery fire tests. The experiments were performed using an external propane burner for the purpose of heating and igniting the battery cells as described in the Methods section. Seven different types of batteries, type A–G, were investigated, from seven manufacturers and with different capacity, packaging type, design and cell chemistry, as specified in Table 1. Type A had a lithium cobalt oxide (LCO) cathode and carbon anode, types B to E had lithium-iron phosphate (LFP) cathode and carbon anode, type F had nickel cobalt aluminum oxide (NCA) and lithium aluminum titanium phosphate (LATP) electrodes while type G was a laptop battery pack with unspecified battery chemistry. All electrolytes contained LiPF₆. Most of the cells were tested for different SOC levels, from fully charged, 100% SOC, to fully discharged, 0% SOC. The study included large-sized automotive-classed cells, i.e. series production cells of high industry quality, with long life time etc.

The heat release rate (HRR) and the emitted HF for B-type cells with different SOC values are shown in Fig. 1. Only the 100% SOC cells show several distinct peaks, corresponding to intense flares, when the cells vented and the emitted gas burn, for all other cells the heat release as a function of time is more smooth. These behaviors are reproducible also for the other tested cell types, e.g., only the 100% SOC cells show the more violent heat release peaks with intense flares.

The measurements of the gas emissions during the fire tests show that the production of HF is correlated to the increase in HRR although somewhat delayed. From Fig. 1b it is evident that the higher SOC value, the higher values for the peak HF release rate. The total amount of HF varies considerably for the different battery types, see Fig. 2a. The amount of HF produced, expressed in mg/Wh, where Wh is the nominal battery energy capacity, is approximately 10 times higher for the cell with the highest values compared to the cells with the lowest values. The different relative amount of electrolyte and filler materials in the cells could be the simple explanation of this variation but information on those amounts are difficult to access for commercial batteries. The highest HF values are found for the pouch cells, a possible explanation would be that hard prismatic and cylindrical cells can build a

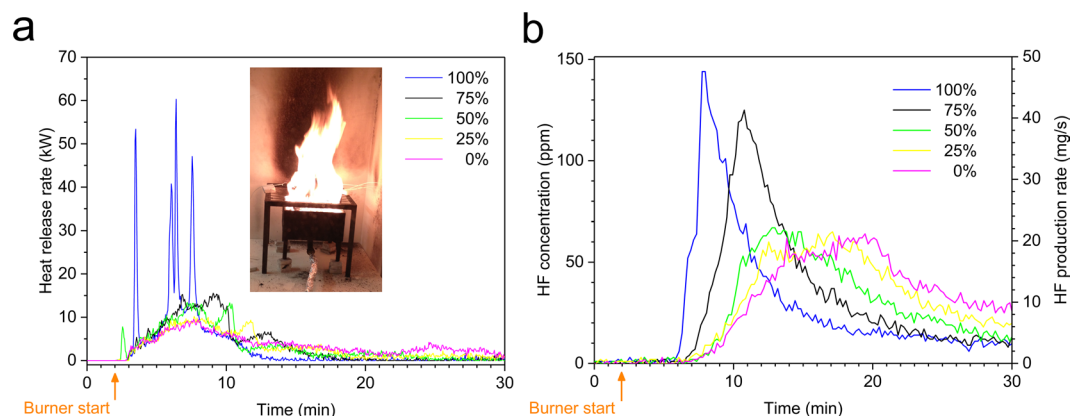


Figure 1. Results for type B cells, for 0–100% SOC with intermediate SOC-steps of 25%, exposed to an external propane fire; **(a)** showing the heat release rate (burner HRR contribution is subtracted), the inset photo shows burning battery cells during the test; **(b)** showing the HF release both as the measured concentrations as well as the calculated HF production rates. The HF production rates are calculated from the measured HF concentration by the Ideal gas law taking into account the ventilation flow, see Methods. The starting time of the heating process is marked on the time axis.

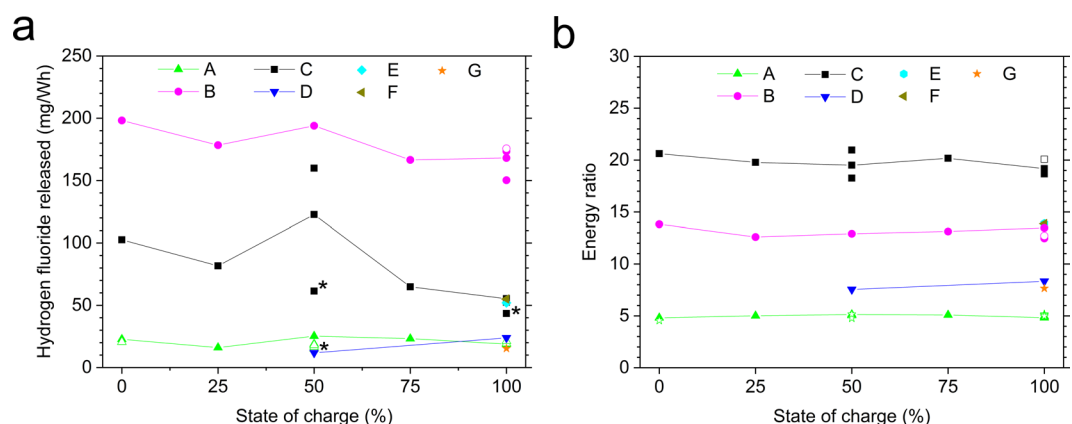


Figure 2. Total amount of HF measured by FTIR, normalized to nominal electrical energy capacity **(a)** and the energy ratio **(b)**, for seven types of Li-ion battery cells and with various state of charge levels. Non-filled symbols indicate a repetition variant, e.g. applying water mist. The lines are intended as a guide for the eye. The energy ratio is a dimensionless value calculated by taking the total heat release from the battery fire divided by the nominal electrical energy capacity. Note that for 100% SOC the values are overlapping for type C, E and F as well as for type A, D and G in **(a)** and type B, E and F in **(b)**. *Low value for type C at 50% and 100% SOC and type D at 50% SOC due to that a pre HF-saturation was not applied, therefore a part of the HF release was likely to be saturated in the gas sampling system, see Methods.

higher pressure before bursting, rapidly releasing a high amount of gases/vapors from the electrolyte. Due to the high velocity of the release and thus the short reaction time, combustion reactions might be incomplete and less reaction products might be produced. In the test involving type G the cylindrical cells were layered horizontally, thus having a different venting direction and possibly increased wall losses, which combined with a very energetic response, might suggest why HF was detected only from the filter analysis and not detected by FTIR-analysis. The tested pouch cells of type B and C burned for longer time and with less intensity. The pouch cell of type F, however, burned faster, possibly due to its different electrode materials. The SOC influence on the HF release was less significant and the trend in Fig. 2a shows higher HF values for 0% than for 100% SOC, however with clear peaks at 50% SOC. Although these results are reproducible, they are difficult to explain. In other studies^{30,31}, significantly narrower in test scope, involving smaller-sized cells and using a somewhat different abuse method, it was found that the total amount of HF measured by real-time FTIR was higher for decreasing SOC (tests conducted at 100%, 50% and 0% SOC).

The HRR curve is used to calculate the total heat release (THR) which corresponds to the energy released from the burning battery. THR is obtained by integrating the measured HRR (with the burner contribution subtracted) over the complete test time. Fig. 2b shows the energy ratio, that is how much energy is produced by the burning

Battery	Nominal energy capacity (Wh)	Normalized total HF detected with FTIR (mg/Wh)	Normalized maximum HRR (W/Wh)	Normalized THR (kJ/Wh)
A	128	15–25	243–729	17–19
B	128	150–198	78–633	45–50
C	112	43–160	116–491	66–75
D	92	12–24	207–315	27–30
E	132	52	235	50
F	138	55	384	50
G	124	15	460	28

Table 2. Main test results normalized to nominal energy capacity, when applicable including various SOC-levels.

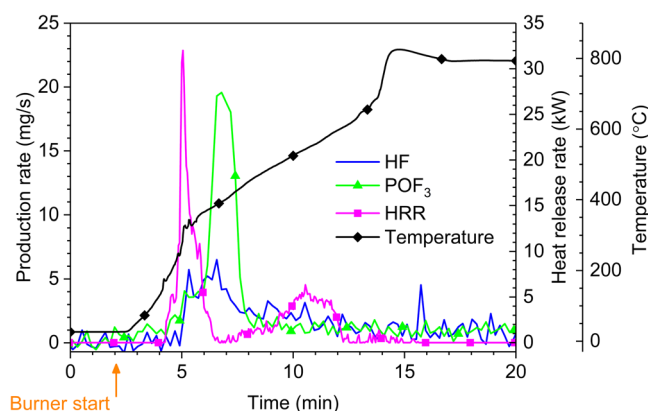


Figure 3. Results for a test with 5 type A cells at 0% SOC showing HF and POF_3 , HRR and average surface temperature of the battery cells.

battery, compared to the amount of nominal electrical energy capacity a fully charged battery can deliver to an external circuit. The energy ratio is therefore a comparison between the chemical and the electrical energy of the Li-ion battery cell. The energy ratio varies considerably for the different cell types but is approximately constant for each cell, independent of SOC level. There are some similarities in Fig. 2a and b for the pouch cells, type B and C, which give the highest values in both cases, although in reverse order. This might indicate a higher amount of combustibles, e.g. electrolyte, in these cells compared to the other cells. It is also interesting to see that the energy ratio varies significantly between the tested cells, ranging from 5 to 21. This is important knowledge for fire protection and fire fighting. The energy ratio thus refers to a nominal fully charged battery while in normal use only a part of the SOC-window is used, for example half (50%) of the SOC-window (corresponding to cycling the battery between e.g. 30% and 80% SOC). If instead, the total heat release divided by the used electric battery capacity in the specific application is considered, higher energy ratio values are obtained. A summary of the results is shown in Table 2.

The measured heat release from an overheated battery may include several aspects, e.g. the battery temperature increase and the combustion of released gases. Variations due to the type of battery cell, the initiation method, e.g. if the test is done as an external fire test, an external heating or an overcharge test, and the test method, e.g. access to ambient oxygen (inert, under-ventilated or well-ventilated fire), and the presence of an external igniter, can greatly affect the amount of measured heat release. Energy release from a internal cell event in a confined environment can, for example, be lower than the energy release from the same cell in case of external fire. Thus energy ratios published using other methods and other types of Li-ion cells can be significantly different^{7,52,53}.

For all tested battery types and selected SOC-levels, POF_3 could only be measured quantitatively for type A battery cells at 0% SOC. Repeated measurements confirmed the presence of POF_3 only for type A and only for 0% SOC. No POF_3 could thus be detected in any of the other tests. POF_3 is an intermediate compound and the local combustion conditions in every test, will influence the amounts of POF_3 generated. This shows the importance of investigating many different set-ups when evaluating emitted gases.

In Fig. 3 the HRR, the average surface temperature of the five cells as well as the HF and POF_3 production rates are shown for type A cells at 0% SOC. The POF_3 curve is less noisy than the HF curve due to different signal-to-noise ratios of the FTIR instrumentation at the different wavenumbers. There is a secondary peak in HRR approximately 5 minutes after the main heat event, this peak does not correspond to any peaks in the mass flow of HF or POF_3 . The explanation for this could be that the second peak in the heat release rate involves burning of mainly non-fluorine containing compounds. The temperature curve shows a rapid increase above the

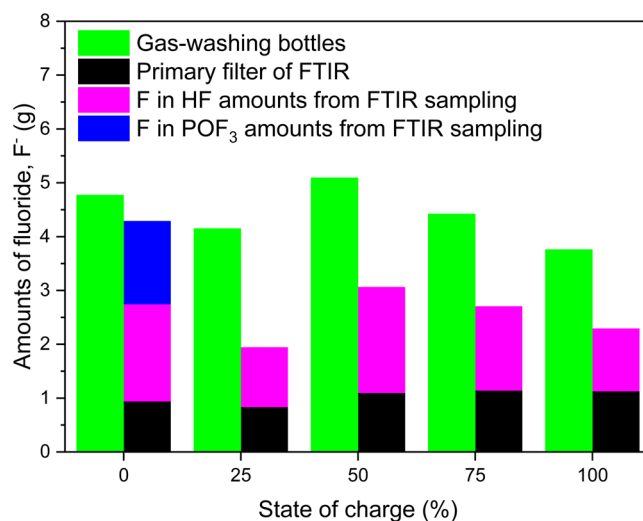


Figure 4. Total amount of measured fluoride, F⁻, for type A, for 0–100% SOC with intermediate steps of 25%. The amount of F from the FTIR is calculated from the measurement results for PO₃F and HF, while the amount of fluoride from gas-washing bottles and primary filter analyses is measured as water soluble fluoride.

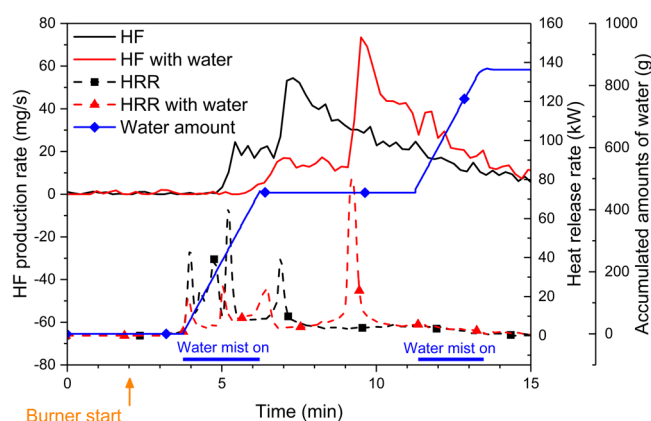


Figure 5. Results for type B cells at 100% SOC with and without the use of water mist.

melting temperature of the alumina cell case at about 660 °C. At these temperatures the alumina is molten and has formed a puddle on the burner bed beneath the battery cells. The thermal conditions in and around the thermocouples and the remains of the batteries have therefore changed considerably causing the apparent temperature increase.

In addition to the time resolved measurements with the FTIR, gas-washing bottles were used to determine the total fluorine content in the gas emissions during the tests. A comparison between the different measurement methods used can be seen in Fig. 4 for type A cells. Note that the FTIR measurements are performed only to detect HF and PO₃F, other fluoride compounds are not included. It is interesting to note that for 0% SOC the total amount of fluoride measured by the gas-washing bottle technique matches rather well with the FTIR and primary filter analysis. For other SOC values the fluoride content is higher from the gas-washing bottle measurements. Still, the general trend observed in the FTIR measurements for different SOC values is more or less confirmed by the gas-washing bottle measurements.

Gas-washing bottles were also used for some of the tests involving battery types B and C. These batteries showed higher amounts of released HF compared to type A. The ratio between the total values of released fluoride from FTIR plus filter analysis and from the gas-washing bottles for type B and C was between 0.89 and 1.02, indicating a better correlation between FTIR and gas-washing bottles measurement when HF gas emissions are higher.

The total amount of PO₃F measured by FTIR for type A at 0% SOC was 2.8 g (for 5-cells) and 3.9 g (for 10 cells). Hence, the normalized total PO₃F production was 15–22 mg/Wh of nominal battery energy capacity. Abuse studies measuring PO₃F are few, Andersson *et al.*⁴⁶ found both HF and PO₃F when burning mixtures of propane and Li-ion battery electrolytes with a HF:PO₃F production ratio between 8:1 and 53:1. Besides HF and PO₃F measurements, several distinct non-assigned peaks were found in the FTIR measurements, e.g. at 1027 cm⁻¹

Battery	SOC (%)	Number of tests	Normalized total HF detected (mg/Wh)		Normalized maximum HRR (W/Wh)	Normalized THR (kJ/Wh)
			From FTIR	From gas-washing bottles		
A	100	6	19.8 ± 1.2 [3]	29.1 ± 3.1 [5]	612 ± 102	18.1 ± 0.46
	50	7	18.5 ± 3.9 [6]	36.7 ± 3.3 [6]	416 ± 39 [6]	18.0 ± 0.61 [6]
	0	2	21.6 ± 1.5	38.3 ± 1.6	214 ± 53	16.8 ± 0.66
B	100	4	166.8 ± 11.5	191.3 ± 11.3 [2]	538 ± 77	46.9 ± 1.9
C	100	3	53.9 ± 2.0 [2]*	N/A	461 ± 27	69.5 ± 2.6
	50	3	141.3 ± 26.3 [2]*	N/A	149 ± 5	70.5 ± 4.9

Table 3. Detailed results for all available repetitions. Values presented as mean values followed by the standard deviation, in case the data parameter was not measured in all tests the value in bracket declares the number of available tests used for the specific data parameter value. *For FTIR data for battery type C, one data point of 50% and one data point at 100% SOC are excluded as outliers since they were low due to that a pre HF-saturation was not applied in the test, see Methods.

and 1034 cm⁻¹, which have also been seen in other studies⁴⁶. They are compatible with the typical C-O stretching energies of low molecular weight alcohols in gas phase but also with in-plane stretching of aromatic compounds. This indicates the complexity and the limited knowledge in this area.

Water mist measurements. In order to study the effects of water on gas emissions, fire tests have also been performed where a water mist was applied during the fire. The reason for this experiment is that water is the preferred extinguishing agent for a lithium-ion battery fire. The intention in this study was however not to extinguish the fire completely. One potential problem regarding the use of water mist is that the addition of water may, in principle, increase the rate of formation of HF, see Eqs (2) and (3).

Figure 5 shows the results for type B cells with and without exposure to water mist, note that both the HRR and HF production are delayed when water mist is used. In this limited study, the peak of the HF production rate increased by 35% when using water, however no significant change in the total amounts of the HF release could be seen. A similar result has been reported in a previous study²⁸. The water mist was applied during two different periods of time, as marked in Fig. 5, adding a total of 851 g of water in the reaction zone, however, several other large sources of water were also present in the experiment, i.e. water production from the propane combustion and from humidity in the air. The water mist is cooling the fire and the top surface of the pouch cell was for some time partly covered with liquid water; this is the reason that the battery fire is delayed as seen in Fig. 5. The water mist might actually also clean the air by collecting fume particles and HF can be bound to water droplets, thus possibly lowering the amount of HF in the smoke duct and increasing the non-measured amount of very toxic hydrofluoric acid on the test area surfaces (e.g. walls, floor, smoke duct walls).

Repeatability

Repeated tests were performed for battery types A-C for selected SOC-levels. Some of the repetitions included a variant, e.g. including water mist; see Methods. In Fig. 2 all available test data are presented. Since the test repetitions are not clearly observable in Fig. 2 the results are also presented in Table 3 showing the mean values and standard deviations and the number of performed tests. While the ranges in Table 2 include data for all tested SOC-values, Table 3 shows test data for repeated measurements including repetition variants.

Figure 6 shows the repeatability results for four tests of battery type B for 100% SOC. The time evolution of HRR varies in the fire tests as seen in Fig. 6a. In fire tests there are always natural variations, however comparing the tests with 100% SOC, in Fig. 6a, with those with lower SOC-values presented in Fig. 1a, the repeatability of the 100% SOC tests is significant. The third repetition (black line) in Fig. 6a is delayed due to that it included an application of water mist, as discussed above. Although the appearance of the HRR plots of the four tests differs in Fig. 6a the THR (the integrated HRR) values are rather similar. Fig. 6b shows the HF release for the same four tests of type B at 100% SOC. Repetition 2 and 3 were performed in the third test period, without secondary FTIR filter, and therefore Repetition 2 occurs earlier while Repetition 3 is delayed due to the applied water mist, as discussed above. For the four tests of type B at 100% SOC the mean value of the total FTIR detected HF release is 166.8 mg/Wh with a standard deviation of 11.5 mg/Wh, as seen in Table 3. Comparing Fig. 1b and Fig. 6b, shows that for 100% SOC the HF release is faster and reaches a higher value. Repetition 1 in Fig. 6b shows lower HF release peak values, however, the total HF release value from the FTIR measurement of 168 mg/Wh is close to the average value (166.8 mg/Wh, as seen in Table 3).

Conclusions

This study covered a broad range of commercial Li-ion battery cells with different chemistry, cell design and size and included large-sized automotive-classed cells, undergoing fire tests. The method was successful in evaluating fluoride gas emissions for a large variety of battery types and for various test setups.

Significant amounts of HF, ranging between 20 and 200 mg/Wh of nominal battery energy capacity, were detected from the burning Li-ion batteries. The measured HF levels, verified using two independent measurement methods, indicate that HF can pose a serious toxic threat, especially for large Li-ion batteries and in confined environments. The amounts of HF released from burning Li-ion batteries are presented as mg/Wh. If extrapolated for large battery packs the amounts would be 2–20 kg for a 100 kWh battery system, e.g. an electric

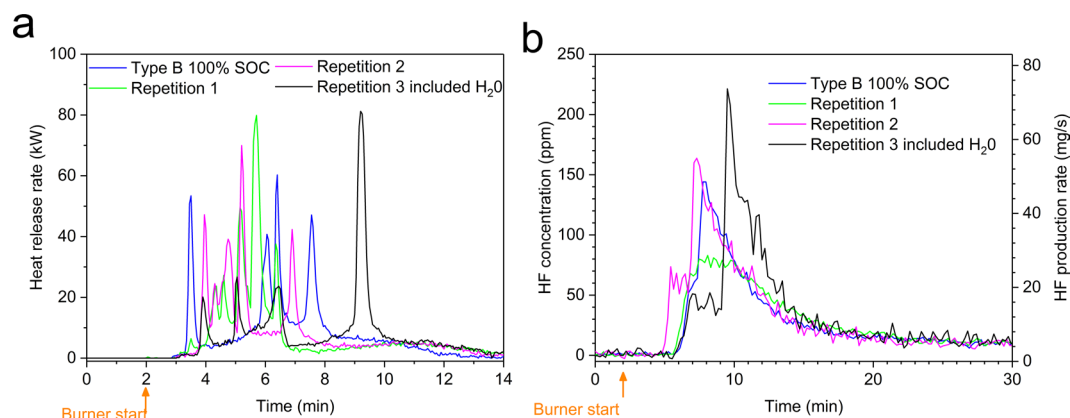


Figure 6. Repeatability for four tests of type B cells at 100% SOC, (a) shows the heat release rate (burner HRR contribution is subtracted) and (b) shows the HF release, both as the measured concentrations as well as the calculated HF production rates.

vehicle and 20–200 kg for a 1000 kWh battery system, e.g. a small stationary energy storage. The immediate dangerous to life or health (IDLH) level for HF is 0.025 g/m³ (30 ppm)²² and the lethal 10 minutes HF toxicity value (AEGL-3) is 0.0139 g/m³ (170 ppm)²³. The release of hydrogen fluoride from a Li-ion battery fire can therefore be a severe risk and an even greater risk in confined or semi-confined spaces.

This is the first paper to report measurements of POF₃, 15–22 mg/Wh, from commercial Li-ion battery cells undergoing abuse. However, we could only detect POF₃ for one of the battery types and only at 0% SOC, showing the complexity of the parameters influencing the gas emission. No POF₃ could be detected in any of the other tests.

Using water mist resulted in a temporarily increased production rate of HF but the application of water mist had no significant effect on the total amount of released HF.

The research area of Li-ion battery toxic gas emissions needs considerable more attention. Results as those presented here are crucial to be able to conduct a risk assessment that takes toxic HF gas into account. The results also enable strategies to be investigated for counteractions and safety handling, in order to achieve a high safety level for Li-ion battery applications. Today we have a rapid technology and market introduction of large Li-ion batteries but the risks associated with gas emissions have thus far not been possible to take into consideration due to the lack of data.

Methods

Seven types of Li-ion batteries were exposed to an external propane fire. Fire characteristics, gas emissions, battery temperatures and cell voltages were measured. In total 39 fire tests were conducted of which 20 were within the base test matrix, 19 were repeated measurements of selected battery types and SOC-levels of which 10 included a variant, e.g. water mist for fire-fighting. The amounts of emitted fluoride gases were measured with two parallel and independent techniques, FTIR (time resolved concentration measurements and total values achieved by integration of the time resolved curve) and gas-washing bottles (total values). The experimental setup is schematically shown in Fig. 7. The gas collecting system and measurement system of the *Single Burning Item (SBI) method* (EN 13823⁵⁴), which is normally used for reaction-to-fire classification of construction products according to EN 13501-1⁵⁵ was used in the tests. The tests were performed in three different test periods; the second test period was conducted about 1 year after the first and the third test period was conducted about 2.5 years after the first. Each test period involved several days of testing. The measurement equipment, as specified in the text below, was somewhat varying between the three test periods.

Batteries. Six different types of Li-ion battery cells, type A–F, and one Li-ion battery pack, type G, were tested as seen in Table 1. The number of cells used in each test was varied in order to achieve similar electrical energy capacity per test. The batteries were placed on wire gratings just above a 16 kW propane burner. The wire grating was made of steel wire about 2 mm thick over a surface of about 300 × 300 mm. The quadrants of the grating were 40 × 100 mm. The cells were not electrically connected to each other (except the laptop packs of type G, see note in Table 1). Type A–F was pure battery cells while type G was a complete laptop battery pack which included plastics box, electronics and cables. The chemical content of the polymer materials in the auxiliary components of the battery pack of battery type G is not known. It is possible, however not likely, that fluorine was included in some of the components, which in that case could have resulted in the production of HF. For battery type A, 5 cells/test was used except in two variant tests in which 10 cells/test were used.

The influence of different state of charge was investigated, for some battery types the complete SOC-window ranging from 0% to 100%, with intermediate steps of 25%, was investigated. The SOC levels included for each battery type and the numbers of repetitions per test type, i.e. the fire test matrix, is seen in Table 4. All parameters were not measured in all of the tests. Measurement of HRR and corresponding THR was conducted in 38 tests, FTIR in 35 tests and gas-washing bottles were used in 19 tests.

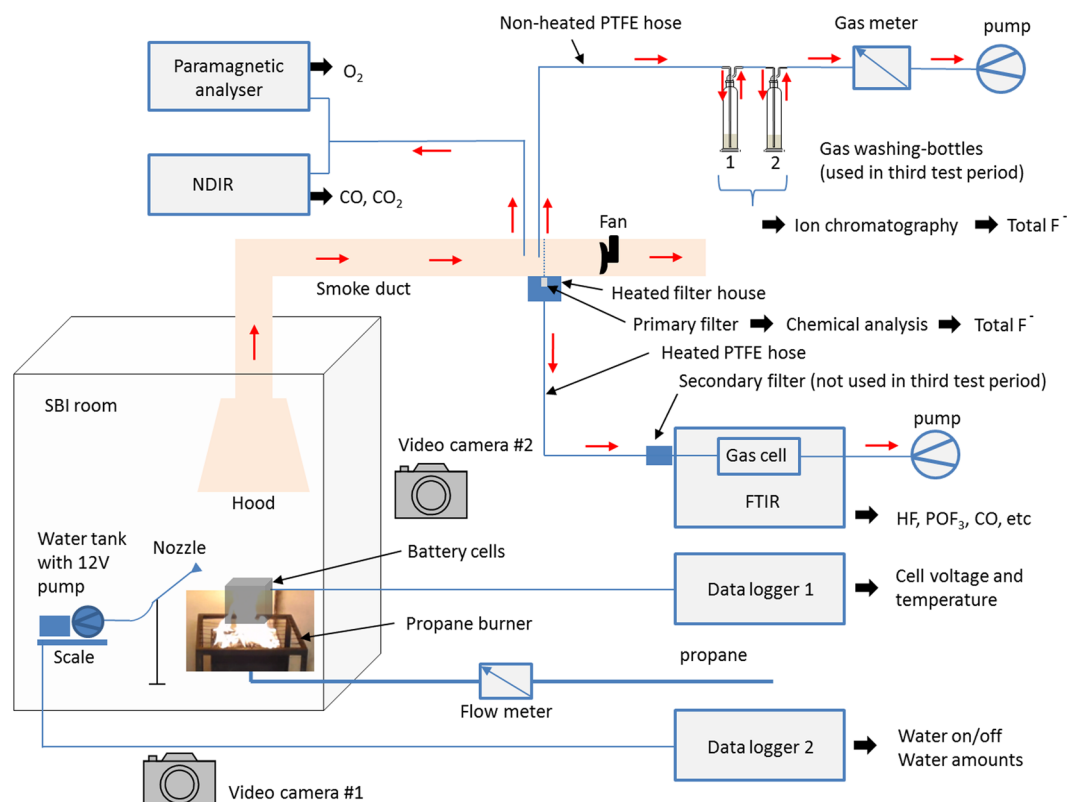


Figure 7. Schematic illustration of the experimental setup.

Battery	Number of tests per SOC-level					Number of tests
	0%	25%	50%	75%	100%	
A	1 + 1*	1	3 + 4*	1	3 + 3*	17
B	1	1	1	1	3 + 1*	8
C	1	1	3	1	2 + 1*	9
D			1		1	2
E					1	1
F					1	1
G					1	1
Total number of tests						39

Table 4. Detailed test matrix of the fire tests. * repetition includes a variant, e.g. water mist or 2 × 5-cell-pack (for battery type A).

The selected SOC level in each test was set using a charge/discharge procedure using ordinary laboratory equipment as well as dedicated battery test equipment, i.e. a *Digatron battery tester* and *Metrohm Autolab PGSTAT302N* with 20 A booster module. The cells were first fully charged by constant current followed by constant voltage (CC-CV) according to the manufacturer's instructions. For cells intended for tests with less than 100% SOC, the cell was discharged to the selected SOC level, using constant discharge current (CC). A relative low current rate, about C/5, was used and voltage and current rates were within the manufacturer limits. In most cases each battery type was tested during the same test period. However, the tests for type C and D were split in several test periods, for type C repetitions on 50% SOC were conducted in all three test periods, and for type B repetitions at 100% SOC were made in two test periods, the latter one included a water mist test.

All batteries were unused and the calendar life time of the cells before the tests were approximately 6–12 months for type A, F and G and between approximately 2–3 years for type B–E. The pouch cells; type B, C and F was mechanically tied together with steel wires (0.8 mm diameter). The type A hard prismatic cells were tight together in packs of five cells, “5-cell-pack”, using steel straps (1 × 13 mm). The hard prismatic and cylindrical cells were placed in boxes to protect test personnel from potential projectile hazards in case of cell explosions due to excessive pressure. The 5-cell-pack of type A was placed standing up, with the cell safety vents releasing straight upright in direction to the hood and smoke duct, inside a custom-made steel-net-box, see Fig. 8. Additionally, the 5-cell-pack of type A was fastened to the bottom of the steel-net-box with steel wire (0.8 mm diameter) in the

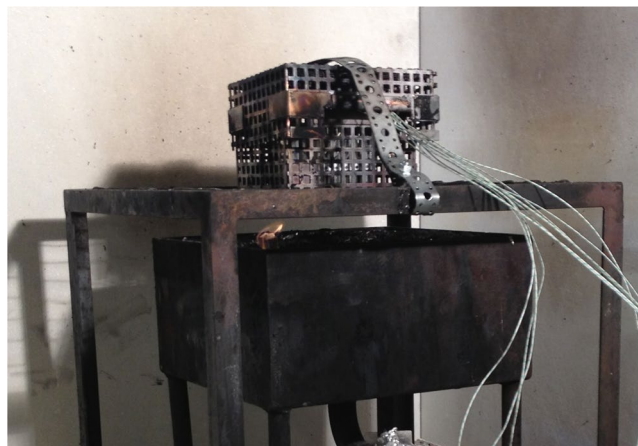


Figure 8. Photo of test type A, showing the 5-cell-pack inside a steel-net-box placed on the wire gratings. The sand bed for the propane burner is underneath the wire grating, a pilot flame (seen in front left corner of the burner) is used to ignite the propane gas.

corners to avoid it moving around due to e.g. explosion/rupture/venting. Type D and E cells were placed standing up in custom-made boxes made of non-combustible silica board and steel net at the top and bottom. Type G was placed in a steel net. The protective boxes and steel net were fastened in the wire gratings with steel wire and steel straps to avoid movement due to response to the fire. Care was taken to avoid external short circuiting when placing the battery on the wire gratings as well as avoiding accidental external electrical inter-cell-connections, e.g. for pouch cells the electrical tab terminals were cut. Still the battery test setup allowed that the separators and electrical insulation in the cells could melt due to the heat exposure which could cause various internal and external electrical contacts.

The battery surface temperature was measured with several type K thermocouples; the number of sensors varied for the different battery types. Battery cell surface temperature values presented in this paper are average values over the cell. Cell voltages were measured for type A, B, C and F battery tests. Cell voltage and thermocouple readings was sampled with 1 Hz using two types of data loggers, *Agilent 34972 A using an Agilent 34902 A reed multiplexer module* (for the third test period) and *Pico Technology ADC-24* (for the first and second test period).

Test procedure. The propane burner was started 2 minutes into each test, as indicated with arrows in the result figures in the paper. The burner was active as long as there was a heat contribution from the burning batteries; therefore, the burner was active for different durations of time for different batteries and SOC-levels. When the heat release from the batteries was no longer detectable, the power of the propane burner was doubled, i.e. to 32 kW, in order to be sure to fully burn out any residues of the batteries, for increased personnel safety. The fire emissions were collected in the hood and transferred in the smoke duct having a ventilation flow of 0.4 m³/s, with the exception that 0.6 m³/s was used in two tests with 100% SOC for type C. For these cases the values were scaled down to the lower flow values making the results from the two flow rates comparable. The SBI-room, see Fig. 7, had a ventilation inlet from an adjacent indoor laboratory hall (which had fresh air inlet from the ventilation system in the building), supplying ambient air with temperature about 20 °C entering beneath the propane burner. We consider the amount of ambient air to be sufficient to provide an oxygen-rich environment and thereby consider the battery fire as well-ventilated. However for some tests, during the rapid and energetic gas outbursts, a full combustion might not have occurred in these short time periods.

All tests were video recorded and for the majority of the tests an additional camera was used set at 90 degree angle from the other video camera, allowing simultaneous recording from two sides of the battery fire.

A part of the smoke duct flow was sampled to a *Servomex 4100 Gas purity analyser* where the oxygen content was measured by a *paramagnetic analyser* and CO and CO₂ were measured by a *non-dispersive infrared sensor (NDIR)*. By combining these two measurements, the heat release rate (HRR) is calculated using the oxygen consumption method corrected by CO₂⁵⁴. Each test day started with a blank test, i.e. using only the propane burner, to measure the HRR of the burner alone and measure blanks for FTIR and gas-washing bottles. In the presented HRR values of the battery tests the burner contribution to the HRR (about 16 kW, with slight daily variations, established by the blank tests) has been subtracted. The combined expanded uncertainty is ±5 kW for the HRR-values. By integrating the HRR values over the entire test, subtracting the HRR from the burner, the total heat release (THR) from the battery cells could be established. The oxygen consumption method is common in fire calorimetry, however when using it with batteries, the joule heating from electrical discharge within the cells is not accounted for, therefore the values of HRR and THR do not include the Joule heating. During the external fire tests, it is difficult to measure how much a battery cell is electrically discharged when the separator is melting. The energy ratios presented in Fig. 2b do not include any Joule heating as clearly stated by its definition. For 0% SOC the influence from Joule heating is in principle zero, however small amounts of joule heating might possibly be liberated when going to zero voltage even though other processes might occur. Li-ion cells can also release oxygen during thermal runaway and this could affect the measured O₂ levels. The amount of oxygen release varies

Spectral bands (cm ⁻¹)	Type of band
POF ₃	
868–874	P-F symmetric stretching mode ²⁰
1413–1418	P-O stretching mode ²⁰
HF	
4172–4175	HF R-branch stretching mode ⁵⁸
4202–4203	HF R-branch stretching mode ⁵⁸

Table 5. FTIR spectral band used for measurements of POF₃ and HF.

for different electrode materials, e.g. LFP typically releases less oxygen than LCO. However, the ventilation flow is large and the O₂ released from the battery cells is regarded as negligible.

Gas measurements. Besides the gas measurements in the SBI apparatus, measurements of gases were also conducted by online Fourier transform infrared spectroscopy (FTIR). The FTIR offers broad and diverse spectra of gases, the focus was however on fluoride gas emissions. The FTIR used was a *Thermo Scientific Antaris IGS analyzer (Nicolet)* with a gas cell. The gas cell was heated to 180 °C and had a volume of 0.2 L, 2.0 m path length and a cell pressure of 86.7 kPa which was maintained during the tests. The spectral resolution of the FTIR was 0.5 cm⁻¹ (accuracy 0.01 cm⁻¹) and 10 scans were used to collect a spectrum every 12 s, giving both accurate intensity, as well as relatively rapid measurements with its five spectrum per minute rate. A part of the duct flow, taken along the full duct pipe width (in the mid height of the pipe) from around 15 sampling holes (about 2 mm diameter, directed opposite to flow, pipe end was closed), was taken to online FTIR measurement. This sub-flow was extracted through a primary filter inside a heated filter house (180 °C) and then extracted through an 8.5 m sampling PTFE hose, heated to 180 °C, and then through a secondary filter and finally through the gas cell of the FTIR. The sub-flow was selected to be 3.5 L/min using a pump located after the FTIR gas cell. Between each test the FTIR sampling system was flushed with N₂ gas and a new background spectrum was measured. There is a natural delay time between the FTIR and the heat release measurement. In order to time synchronize them the (CO₂ measurements from both the FTIR and the NDIR) part of the heat release rate measurement, were overlayed.

One primary filter (M&C ceramic filter, type “F-2K”) was used per test and was chemically analysed for fluoride content after the test. It is known that HF may be partly adsorbed by this type of filter⁵⁶. The fluoride amount absorbed by the filter was determined by leaching the filter in an ultrasonic water bath for at least 10 min and thereafter the fluoride content in the water was measured by ion chromatography with a conductive detector, according to the method B.1 (b) of the SS-ISO 19702:2006 Annex B standard. The amount of HF is calculated by assuming that all fluoride ions present in the filter derives from HF. The secondary filter (M&C sintered steel filter), heated to 180 °C, was the same in all tests in the first and second test period. In the third test period the secondary filter was removed in order to decrease delay time and losses. The third test period started with burning 10 cells of type A in order to saturate the FTIR sampling system with HF and it was conducted because in the first and the second test period the first tests had indicated low HF values, HF was potentially lost during saturation of the gas collecting system.

The FTIR was calibrated^{29,57} for HF and POF₃. The minimum detection limit (MDL) for HF was 1.7 ppm and the limit of quantification (LOQ) was established to 5.7 ppm. The detection limit for POF₃ was 6 ppm²⁹. PF₅ was also qualitatively detectable by the FTIR²⁹ but not quantitatively calibrated. A classical least square (CLS) method was used for the quantification of HF and POF₃ using the spectral bands specified in Table 5. The relative error of the HF prediction is lower than 10 rel-%.

For all measurements, except type G, the measured ppm levels of HF were above the detection level. For POF₃, the maximum concentration was 11 ppm (5-cells) and 19 ppm (10-cells).

When the FTIR measurement stopped, HF levels were, in some of the tests, still somewhat above the detection limit, even though no HRR contribution was measured from the batteries. It is also possible that the HF was temporarily clogged in the sampling system. Some HF might not have been collected in the measurements and the effect of this error is largest for the batteries that give the lowest values. Thus the reported values might underestimate the released gas emissions.

In order to further improve the accuracy of the FTIR measurements, a data offset determination and a subsequent adjustment of the HF values was performed. The improvement was greatest for tests with lower concentrations, closer to the MDL value, e.g. type A with 5 cells with low values during relatively short periods of time. With 10 cells per test, the type A batteries gave higher signal-to-noise levels. The FTIR measurements started around 8 minutes before the burner was started. The calculated average HF ppm noise level was treated as an offset that had both negative and positive values, ranging from extreme values of about −2 to 3.5 ppm. This offset was compensated for by assuming a constant offset value and adding positive or negative offset values to the total HF release value. Note that the reported concentration values in ppm are only valid for the measurements in the smoke duct of our specific test equipment and method. The HF and POF₃ concentration values (in ppm) were used for calculating the corresponding production rates (in mg/s) using the ideal gas law and taking into account the measured ventilation flow rate in the smoke duct.

In the third test period the total amounts of water soluble fluorides were determined using gas-washing bottle technique. This was made in order to validate the results from the FTIR measurements with a separate measurement technique. The water soluble fluorides were collected in the bottles and the amount of HF was calculated by assuming that all fluoride ions present derives from HF. The sample gas was extracted from the center of

the smoke duct using a non-heated 6 mm (o.d.) diameter PTFE sampling tube with a length of about 1.5 m. The sampling was made using two gas-washing bottles connected in series each containing 40 mL of an alkaline buffer solution (20 mM Na_2CO_3 /20 mM NaHCO_3). The second bottle was used to capture any losses from the first bottle. The sampling flow was 1.0 normal-L/min and the total sampled volume during a test was measured by a calibrated gas volume meter. The sampling flow rate was checked before the start of each test using a *Gilian Gilibrator-2 NIOSH Primary Standard Air Flow Calibrator* gas flow meter. The procedure during a test was to continuously sample during the full test time. When the test was completed, the sampling tube was disconnected from the exhaust duct to allow rinsing of the tube with buffer solution, about 30 mL in the first gas-washing bottle, to collect any fluoride deposited on the inner walls of the tubing, in order to minimize losses in the tube. Since the tube was rinsed, heating of the tube was not necessary (any condensation in tube was collected anyhow). Analysis of fluorine content of the absorption solutions was made using High Performance Ion Chromatography (HPIC). The contents of the two gas-washing bottles were analyzed separately. The bottles were rinsed with distilled water between each test in order to minimize any interference between tests.

Water mist test. In the water mist tests, a custom-made equipment was constructed, including a 12 V automotive pump and water container which was placed on a scale measuring the weight of the water. The scale readings and the on/off manual switching (of the 12 V) was recorded with 1 Hz using *Pico Technology ADC-24* with a custom-made *LabVIEW* program. The water mist was sprayed on or above the batteries using a metal nozzle. In order for precise time synchronization, the on/off 12 V signal was recorded by both data loggers (data logger 1 and data logger 2). A blank test, i.e. using only the propane burner and without batteries, was performed in order to calibrate the setup. The water flow was around 190 g water per min and consisted of deionized water.

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Author Contributions

F. Larsson planned the experiments, partially together with P. Andersson and B.-E. Mellander. P. Andersson made the initial data process of the SBI heat release data. P. Blomqvist planned and performed the FTIR and gas-washing bottles measurements and made the initial data processing. F. Larsson prepared the batteries and performed the measurement and data analyses of temperature, cell voltage and water mist, and did the post-measurements and final data processing. Water mist setup was planned and constructed by B.-E. Mellander and F. Larsson. All four authors were involved in the analyses of the data and wrote the paper.

Additional Information

Competing Interests: The authors declare that they have no competing interests.

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ATTACHMENT 2.

**Slide from Commission Presentation Given
September 1, 2026.**

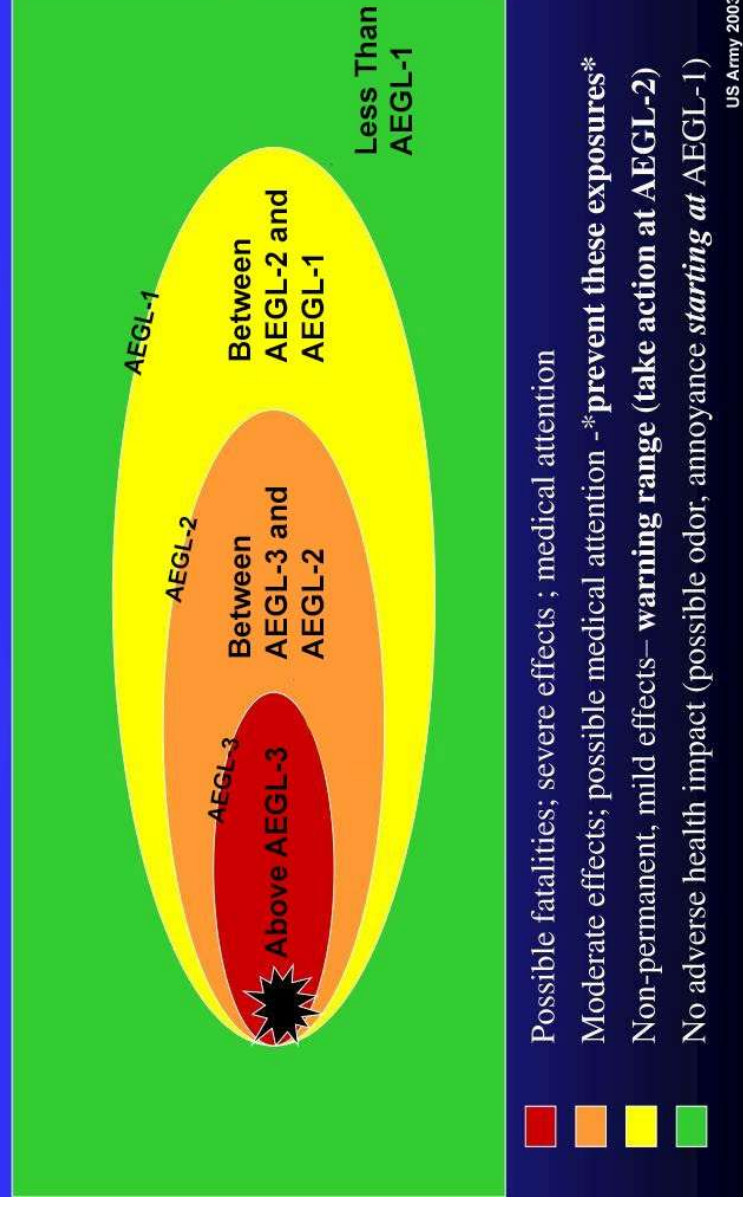


Battery Safety

Public Health Impacts Guidelines

- Modeled results compared with U.S. EPA Acute Exposure Guideline Levels (AEGLs, 1 hour):
 - AEGL-1: Temporary and not disabling discomfort/irritation
 - AEGL-2: Serious, long-lasting/irreversible health effects
 - AEGL-3: Severe adverse effects, increasing chance of fatality

Example AEGL Application - US EPA Chemical Emergency Preparedness Office



ATTACHMENT 3.

**Excerpt from Environmental Impact Report
Prepared by the California Public Utilities
Commission for the South Orange County
Reliability Enhancement Project.**

fraction of the regional emission inventory included in the SDAPCD's 2009 RAQS. In addition, these emissions would be temporary in nature. Construction equipment for the proposed project would be operated in compliance with applicable local, state, and federal regulations mandating reductions in emissions as outlined in the plan and related SIP, and project emissions would be consistent with the 2009 SDAPCD. Impacts under this criterion that would be associated with the portion of proposed project that would be constructed in San Diego County would be less than significant under this criterion.

Operation and maintenance activities associated with the proposed project would be similar to those associated with the existing substations, transmission, and distribution lines operation and maintenance activities. Therefore, operation of the proposed project would not create a new impact on air quality plans in both the SCAQMD and SDAPCD.

Impact AQ-2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.
SIGNIFICANT

SCAQMD

To identify the maximum daily emissions that would result from the simultaneous construction of various segments and the substation construction associated with the proposed project, the schedule was reviewed to identify the year in which maximum emissions would occur. Maximum daily emissions are expected to occur in 2015, as presented in Table 4.3-7. It was assumed that all 2015 activities could occur simultaneously except building removal, and distribution undergrounding. Detailed emissions estimates are provided in Appendix K.

As shown in Table 4.3-7, maximum daily construction emissions would exceed the regional significance thresholds for all criteria pollutants except CO and SO_x. Implementation of APM AQ-1 and APM AQ-2 to control fugitive dust emissions and reduce emissions from vehicles and heavy equipment would reduce emissions, but not to the extent that all emissions would be lower than LST and regional significant thresholds. As discussed in Section 4.3.4, Mitigation Measure (MM) AQ-1, would require the applicant to purchase NO_x emission offsets through the SCAQMD's Regional Clean Air Incentive Market Trading Credits for every pound of NO_x emissions in excess of the SCAQMD regional significance threshold of 100 pounds per day (see Section 4.3.4). Implementation of MM AQ-1 would reduce impacts from NO_x emissions to less than significant. ROG, PM₁₀ and PM_{2.5} emissions would remain to be significant and unavoidable. Construction would, therefore, result in a significant, but temporary, impact on the ambient air quality with respect to ROG, PM₁₀, and PM_{2.5} emissions.

Daily emissions related to construction of the substations, transmission line, and distribution line for each phase of construction, were compared to SCAQMD LSTs. Table 4.3-8a presents a summary of the significance determinations for the substations (Talega Substation and the proposed San Juan Capistrano Substation) and the proposed double-circuit 230-kV transmission line construction phases using the LST Methodology. Appendix K presents a quantitative detailed analysis for each phase of construction, in comparison with the SCAQMD LSTs.

ATTACHMENT 4.

**Description of EPRI BESS Database Including
Disclaimer Regarding the Completeness of the
Database.**

BESS Failure Incident Database

Contents

About EPRI's Battery Energy Storage System Failure Incident Database

About the BESS Failure Incident Database

The Data in Context

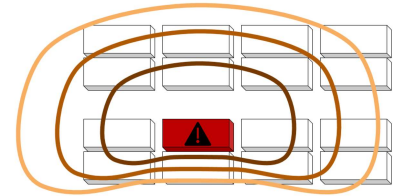
Root Cause Categorization

Database Methodology

Database Citation

Stationary Energy Storage Failure Incidents

Other Energy Storage Failure Incidents



About EPRI's Battery Energy Storage System Failure Incident Database

The database compiles information about stationary battery energy storage system (BESS) failure incidents. There are two tables in this database:

- Stationary Energy Storage Failure Incidents – this table tracks utility-scale and commercial and industrial (C&I) failures.
- Other Storage Failure Incidents – this table tracks incidents that do not fit the criteria for the first table. This could include failures involving the manufacturing, transportation, storage, and recycling of energy storage.

Residential energy storage system failures are not currently tracked.

If you would like to be notified when a new event is added to this database or are interested in other EPRI energy storage safety research resources and opportunities please reach out to Storage-Safety@epri.com (<mailto:Storage-Safety@epri.com>). For more information on energy storage safety, visit the [Storage Safety Wiki Page \(https://storagewiki.epri.com/index.php/Storage_Safety\)](https://storagewiki.epri.com/index.php/Storage_Safety).

About the BESS Failure Incident Database

The BESS Failure Incident Database^[1] was initiated in 2021 as part of a wider suite of BESS safety research after the concentration of lithium ion BESS fires in South Korea and the Surprise, AZ, incident in the US. The database was created to inform energy storage industry stakeholders and the public on BESS failures.

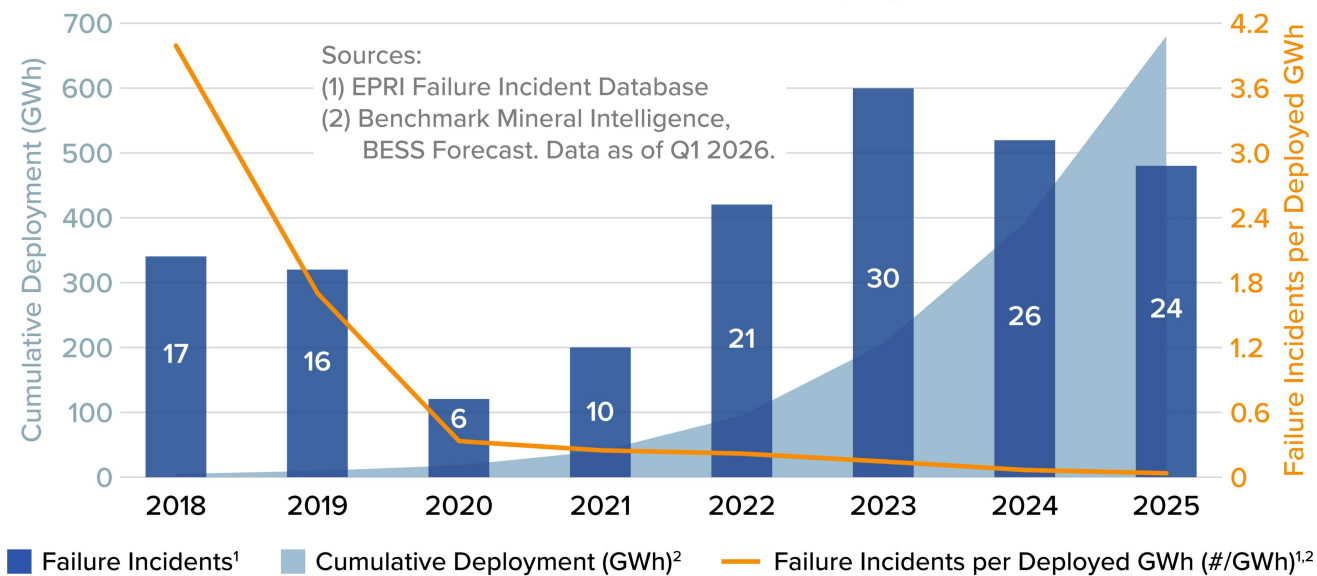
Tracking information about systems that have experienced an incident, including age, manufacturer, chemistry, and application, could inform R&D actions taken by the industry to improve storage safety. The focus of the database is on incidents that had a wider public health and safety impact, rather than on operational failures. Some helpful definitions follow:

- BESS: A stationary energy storage system using battery technology. The focus of the database is on lithium ion technologies, but other battery technology failure incidents are included.
- Failure incident: An occurrence caused by a BESS system or component failure which resulted in increased safety risk. For lithium ion BESS, this is typically a thermal risk such as fire or explosion.
- Utility-scale: This refers to systems and projects that are interconnected to the grid.
- C&I: This includes systems and projects that are behind-the-meter installations. Residential system failures are not currently tracked. Note that the Stationary Energy Storage Failure Incidents table tracks both utility-scale and C&I system failures.

The Data in Context

Global Grid-Scale Storage Deployment and Failures

Failure rate continues to decrease even as deployment accelerates



It is instructive to compare the number of failure incidents over time against the deployment of BESS. The graph shows the failure rate per cumulative deployed capacity, up to 12/31/2025. This graph includes 33 non-public incidents that EPRI is aware of. These incidents are not included in the database itself, but they are reflected in the graph above. The global installed capacity of utility-scale BESS has dramatically increased over the last five years, and while failure incidents continue to occur, the overall rate of incidents has sharply decreased. The failure rate dropped by 99% from 2018 to 2025 as lessons learned from early failures have been incorporated into the latest designs and best practices.

The battery industry continues to engage in R&D activities to improve risk reduction measures.

Root Cause Categorization

The database includes the cause of failure for each incident, where available. EPRI, TWAICE, and the Pacific Northwest National Laboratory (PNNL) collaborated on an effort to classify the root cause of each incident in the database. The team used the best available information to categorize root cause (e.g., design; manufacturing; integration, assembly & construction; operation; or combination thereof) and the physical location of failure (e.g., cell/module, controls, balance-of-system equipment) to broadly classify the incidents for later comparison and contrast. These are based on technical details in the publicly available reporting, personal communications with entities involved and engineering judgement by industry experts. The published report Insights from EPRI's Battery Energy Storage Systems (BESS) Failure Incident Database: Analysis of Failure Root Cause (<https://www.epri.com/research/products/000000003002030360>) contains the methodology and results of this root cause analysis.

Database Methodology

The information in this database is gathered from media reports and other public documents, such as released root cause analyses (RCA) or corporate press releases. Source documents are identified by active searching of global English-language media, and passive collection of reports through keyword flagging on internet websites and RSS feeds. Crowdsourced information that can be verified through publicly available documentation is also incorporated.

All linked citations have been downloaded (or subsequently re-located on InternetArchive or WayBackMachine after removal), to preserve the available information from each incident.

The database was begun in 2021, though it includes incidents as far back as 2011. EPRI engages in every effort to ensure that the information in the database is complete and accurate. Outside of online media, EPRI has used academic publications and collaborated with other organizations tracking failures to ensure all known incidents are captured. However, many incidents are not reported in news media, especially before 2018-19 when there was a renewed industry focus on safety. EPRI cannot guarantee that the database captures every relevant BESS failure incident, nor can we guarantee that all project data related to an incident is captured. If you are aware of missing data, please contact our Storage-Safety@epri.com (<mailto:Storage-Safety@epri.com>).

Once an incident is identified, EPRI reaches out to involved parties for interviews whenever possible, and then links to formal reports released by any investigative entities once they are published. EPRI is also occasionally involved in RCAs or technical evaluations of incidents directly. For example, EPRI provided technical support for the investigation of the Carnegie Road, UK incident (https://storagewik i.epri.com/index.php/Failure_Event_-_UK,_Liverpool_-_15_Sep_2020) in 2020, and published a report (<https://www.epri.com/research/products/000000003002026396>) on the findings.

The included incidents are intended to reflect global activity. However, the database is necessarily limited to public reporting and may have missed incidents with minimal or local-only media coverage. Our automated alerts may not capture local language sources, which is why we engage in outreach and publicizing of the database. EPRI has reports from several recent incidents in Taiwan and South Korea that use local language sources and have paid to get translations where applicable. Substantial time has been spent to make sure incident information is accurate, and EPRI continues to corroborate incidents using other sources and update incidents (both new and old) regularly.

Database Citation

You are welcome and encouraged to use this database and cite it; the preferred format is below:

EPRI BESS Failure Incident Database. Accessed MM/DD/YYYY.
https://storagewiki.epri.com/index.php/BESS_Failure_Incident_Database.

If the database is the centerpiece of an analysis, we request that you reach out to EPRI at Storage-Safety@epri.com (<mailto:Storage-Safety@epri.com>) for review of the data application. We have a wealth of information on many [BESS safety topics](https://storagewiki.epri.com/index.php/Storage_Safety) (https://storagewiki.epri.com/index.php/Storage_Safety) that can bolster your study and provide needed context. We are also tracking applications of the database to solicit continued EPRI support for maintenance. If you find this useful, please let us know!

Stationary Energy Storage Failure Incidents

This table tracks utility and C&I scale energy storage failure incidents with publicly available information.

- Click here to download a csv version of the data in this table. (https://storagewiki.epri.com/resources/assets/BESS_Failure_Database/Failure_DB_List.csv)

Note: Missing values in this table reflect unknowns.

Show

10

 entries

Search:

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Location	Energy (MWh)	Power (MW)	Module Type	Application	Installation	Event Date	System Age (yr)	State During Accident	Source
UK, Rainworth		7	NMC	Frequency regulation and grid support services	Rural	1 May 2026	9		BBC (https://www.bbc.com/news/articles/c4g0vqrd4kjo)
US, CA, San Marcos			Li ion	EV charging	Parking lot	21 January 2026			San Diego Union-Tribune (https://www.sandiegouniontribune.com/2026/01/21/fire-damage-s-battery-storage-system-that-powers-tesla-chargers-in-san-marcos/)
US, NY, Warwick	17.9	4	LFP	Peak shaving		19 December 2025			Village of Warwick (https://villageofwarwickny.gov/28-church-street-west-warwick-3-battery-energy-storage-site-fire-information-updates/)

<u>Location</u>	<u>Energy (MWh)</u>	<u>Power (MW)</u>	<u>Module Type</u>	<u>Application</u>	<u>Installation</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Source</u>
<u>US, AZ, Peoria</u>	100	25	NMC	Peak shaving	Substation	1 October 2025	4	Operational	AZ Family (https://www.azfamily.com/2025/10/02/multiple-agencies-fighting-fire-battery-storage-facility-glendale/)
<u>US, NV, Boulder City</u>	360	90	NMC	Solar shifting	Solar + storage	23 September 2025	3.8		KTNV (https://www.ktnv.com/news/fire-breaks-out-at-townsite-solar-in-boulder-city)
<u>US, CA, Parkfield</u>	240	60	NMC	Solar integration	Solar + storage	30 August 2025	4		Monterey County Sheriff's Office (https://mcsoco.untyofmonte rey.gov/press-releases/press-release-evacuation-order-lifted-for-area-south-east-of-parkfield-california)
<u>Netherlands, Almelo</u>	0.2				Commercial	4 August 2025			112 Nieuws (https://112nieuws.net/2025/08/04/uitslaande-brand-in-accupakket-meerdere-brandweerwagens-ter-plaatse/?feed_id=28524&unique_id=6890f306a9e62)
<u>South Korea, Gyeongsangbuk-do, Pohang City</u>	62.1		Li ion	Industrial	Building	16 June 2025		Operational	Yonhap News Agency (https://www.ynhnews.com/2025/06/16/62651053?site=mapping_related)

Location	Energy (MWh)	Power (MW)	Module Type	Application	Installation	Event Date	System Age (yr)	State During Accident	Source
South Korea, Angang-eup, Gyeongju, North Gyeongsang Province		1.32	LG Chem	Solar+storage		16 June 2025	8		News Tomato (http://47.newstomato.com/ReadNews.aspx?no=1285705)
South Korea, Angang-eup, Gyeongju, North Gyeongsang Province		1.32	LG Chem	Solar+storage		16 June 2025	8		News Tomato (http://47.newstomato.com/ReadNews.aspx?no=1285705)

Showing 1 to 10 of 175 entries

Previous12345...18Next



Figure 1. A breakdown of the stationary energy storage failure events from the above table.

Other Energy Storage Failure Incidents

This table tracks other energy storage failure incidents for scenarios that do not fit the criteria of the table above. This could include energy storage failures in settings like electric transportation, recycling, manufacturing, etc.

Note: Missing values in this table reflect unknowns.

Show 10 ▾ entries

Search:

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<u>Location</u>	<u>Setting</u>	<u>Capacity (MWh)</u>	<u>Capacity (MW)</u>	<u>Operator / Integrator</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Description</u>	<u>Source</u>
<u>Ireland, Claregalway</u>	Battery manufacturer			Xerotech	29 January 2025		Stored in container	Fire started in a shipping container used to store battery modules at Xerotech battery facility. Damaged batteries were isolated to prevent spread to other parts of facility. Crews have been using water to moderate overheating. Water is being recirculated to prevent runoff contamination.	<u>Connacht Tribune (https://connachttribune.ie/battery-fire-incident-in-claregalway-now-contained/)</u>
<u>US, MO, Fredericktown</u>	Battery recycling plant			Critical Mineral Recovery	30 October 2024			A fire and explosion occurred at a lithium ion battery recycling plant. Residents north and west of Fredericktown were told to evacuate if they could smell smoke. The evacuation order was revised within a couple hours to cover only residents (approx. 25 homes) living on the same road as the recycling plant. Other residents were asked to shelter in-place. The fire was controlled after 3 days and hot spots	<u>Missouri Independent (https://missouriindependent.com/briefs/fire-erupts-in-south-east-missouri-at-one-of-worlds-largest-lithium-ion-battery-facilities/)</u>

<u>Location</u>	<u>Setting</u>	<u>Capacity (MWh)</u>	<u>Capacity (MW)</u>	<u>Operator / Integrator</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Description</u>	<u>Source</u>
								requiring fire suppression remained 8 days later. The EPA conducted air monitoring and found that concentrations of contaminants remained below thresholds. 2 days after the fire broke out, a 3 mile fish kill was discovered in Little St. Francis River. Firefighting foam is hypothesized to be the cause. Drinking water was not affected.	
<u>US, CA, San Pedro</u>	On road during transport				26 September 2024		In transit	A truck hauling 60,000 lbs of lithium ion batteries overturned and resulted in a deflagration and a fire. The freeway and bridge were shut down along with 6 port terminals. Firefighters utilized a defensive firefighting strategy to monitor and contain the fire. After 24 hours, the smoldering container was moved off the road to an open lot for monitoring, and the roads were re-opened after hazardous	<u>LB Post (https://lbpost.com/news/truck-batteries-bridge-long-beach-los-angeles-port-fire-how-long/)</u>

<u>Location</u>	<u>Setting</u>	<u>Capacity (MWh)</u>	<u>Capacity (MW)</u>	<u>Operator / Integrator</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Description</u>	<u>Source</u>
								materials were cleared.	
<u>Canada, Montreal</u>	Temporary storage at a port				23 September 2024			A container storing 15,000 lbs of lithium ion batteries on land caught fire at the Port of Montreal. Firefighters sprayed the container with water to cool it without opening the container. The City of Montreal ordered a lockdown for nearby residents due to concerns about the smoke.	CTV News
<u>US, NV, Nye County</u>	On highway during transport				17 September 2024		In transit	A semi-truck hauling lithium ion batteries sideswiped another semi-truck headed in the opposite direction, shortly after midnight on I-95. The resulting fire was extinguished and the road cleared by a HAZMAT crew. The road was reopened approximately 18h after the crash was reported.	Review Journal (https://www.reviewjournal.com/local/local-nevada/semi-carrying-31k-pounds-of-lithium-batteries-caught-fire-outside-las-vegas-3171230/)
<u>Germany, Thuringia</u>	Temporary storage			Suncycle	11 August 2024		Temporarily stored onsite; not interconnected	A group of batteries that was intended for disposal and was being temporarily stored at the site caught fire. An employee used a forklift to move the	PV Magazine (https://www.pv-magazine.com/2024/08/13/third-battery-fire-at-the-same-site-in-germany/)

<u>Location</u>	<u>Setting</u>	<u>Capacity (MWh)</u>	<u>Capacity (MW)</u>	<u>Operator / Integrator</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Description</u>	<u>Source</u>
								burning storage unit to prevent propagation, and was suffered minor injuries due to the fumes and smoke. This incident is the third in a series of incidents at the Suncycle site.	
<u>US, South Carolina, Seneca</u>	Manufacturing			BorgWarner	8 August 2024		Battery on assembly line	A lithium ion battery caught fire on the assembly line at a manufacturing facility. The fire department got the fire under control after 2.5 hours.	WSPA
<u>US, CA, Baker</u>	On highway during transport				26 July 2024		In transit	A truck hauling lithium ion batteries was involved in a crash, overturning the truck and resulting in a fire. The I-15 freeway, a major artery between South California and Las Vegas, was shut down for two days. Several drivers stuck in the resulting traffic and high temperatures of the day experienced heat-related medical issues.	CBS (https://www.cbsnews.com/losangeles/news/hazmat-fire-15-freeway-shutdown-in-baker-leads-to-heads-to-heads)
<u>Germany, Thuringia</u>				Suncycle	30 June 2024			This incident is the second in a series of incidents at the Suncycle site. The fire	MDR.DE (https://www.mdr.de/nachrichten/thueringen/a)

<u>Location</u>	<u>Setting</u>	<u>Capacity (MWh)</u>	<u>Capacity (MW)</u>	<u>Operator / Integrator</u>	<u>Event Date</u>	<u>System Age (yr)</u>	<u>State During Accident</u>	<u>Description</u>	<u>Source</u>
								department used a controlled burn approach to avoid costly disposal of contaminated firewater. The fire was extinguished after 12 hours. Nearby residents were advised to keep windows closed due to smoke.	polda-weimar-land/iss eroda-contai ner-brand-fe uer-102.htm l)
South Korea, Hwaseong	Manufacturing			Aricell	24 June 2024			A single battery cell in the factory caught fire and spread to the 35,000 battery cells stored on the factory's second floor, producing a series of explosions. 22 workers were killed and 8 were injured in the fire.	New York Times (https://www.nytimes.com/2024/06/24/world/asia/lithium-battery-fire-south-korea.html)

1. This database was formerly known as the BESS Failure Event Database. It has been renamed to the BESS Failure Incident Database to align with language used by the emergency response community. An 'incident' according to the Federal Emergency Management Agency (FEMA) is an occurrence, natural or man-made, that requires an emergency response to protect life or property, while an 'event' is a planned, non-emergency activity. The use of incident is prevalent, for example, in referring to the Incident Command, or Incident Command System used by public and private agencies to coordinate incident management operations. See <https://www.fema.gov/pdf/emergency/nrf/nrf-glossary.pdf>

ATTACHMENT 5.

**Sacramento Fire Department “Green Sheet”
From the 2025 EV Fire.**

**Sacramento Fire Department Preliminary Summary
Report of Serious or Near Serious
Injuries**



GREEN SHEET

**Electric Vehicle MVA and ensuing fire—causing
respiratory injuries to responding firefighters.**

April 11, 2025

Tesla Fire

6520 Riverside Bl, Sacramento

(CA-SCR-25-029878)

A Board of Review has not approved this Summary Report. It is intended as a safety and training tool, an aid to preventing future occurrences, and to inform interested parties. Because it is published on a short time frame, the information contained herein is subject to revision as further investigation is conducted and additional information is developed.



Incident Overview:

- April 11th, 2025 @ 22:04. MVA with electric vehicle (EV) lithium-ion battery (LIB) Fire Involvement.
 - Initial dispatch for MVA with major injury.
 - Upon arrival, crews discovered a single Tesla Model S had struck a tree.
- **Weather:**
 - Clear skies, temperature approx. 63°F, light winds from the south/southwest at 4-13 mph.
 - As of this writing, exact weather data for the closest weather station is no longer available.
- The vehicle's battery pack was compromised and had over 400 scattered battery cells across the roadway. A typical Tesla Model S LIB pack contains ~7,500 cells.
- E11 initiated patient care and identified battery cell ignition risk.
- The patient was transported to the ER in a Medic unit.
- E11 upgraded the incident to Level II Hazmat.
- Hazmat 30, Hazmat 7 and Special Ops (2293) were called to the scene.
- The main EV LIB pack reignited when the vehicle was moved for tow operations.
- Five firefighters exposed to smoke plume during tow operations were injured.
 - As of this writing, four firefighters are still unable to return to work from the injuries they sustained.

FACTORS TO CONSIDER

- **Victim Profile:**
 - Initially, a solo vehicle occupant was trapped.
 - The victim was successfully treated and transported.
 - Afterwards, the only threats were from potential EV LIB vapors.
- **Hazmat Considerations:**
 - Lithium-ion battery (LIB) battery pack of a Tesla EV compromised and intermittently in thermal runaway with thick white persistent vapor being produced.
 - Intermittent spontaneous ignition of individual ejected battery cells, white vapor being produced from individual cells.
- **Incident Priority:**
 - Life Priority initially.
 - After the occupant was successfully extricated and transported, the incident priority was environmental protection.
- **Incident Mode:**
 - Offensive initially.
 - Defensive later, after victim removal and transport to the ER.

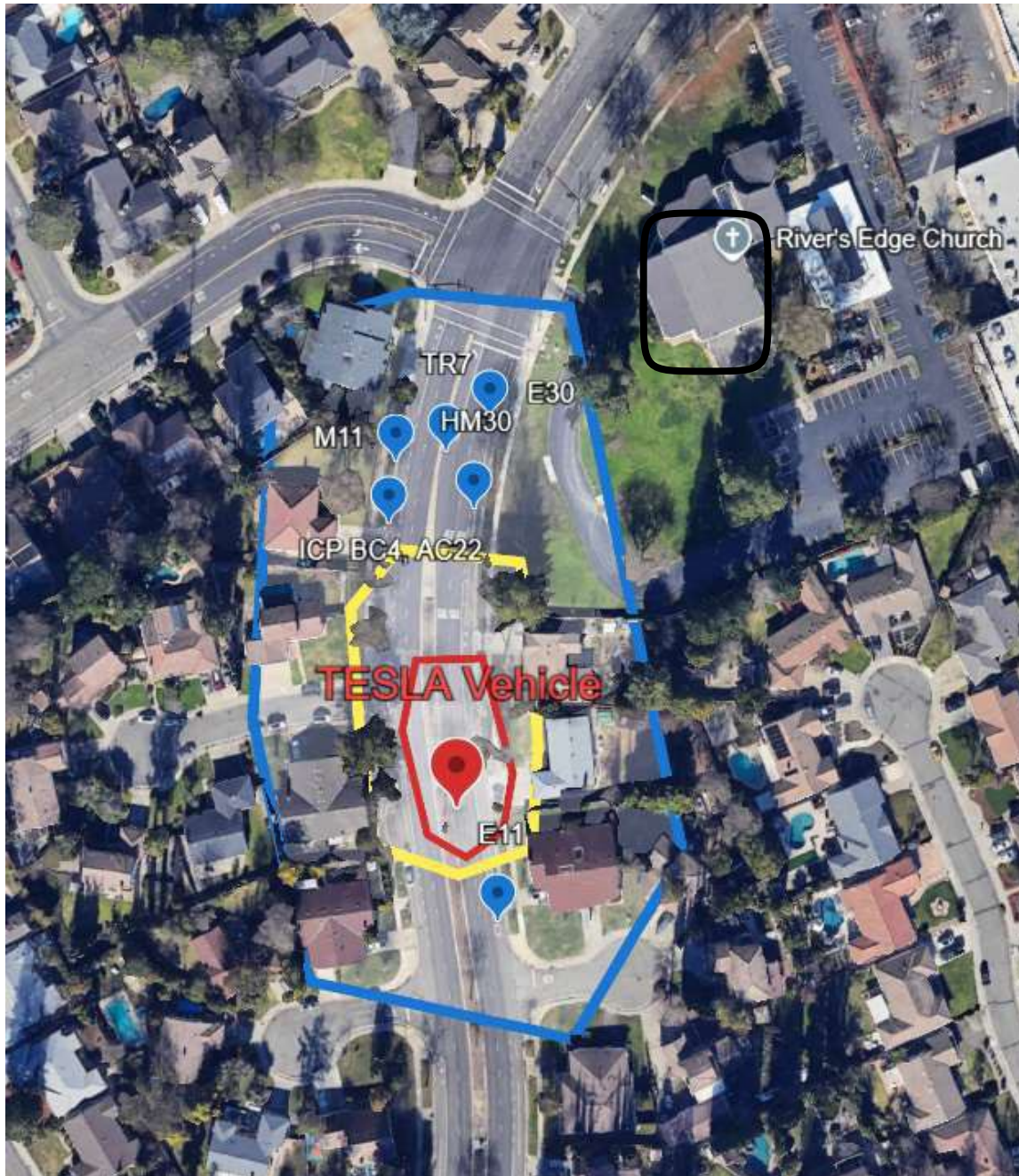
Sequence of Events:

SIN (Safety, Isolate, Notify)

- Crews found one occupant from a heavily damaged Tesla.
 - The patient was removed from the vehicle prior to the arrival of E11.
- After extrication and transport, crews recognized signs of battery compromise, including scattered lithium-ion cells intermittently and spontaneously entering thermal runaway.
- A Level II Hazmat response was initiated.

CIA (Command, Identification, Hazard Assessment)

- Hazmat crews arrived later and positioned at the previously established command post location.
- Lacking noticeable winds and unaware of wind direction, command and hazmat units positioned themselves approximately 200' to the north of the incident.
- Technical Reference position was established to look up best practices for the hazards presented by EV LIB.
- Hazmat Group Supervisor, Hazmat Assistant Safety Officer (ASO), Entry Team, and Back-Up Team were established.



This building is
85 feet wide

This means that
the firefighters
who were hurt
were actually
more than 300
feet from the
burning Tesla

PCP (PPE, Containment and Control, Protective Actions)

- E11 was left in place with a protection line.
 - E11 personnel were operating about 100' upwind of the EV.
 - E11 personnel were not adversely affected by the LIB vapors, likely due to personnel remaining out of the vapor plume.
 - The importance of understanding the wind direction and its effects on operations cannot be overstated.

- Hazmat Entry Team entered the area to safely gather the ejected LIB cells for mitigation, storage, and disposal.
- The first responder cut loop was cut by the Entry Team at the direction of the Incident Commander.
 - Current guidance advises against cutting first responder cut loops in this situation.
 - However, with the level of destruction of this Tesla, we cannot say whether this action had any effect on the subsequent events.
 - It is unknown whether the battery management system (BMS) was functioning at all.
- Later, as the tow truck operator began to move the vehicle, a thermal runaway event occurred within the main EV LIB pack.
 - This event produced a large volume of white gas.
 - E11 was positioned nearby, and water was promptly applied to the battery pack.
 - A significant vapor plume was produced by the event.
 - The gases produced may resemble steam or smoke, but they contain highly toxic chemicals and metals. Unlike typical smoke, these vapor clouds may behave unpredictably, lingering low to the ground and dissipating slowly, depending on humidity, temperature, and wind conditions.
 - The vapor plume soon exposed support zone personnel approximately 200 feet away in what was now clearly the downwind direction.
- Crews attempted to disconnect their hoses and evacuate the area but were overcome by the vapor plume prior to being able to clear the area.
 - We know now that aggressive utilization of fog streams can be effective in these situations to protect crews and populations from the effects of these toxic vapor plumes.
 - When the crews were overcome by the vapor plume, they immediately began complaining about the noxious smell and taste of the vapors.
 - Crews then fled the area in their apparatus.
 - The vapor plume continued with the wind as the crew escaped its path.
 - The vapor plume then dissipated.

DDD – (Decontamination, Disposal and Documentation)

- Crews returned to the area and later escorted the vehicle and ejected cells to the planned disposal sites.
 - Approved disposal practices and sites are still being worked out at the time of this writing.
- While escorting the tow truck to the tow yard, three out of the four firefighters in the engine complained of feeling ill.
 - One of the four firefighters began vomiting out of their window.
 - The company called a medic and had the firefighter that was vomiting transported in an ambulance.
 - The engine company followed the ambulance to the hospital.
 - Another engine was dispatched to replace the initial engine.
 - The replacement engine finished escorting the damaged Tesla and the ejected cells to the planned disposal sites.
 - At the hospital, the two additional personnel that were symptomatic agreed to seek treatment for their injuries.
 - By the end of the night, two additional firefighters that were overcome by the vapor plume felt ill and sought treatment.

Overview of injuries

- *Ongoing testing indicates that toxic vapor plume composition can vary significantly throughout the plume.*
- *Symptoms and injuries from exposure can vary significantly because of the varied composition of chemicals found in the different areas of these toxic vapor plumes.*
 - Firefighter #1 was nauseous and vomiting. Transported to the ER in a Medic.
 - Within a week they felt recovered and returned to work.
 - Firefighter #2 felt nauseated and had flu-like symptoms for several days.
 - Flu-like symptoms persisted, but they felt well enough to return to work after a couple of weeks. They were able to work for 3 weeks.
 - Placed back off-duty with a constant decrease in exercise tolerance. 20% decrease in lung function. They have remained off work since then.
 - Firefighter #3 has significant respiratory and renal symptoms, as well as low exercise tolerance, persistent hypertension, tachycardia, and fatigue.
 - Two months later, they are still unable to work.
 - Firefighter #4 has severe persistent fatigue, low exercise tolerance and persistent respiratory symptoms.

- Two months later, they are still unable to return to work.
- Firefighter #5 has severe persistent respiratory symptoms with a 20% decrease in lung function, symptoms of fatigue, significant cardiac symptoms, and symptoms of renal compromise.
 - Two months later, they are still unable to work.

LESSONS REINFORCED BY THIS INCIDENT

Things that went well:

- Prompt extrication and treatment of the patient.
- Rapid identification of EV LIB risk and escalation to Level II Hazmat.

Other Recommendations not mentioned above:

- Establish Hot, Warm, and Cold zones early. The following distances are initial recommendations and are subject to change based on plume modeling by Hazmat teams.
 - Hot/Exclusion Zone- All personnel within 75 feet of a compromised EV must be on air.
 - Warm/Contamination Reduction Zone – Apparatus should be placed outside 150 feet, upwind if possible.
 - If not feasible, assess risk vs. gain and apply controls to limit exposure.
 - Cold/Support Zone- Upwind, 330’.
- Post-incident PPE procedures: If you operated in the vapors—gross decon **before** going off air and doffing PPE.
- Tow truck operators should be briefed, and their work should be coordinated with Command or Hazmat Group Supervisor due to risk of exposure and reignition.
 - A charged and staffed hose line needs to be in place during this process.
- Utilize fog streams as needed, when possible, to protect populations and personnel.
- Monitor for signs of thermal runaway at least 45 minutes post-extinguishment before attempting to relocate vehicle.
 - The return of thermal activity and vapor production resets this clock.
- Coordinate the containment and disposal of the vehicle, battery cells and runoff in consultation with Hazmat best practices.

Best recommended EV LIB practices at the time of this writing:

Purpose and Scope

This guideline provides strategies and tactics for suppression personnel to utilize during electric vehicle (EV) fires involving lithium-ion battery (LIB)-electric or hybrid vehicle battery packs.

Key Considerations

Hazards of lithium-ion / EV LIB Fires

- The incident priorities remain the same: Minimize risks to life, stabilize the incident, protect property, and protect the environment.
- A Level II Hazmat should be declared early, and appropriate actions may be taken prior to Hazmat team arrival to control hazards and improve overall scene safety.
- LIB thermal runaway can release highly toxic substances, including hydrogen fluoride (HF) and metal nanoparticles, both of which present severe acute and long-term health risks:
 - LIB thermal runaway vapors may look like steam but are often highly toxic aerosols.
- Full PPE and SCBA (on air) are required for all operations within the **75-foot exclusion (hot) zone** of confirmed LIB fires.
- Attempt to respond from an upwind direction. Attempt to place all apparatus, initiate operations, and establish the command post upwind of the incident.
 - Apparatus should be positioned outside of the **150 ft isolation (warm) zone**.
 - If not feasible, assess risk vs. gain and apply controls to limit exposure.
- A **330' support and evacuation (cold) zone** should be established.
 - If there is no threat to life or need for evacuation within 330 feet in any direction, it may be appropriate to allow the vehicle to burn to completion.
 - Evacuations, along with fire suppression tactics will allow us to mitigate the toxic plume's impact on populations.
- EV or hybrid LIB fires within structures or parking garages present unique challenges. Aggressive water applications and ventilation need to be utilized to protect life and property.

Tools and Equipment Covered

- Fire attack hose lines
 - Firefighters should deploy a minimum of two 150+ GPM hose streams to suppress thermal runaway and protect exposures.
 - Approach from offset positions upwind, alternate between fog and straight streams, and push the fire and vapors away from suppression personnel as you approach.

- Consider utilization of positive pressure ventilation (PPV) fans.
- The Captain should request additional resources as indicated and use available monitoring tools (e.g., 4-gas meters, TICs) to assess ongoing risk.
 - The Captain should prioritize stretching an additional line with a fog nozzle to have available for toxic plume mitigation and personnel protection.
- The Engineer should establish a water supply and ready a booster line for gross decon.

Recommended Procedural Guidelines SIN –

(Safety, Isolate, Notify)

- Confirm vehicle is an EV or hybrid.
 - Evaluate fire behavior and potential for battery pack involvement and thermal runaway.
- If the high-voltage battery pack is not involved, proceed with standard vehicle fire tactics.
 - Up to 60% of fires in EVs do not involve thermal runaway of the LIB pack.
 - On these fires, standard vehicle fire tactics can prevent EV LIB packs from entering thermal runaway.
- If the LIB is involved in thermal runaway, declare a Level II Hazmat.
 - Request other additional resources as needed.
- Establish clear hazard zones as described above.
 - Adjust based upon HMRT recommendations.

CIA - (Command, Identification and Hazard Assessment)

- Assume Command.
- Identify exposures and threatened populations.
- Formulate an incident action plan.

PCP – (PPE, Containment and Control, Protective Actions)

- Full PPE, with SCBA (on air), is required for **any operations within 75 feet**.
 - Avoid approaching directly in front of or behind an EV with suspected battery fire — these are common jet-flame ejection paths.
 - Do not attempt to access or open battery compartments.

DDD – (Decontamination, Disposal and Documentation)

- Decontaminate all personnel that were potentially exposed to toxic smoke.
 - Use a booster line to gross decon any personnel who operated in vapors.
 - Gross decon should occur **before** personnel doff PPE and SCBA.
 - Anyone who is handling PPE should use medical gloves. PPE should be double bagged.
 - Bagged PPE should be routed to SSC and then left outside the utility shop.
 - Exposed personnel should follow-up with exposure reporting.

- Utilize the TIC, 4-gas monitor, and observation to confirm the absence of fire, smoke, audible popping/hissing, or increasing temperatures present in the high-voltage battery for at least 45 minutes before releasing to law enforcement, tow companies, etc.
 - Hazmat personnel should brief secondary responders on potential hazards.
 - Disposal plans should be coordinated with the Hazmat Group Supervisor and County Hazmat.
- Runoff water may be contaminated and require Hazmat evaluation.
 - The Hazmat team should evaluate runoff for potential contaminants.
 - Any significant findings or environmental impacts must be addressed, documented, and reported in accordance with standard Hazmat protocols.

First Responder Cut-Loop Guidance

The first responder cut loop is designed to disable high-voltage systems in EVs to reduce risks to first responders during rescue efforts. However, cutting the loop also depowers the battery management system (BMS), which may disable critical safety functions, including active cooling. Timing is crucial. Cutting the loop too early, particularly during early battery distress (e.g., smoke without flame), may accelerate thermal runaway.

Do not cut the loop if:

- The battery pack is smoking or showing signs of early thermal instability.
 - The BMS may still be actively cooling the battery and preventing escalation.
- Cutting the loop in this phase may disable pumps or fans and worsen the situation.

Cut the loop only if:

- The action supports life safety or rescue and can be performed safely.

Summary

- Lithium-ion/EV fires are an evolving threat. This document is intended to remain dynamic. Initiate operations from upwind and attempt to establish zones: **Exclusion / Hot Zone: 75 ft, Isolation / Warm Zone: 150 ft, Support / Evacuation / Cold Zone: 330 ft** prior to initiating operations to protect both responders and the public.

ATTACHMENT 6.

Jacqueline Ayer CV.

JACQUELINE AYER

CURRICULUM VITAE

Summary of Experience:

Ms. Ayer is the Director of Engineering Operations for Air Quality Specialists ("AQS"), an engineering consulting firm that began in 1994 and provides technical consulting support and regulatory compliance assistance to manufacturers, regulators, defense contractors, and community advocacy groups. Ms. Ayer has particular experience in toxic and criteria air emission assessments and air pollution control strategies; she has also participated extensively in electrical generation and transmission system siting assessments and in licensing proceedings before the California Public Utilities Commission ("CPUC"), the Federal Energy Regulatory Commission ("FERC"), the California Energy Commission, and local agencies. These projects include the Humidor BESS and the Prairie Song BESS developments, SCE's Alberhill and Tehachapi Renewable Transmission Projects, SDG&E's South Orange County Reliability and Sunrise Projects, and Nevada Hydro's Lake Elsinore Advanced Pumped Storage and TEVS Line Project. Ms. Ayer has also participated extensively in CPUC Rulemaking, Investigation, and Complaint Proceedings pertaining to utility projects and other matters. Ms. Ayer has provided consulting support to the U.S. Environmental Protection Agency ("EPA"), the South Coast Air Quality Management District ("AQMD"), the California Air Resources Board, the U.S. Army, the U.S. Navy, the U.S. Air Force, and the U.S. Marine Corps, as well as industrial clients such as Gulfstream, Fender Instruments, Northrop-Grumman, Coors, Ball Container, Steelcase, HON, Maruchan, American National Can, etc. Ms. Ayer also provides engineering assistance and environmental analysis to community groups, property owners, and other stakeholders affected by entitlement programs, private developments, and large "public benefit" projects such as energy generation projects, transmission infrastructure, railway development, and National Park/ Monument expansions. Documents prepared by Ms. Ayer include expert witness testimony, technical briefs, formal filings with local, state, and federal agencies, analytical reports, land use and zoning assessments, and technical/regulatory compliance analyses. Ms. Ayer has particular experience in presenting stakeholder concerns to numerous agencies, boards, political subdivisions and legislative entities including the CPUC, FERC, California Water Boards, California Air Resources Board, California Independent System Operator (CAISO), Surface Transportation Board, California High Speed Rail Authority, Federal Railway Administration, Department of Defense, County of Los Angeles, County of Orange, County of Riverside, incorporated Cities, and the California Legislature. Ms. Ayer routinely consults on matters pertaining to air quality, land use/entitlement, and energy development and provides technical consulting support pertaining to state and federal legislation such as the California Environmental Quality Act ("CEQA"), the National Environmental Policy Act ("NEPA"), the California Subdivision Map Act ("SMA"), the Clean Air Act Amendments ("CAAA"), and the Energy Policy Act ("EPACT"). Since 1986, Ms. Ayer has provided engineering assistance and support to government, industry, and community stakeholders; she continues to work diligently to ensure projects comply with adopted state and federal statutes, local ordinances, applicable environmental regulations and adopted land use policies.

Education:

M.S., Mechanical Engineering (1986)
University of California at Berkeley
Berkeley, CA.

A.B., Physics (1982)
Vassar College
Poughkeepsie, NY.

Work History:

1994-Present: Air Quality Specialists, Director of Engineering Operations
Newport Beach, CA.

1990-1994 Arcadis (formerly Acurex), Engineering Manager – Air Quality.
Irvine, CA.

1986-1990 Acurex. Project Manager (1988-1990), Staff Engineer (1986-1988).
Mountain View, CA.

1984-1986 Lawrence Berkeley Laboratory, Solar Energy Researcher.
Berkeley, CA.

1980-1983 IBM T.J. Watson Laboratory and Poughkeepsie Laboratory, researcher.
Yorktown Heights, NY and Poughkeepsie, NY.

Some of the Publications and Documents Prepared by Jacqueline Ayer:

“Report on Deficiencies in CAL FIRE’s Rulemaking Process Relating to the Classification of Lands in State Responsibility Areas into Fire Hazard Severity Zones (FHSZs)”. January 24, 2023. Filed on behalf of the Acton Town Council pursuant to the State Fire Marshal’s Notice of Proposed Rulemaking Action issued December 16, 2022.

Analyses Of The "Public Utilities and Energy", "Noise and Vibration", "Hydrology and Water Resources", and "Transportation" Sections of The Palmdale-Burbank Draft Environmental Impact Report/Environmental Impact Statement.” December 1, 2022. Filed on behalf of the Acton Town Council in response to the Notice of Availability/ Notice of Public Hearing for the California High Speed Rail – Palmdale to Burbank Project Section Draft Environmental Impact Report/Environmental Impact Statement.

“Deficiencies in the General Waste Discharge Requirements for Small Domestic Wastewater Treatment System for Thousand Trails Soledad Canyon RV and Camping Resort”. November 17, 2022. Filed on behalf of the Acton Town Council in response to General Waste Discharge Requirements issued by the Los Angeles County Regional Water Quality Control Board. LARWQCB File No. 20-116.

“Comments on the County of Los Angeles’s Draft Safety Element and Negative Declaration”. March 17, 2022. Filed on behalf of Save Our Rural Town pursuant to the Board of Supervisors Hearing Notice. Project No. PRJ2021-002039-(1-5).

“Assessment Of The Land Area Required To Fully Decarbonize Los Angeles County Via Photovoltaic Solar Generation”. March 2022. Filed with Los Angeles County Regional Planning Department for inclusion into the Climate Action Plan CEQA Record.

“Scoping Comments Regarding the Climate Action Plan”. February 1, 2022. Filed on behalf of the Acton Town Council in response to the “Notice of Preparation of a Program Environmental Impact Report and Public Scoping Meeting for the Los Angeles County 2045 Climate Action Plan” issued December 23, 2021.

“Opening Comments”, “Reply Comments”, “Comments on Proposed Decision”, and “Rehearing Request”. March 2021 – July 2021. Filed on behalf of the Acton Town Council pursuant to the Order Instituting Rulemaking to Examine Electric Utility De-Energization of Power Lines in Dangerous Conditions. CPUC Docket No. R.18-12-005.

“Opening Comments”, “Reply Comments”, “Comments on Proposed Decision”, “Reply Comments on Proposed Decision” and “Rehearing Request”. January 2020-May 2021. Filed on behalf of the Acton Town Council pursuant to the Order Instituting Investigation on the Commission’s Own Motion on the Late 2019 Public Safety Power Shutoff Events. CPUC Docket No. I.19-11-013.

“Response to Order Instituting Investigation on the Commission’s Own Motion on the Late 2019 Public Safety Power Shutoff Events”. January 2020. Filed on behalf of The Acton Town Council. CPUC Docket No. I-19-11-013.

“Comments Regarding the ‘Study 34b: Phase Shifting Transformer Study’ Submitted by the Nevada Hydro Company”. March 1, 2019. Filed on behalf of Forest Residents Opposing New Transmission Lines in response to supplemental information submitted February 19, 2021 by Nevada Hydro Company to FERC. FERC Docket No. P-14227.

“Comments Regarding the ‘Request for Additional Information and Comments on Study Plans’ Letter Issued to The Nevada Hydro Company”. February 22, 2019. Filed on behalf of Forest Residents Opposing New Transmission Lines pursuant to FERC’s request for additional information dated January 22, 2019. FERC Docket No. P-14227.

“Comments Regarding the LEAPS License Application”. August 17, 2018. Filed on behalf of Forest Residents Opposing New Transmission Lines in the Lake Elsinore Advanced Pumped Storage Project licensing proceeding. FERC Docket No. P-14227.

“Comments Regarding the Deficiency of the LEAPS License Application”. January 11, 2018. Filed on behalf of Forest Residents Opposing New Transmission Lines in response to the Federal Energy Regulatory Commission’s “Deficiency of License Application and Request for Additional Information” letter issued to The Nevada Hydro Company on January 3, 2018. FERC Docket No. P-14227.

“Comments Regarding Additional Studies Required to Form an Adequate Factual Basis for a Complete Analysis of the LEAPS License Application on its Merit”. December 1, 2017. Filed on behalf of Forest Residents Opposing New Transmission

Lines in response to the Federal Energy Regulatory Commission's "Notice of Application Tendered for Filing with the Commission and Soliciting Additional Study Requests" [FR Doc. 2017-22473]. FERC Docket No. P-14227.

"Opening Brief", "Reply Brief", "Comments on Proposed Decision" and "Reply Comments on Proposed Decision", November 2017- April 2018. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of Southern California Edison Company for a Certificate of Public Convenience and Necessity for the Alberhill System Project. CPUC Docket No. R.09-09-022.

"Comments on Notice of Intent and Attendant Request to Waive Pre-filing Requirements Submitted by The Nevada Hydro Company". September 22, 2017. Filed on behalf of Forest Residents Opposing New Transmission Lines in response to the Federal Energy Regulatory Commission's "Notice of Nevada Hydro Company, Inc. Intent To File License Application, Filing of Draft License Application, and Request To Waive Pre-Filing Requirements" [FR Doc. 2017-18235]. FERC Docket No. P-14227.

"Northrop Grumman Phase 2 & Phase 3 Aircraft Paint Hangar Recirculation Ventilation System Feasibility Assessment". September 19, 2017.

"Expert Rebuttal Testimony". September 11, 2017. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of Southern California Edison Company for a Certificate of Public Convenience and Necessity for the Alberhill System Project. CPUC Docket No. R.09-09-022.

"Expert Direct Testimony". August 28, 2017. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of Southern California Edison Company for a Certificate of Public Convenience and Necessity for the Alberhill System Project. CPUC Docket No. R.09-09-022.

"Analysis of the Impact Assessment Methodologies and Alternatives in the Palmdale-Burbank Section of the California High Speed Rail Project". October, 2016. Filed with the Federal Railway Administration and the California High Speed Rail Authority.

"Comments on the Draft Environmental Impact Report Issued for the Valley-Ivyglen and Alberhill Projects". July 15, 2016. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of Southern California Edison Company for a Certificate of Public Convenience and Necessity for the Alberhill System Project. CPUC Docket No. R.09-09-022.

"Opening Brief", "Reply Brief", "Comments on Proposed Decision", "Comments on Alternate Proposed Decision", "Reply Comments on Proposed Decision" "Comments on Revised Proposed Decision and Alternate Proposed Decision", and "Rehearing Request". January 2016 - January 2017. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of San Diego Gas & Electric Company for a Certificate of Public Convenience for the South Orange County Reliability Enhancement Project. CPUC Docket No. R.12-05-020.

“Expert Supplemental Rebuttal Testimony”. October 19, 2015. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of San Diego Gas & Electric Company for a Certificate of Public Convenience for the South Orange County Reliability Enhancement Project. October 19, 2015. CPUC Docket No. R.12-05-020.

“Comments on Recirculated Environmental Impact Report”. September 21, 2015. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of San Diego Gas & Electric Company for a Certificate of Public Convenience for the South Orange County Reliability Enhancement Project. CPUC Docket No. R.12-05-020.

“Expert Reply Testimony”. May 26, 2015. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of San Diego Gas & Electric Company for a Certificate of Public Convenience for the South Orange County Reliability Enhancement Project. CPUC Docket No. R.12-05-020.

“Petition For Reconsideration of Decision Granting California High Speed Rail Authority’s Request for Declaratory Order”. December 30, 2014. Filed with the U.S. Surface Transportation Board. STB Finance Docket No. 35861.

“Comments on CEQA Alternatives Screening Report”. December 2, 2014. Filed on behalf of Forest Residents Opposing New Transmission Lines in the matter of the application of San Diego Gas & Electric Company for a Certificate of Public Convenience for the South Orange County Reliability Enhancement Project.

Development of the U.S. Naval Facilities Command, U.S. Army Corps of Engineers, and U.S. Air Force Tri-Service Unified Facility Criteria for the “Corrosion Control and Industrial Ventilation”. 2010-2011.

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“Opening Brief”, “Reply Brief”, “Comments on Proposed Decision”, “Reply Comments on Proposed Decision”, and “Rehearing Request”. September, 2009 – January, 2010. Filed on behalf of The Acton Town council in the matter of the application of Southern California Edison for a Certificate of Public Convenience for the Tehachapi Renewable Transmission Project (Segments 4 through 11). CPUC Docket No. A.07-06-031.

“Reply Testimony”. May 15, 2009. Filed on behalf of The Acton Town Council in the matter of the application of Southern California Edison for a Certificate of Public Convenience for the Tehachapi Renewable Transmission Project (Segments 4 through 11). CPUC Docket No. A.07-06-031.

“Comments on the Draft Environmental Impact Report/Environmental Impact Statement”. April 6, 2009. Filed on behalf of The Acton Town council in the matter of the application of Southern California Edison for a Certificate of Public Convenience for the Tehachapi Renewable Transmission Project (Segments 4 through 11). CPUC Docket No. A.07-06-031.

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“Supplemental Comments On The Draft Environmental Impact Report/Environmental Impact Statement For The SDG&E Sunrise Powerlink Transmission Project”. April 11, 2008. CPUC Docket No. A.06-08-010.

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“Response to Notice of Preparation Issued by the City of Palmdale”. March, 2008. Filed on behalf of the Community of Acton in response to a proposed 1,000 acre annexation of the Community of Acton and the “Quail Valley” subdivision project.

“Comments on Proposed Approval of an Urban Commercial Development in the Rural Community of Acton”. July 16, 2007. Filed with the Los Angeles County Board of Supervisors. Variance Case No. 200700002 Project Number: R2006-02393.

“Scoping Comments on the proposed demolition of the historic Doheny House”. May, 2007. Filed with the City of Dana Point on behalf of The Dana Point Historical Society.

“Comments on the California Independent System Operator’s Second White Paper on Advanced Transmission Technology - LEAPS”. March 27, 2007. Filed with the California Independent System Operators and the Federal Energy Regulatory Commission in response to the CAISO’s 2nd “LEAPS White Paper” prepared for the March 20, 2007 CAISO Stakeholder Meeting. FERC Docket No. ER06-278.

“Comments On the Final Environmental Impact Statement And Discussion Of Project Components That Violate State and Federal Laws”. March 12, 2007. Filed in response to the Federal Energy Regulatory Commission Notice of Availability of the Final Environmental Impact Statement for the Proposed Lake Elsinore Advanced Pumped Storage Project [FR Doc. E7-1910]. FERC Docket No. P-11858.

“Comments on Draft Environmental Impact Statement”. November 2, 2006. Filed in response to the Federal Energy Regulatory Commission Notice of Modified Transmission Alignment Proposal and Staff NEPA Alternatives for the Lake Elsinore Advanced Pumped Storage Project [FR Doc. E6-16764]. FERC Docket No. P-11858

“Comments On The Draft Environmental Impact Report/Environmental Impact Statement For The Southern California Edison Segments 2 and 3 of the Tehachapi Renewables Transmission Project”. October 16, 2006. CPUC Docket No. A.04-12-007.

“Comments On The Draft Environmental Impact Report/Environmental Impact Statement For The Southern California Edison Segment 1 of the Tehachapi Renewables Transmission Project”. October 3, 2006. CPUC Docket No. A.04-12-008.

“Scoping Comments on the Proposed Demolition of the Historic Miramar Theater”. August, 2006. Filed with the City of San Clemente on behalf of the San Clemente Historical Society.

Ayer, J., *“ATI Aerospace 3000 and ATI OSM 1000 Filter Efficiency Report”*, Prepared for Chromate Primer Applications for Compliance with South Coast Air Quality Management District Rule 1469.1. December, 2005.

Ayer, J., *“Recirculation Ventilation Assessment for the Robins Air Force Base Aircraft Paint Hangar and Paint Booth”*. April, 2005.

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Darvin, C. H., Proffitt, D., Ayer, J., "Paint Spray Booth Design Using Recirculation/Partitioning Ventilation". Environmental Progress Magazine. Fall, 1998.

Ayer, J., "Controlling VOC & Air Toxic Emissions from Aircraft Refinishing Facilities - A NEW APPROACH". Presented at the 1998 A&WMA Annual Meeting. June, 1998.

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Ayer, J., "Aircraft Hangar Emission Control Cost Effectiveness Evaluation and Assessment of Viable, NESHAP Compliant Aircraft Stripping Technologies". Hill AFB Contract. March, 1998.

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