Submitted to:

Ric Encarnacion, MPH, REHS
Bureau Chief and Director of Environmental Health

Marni Flagg, REHS
Assistant Bureau Chief

Environmental Health Bureau
County of Monterey Health Department
1270 Natividad Road
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Re: *Technical Review of Aiello et al. (2025) Journal Article*, Appendix C, Terraphase Engineering (2026)

Submitted by:

Ivano W. Aiello, Ph.D., on behalf of the authors of Aiello et al. (2025)
Moss Landing Marine Laboratories
San José State University

Date: August 2026

Dear Mr. Encarnacion and Ms. Flagg,

We have carefully reviewed the Terraphase technical review (Terraphase Engineering, 2026, *Technical Review of Aiello et al. (2025) Journal Article.* Appendix C).

Before addressing specific comments, it is important to note that the Terraphase report does **not dispute the central finding of our study**: the post-fire enrichment of Ni, Mn, and Co in surface soils and its rapid decline over the following weeks. The disagreement concerns the quantitative interpretation of the data, particularly the estimation of deposited mass, rather than the occurrence of a transient deposition event. The review therefore challenges primarily the quantification of the deposition, not the evidence that deposition occurred.

The Terraphase report was prepared as part of a regulatory risk assessment commissioned by Vistra to evaluate whether the fire resulted in persistent environmental contamination requiring further action. In contrast, our study was designed as a rapid response environmental investigation documenting the initial deposition and short-term evolution of battery derived metals at a recently restored tidal marsh. Our study has a unique pre-fire baseline dataset that was collected 2 years prior to the fire using the same instrument and sampling approach, allowing direct before and after comparisons. The study underwent independent peer review prior to publication, and many of the methodological limitations and uncertainties emphasized in the Terraphase review were already discussed in detail in the accompanying Supplementary Information. However, several criticisms in the Terraphase report evaluate our study against the expectations of a regulatory site investigation rather than those of an environmental process study.

The principal scientific issues can be summarized as follows:

- **Portable XRF is an established scientific tool.** The review treats FpXRF primarily within the context of EPA Method 6200, a regulatory site screening protocol. Our study used FpXRF for a different purpose: rapid, high-density mapping of an extremely transient surface deposition signal. This capability was fundamental to documenting a rapidly evolving deposition signal that would likely have been missed using conventional laboratory-based sampling alone. This application is well established in the peer reviewed geoscience literature, and the limitations of FpXRF were explicitly discussed in both the manuscript and the Supplementary Information.
- **Different analytical methods interrogate different sampling scales.** The review implicitly assumes that FpXRF and ICP MS should produce highly correlated concentrations. However, in situ FpXRF measures the immediate soil surface where freshly deposited particles accumulate, whereas ICP MS analyzes homogenized bulk samples that dilute any thin surface enriched layer. Imperfect agreement between the two methods is therefore expected and is consistent with the study's central hypothesis.
- **Elemental ratios are widely used for provenance studies.** The Ni/Co ratio was not presented as definitive proof of battery derived material, but as one independent line of evidence interpreted together with spatial patterns, temporal

evolution, SEM observations, and laboratory analyses. While the review does not demonstrate that the use of elemental ratios for source attribution is scientifically inappropriate, geochemical ratios are commonly used in the scientific literature to characterize sediment sources and provenance.

- **The deposited mass estimate was explicitly presented as a first order approximation.** The paper emphasizes that the calculation should be interpreted with caution, evaluates multiple plausible contamination thicknesses, and discusses the associated uncertainties. Most Terraphase criticisms of the mass budget are therefore not independent but stem directly from the review's earlier assumption that FpXRF data are unsuitable for quantitative interpretation.
- **Known analytical limitations were acknowledged, not overlooked.** The tendency of XRF to overestimate absolute concentrations relative to ICP MS, together with the effects of moisture, organic matter, and matrix effects, were explicitly discussed in the manuscript and Supplementary Information. The study relied primarily on relative temporal and spatial changes measured consistently with the same instrument rather than on absolute concentrations.

Finally, several statements in the review move beyond technical analysis and into assertion. For example, the conclusion that the sampling density was "insufficient" to estimate inventories across Hester Marsh is presented without reference to any scientific, statistical, or geostatistical criterion defining what constitutes sufficient sampling. Environmental inventories are routinely estimated from spatially distributed observations using interpolation, extrapolation, and explicitly stated assumptions. The relevant scientific question is therefore not whether uncertainty exists, but whether that uncertainty has been appropriately acknowledged and incorporated into the interpretation.

In summary, the Terraphase memorandum raises reasonable questions regarding the uncertainty of the deposited mass estimate, but it does not invalidate the principal findings of the study. The evidence supporting a transient post fire enrichment of Ni, Mn, and Co in surface soils, its rapid decline over time, and its association with battery derived material remains robust and is supported by multiple independent lines of

evidence, including temporal trends, spatial patterns, laboratory analyses, and SEM observations.

The executive summary indicates that our dataset was not incorporated into the synthesis because it was considered unsuitable for evaluating long-term chronic exposure. While that rationale may be appropriate for certain regulatory questions, it also excludes one of the few datasets collected immediately after the fire and therefore one of the few capable of characterizing the transient surface deposition documented during the first weeks following the event.

Many independent datasets have now been collected following the Moss Landing battery fire. Each provides information on different aspects of the event and operates at different spatial and temporal scales. Our study characterizes the initial surface deposition and its rapid evolution during the first weeks following the fire. Ghostwipe and terrestrial vegetation surveys document spatial patterns of deposition in upland environments. The EMBER water chemistry data characterize the transport and transformation of battery-derived metals within the estuary, while the EMBER biota data provide information on biological uptake and exposure. The Terraphase investigation provides information on deeper soils and longer-term environmental conditions. Considered individually, each dataset has limitations. Considered together, they provide a more complete understanding of the environmental consequences of the fire.

We encourage the County to request that the final synthesis incorporate all scientifically rigorous datasets collected following the fire, recognizing that each was designed to address different questions and different stages of the event. Such an integrated assessment would provide a more complete understanding of both the initial deposition of battery-derived metals and their subsequent redistribution and environmental fate.

We also encourage that the human and ecological risk evaluation consider the range of concentrations documented by the available datasets, including the laboratory ICP-MS measurements from samples collected during the initial post-fire period and the deeper soil concentrations measured by Terraphase months later. These datasets should not be viewed as competing estimates, but as complementary datasets that characterize different stages of the temporal evolution of contamination. Considering both would

provide a more balanced and scientifically robust framework for evaluating potential environmental and health impacts.

We hope that this response will contribute constructively to the County's evaluation and to the broader effort to integrate the different scientific datasets collected following the fire.

My understanding is that written responses can be posted alongside the Terraphase report on the County website, and we would appreciate having our response included there as part of the public record.

Thank you for your consideration, and please let me know if you need any additional information from us.

Best regards,

Ivano

References:

Aiello, I. W., Endris, C., Cunningham, S., Fountain, M., Grand, M. M., Heim, W., Kahn, A. S., & Wasson, K. (2025). *Supplementary Information for "Coastal wetland deposition of cathode metals from the world's largest lithium ion battery fire."* Scientific Reports. https://doi.org/10.1038/s41598-025-25972-8

Terraphase Engineering Inc. (2026). *Technical Review of Aiello et al. (2025) Journal Article.* Appendix C in *Characterization and Screening Level Risk Evaluation Report, Vicinity of Moss Landing Power Plant, Moss Landing, California.* Prepared for Vistra Corp., June 19, 2026.

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