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December 6, 2017

Barbara A. Lee, Director
California Department of Toxic Substances Control
1001 I Street
P.O. Box 806
Sacramento, CA 95812

RE: Evaluation of Lead-acid Batteries as a Potential Priority Product

Dear Director Lee:

The Battery Council International[1] ("BCI") appreciates the opportunity to participate in the California Environmental Protection Agency's ("Cal EPA") Department of Toxic Substances Control's ("DTSC") initial evaluation of lead batteries as a potential priority product under the Safer Consumers Products ("SCP") program. Because this evaluation could have dramatic effects on California consumers and world-wide industries, it must be conducted in accordance with DTSC's statutory and regulatory requirements, in a thorough and deliberate manner that applies the best available scientific, economic, and real-world information. As discussed below, the data presented to date by DTSC and stakeholders shows that lead batteries are not appropriate for listing as a priority product.

BCI and BCI's members have been engaged with DTSC over the past year and a half as part of both the Community Protection Hazardous Waste Reduction Initiative ("CPHWRI") and the SCP evaluation. Over the past 18 months, BCI has met with DTSC staff and given presentations and provided background information on the lead battery industry and have addressed all of the SCP evaluation criteria for the agency's reference.[2] The information presented here supplements that information and the presentations by Mark Thorsby, Adam Muellerweiss, Ana Margarita Garza, Timothy Ellis, and Carl Raycroft at the November 6 workshop. BCI is encouraged by the agency's engagement with industry, but continues to have serious concerns about both procedural and substantive matters regarding the SCP evaluation and the potential listing of lead batteries as a priority product. This letter and accompanying attachments address key concerns we have identified to date, and provides suggestions for addressing those concerns.

[1] BCI is a non-profit trade association whose members are engaged in the manufacture, distribution, and recycling of lead batteries internationally and across North America. BCI members account for over 98% of U.S. lead battery production and 100% of its recycling (i.e., secondary lead smelting) capacity. Our industry promotes lead battery recycling by collecting and recycling lead batteries, encouraging the enactment of mandatory lead battery recycling laws, and supporting ongoing consumer and industry education efforts. BCI members have approximately 1,000 employees in California employed in battery manufacturing, distribution, and recycling facilities.
[2] *See* Attachment A.

I. Lead Batteries are Essential to Today's Energy-Dependent Economy

Lead batteries are an essential commodity in the U.S. Economy. Every mass-produced car and truck (nearly 255 million) and more than 65% of all forklifts in the U.S. contain and rely on lead battery technology.[3] Lead Batteries also are widely-recognized as the single most recycled consumer product in America.[4] Over 99% of lead batteries (by lead weight) are recycled each year, compared to 55% of aluminum cans. This equates to 1.7 million tons annually of lead batteries diverted from landfills. No other battery chemistry comes close to this sort of success.

Wind and solar energy storage, backup power for hospitals, telecommunications, and data centers also rely on lead batteries. 75% of the world's rechargeable energy storage needs are met by lead batteries.[5] World-wide, thousands of hospitals rely on lead batteries to help save lives by providing emergency power for life-saving equipment.

The industry also provides a significant manufacturing base - employing more than 20,500 people, selling more than 129 million car batteries each year, most of which are made in North America, and producing $11.2 billion in GDP.[6]

An SCP listing of car batteries alone could disrupt the availability of new cars in California, increase the price of new cars, and reduce the availability and increase the price of replacement batteries for used cars. It could also negatively impact the availability of lead batteries for other green power or life-saving applications by putting manufacturing and recycling capacity at risk.

II. DTSC Should Fully Complete the CPHWRI Process Prior to Making a Final Determination on Listing Lead Batteries as a Priority Product

BCI is concerned that DTSC has prematurely initiated its public review under the SCP program prior to completing the Governor's mandated CPHWRI review. In the Department of Finance's February 17, 2016 letter, Governor Brown directed DTSC to first evaluate lead batteries though CPHWRI, and that DTSC should use the results of that program to inform its potential evaluation under the SCP program. But DTSC appears to have jumped the gun and started the SCP process prior to completing the CPHWRI process. As of the time of submission of these comments, DTSC has not yet published a CPHWRI report, and has not engaged with any of the companies that proposed public-private partnership battery research and development projects as a part of that process.

The premature start to the SCP process raises two critical concerns. First, the SCP evaluation has been deprived of the formal conclusions that will be presented in the CPHWRI report, defeating the Governor's stated intention. Second, the public and industry have not been

[3] Top 20 Industrial Lift Truck Suppliers, Modern Material Handling, 2017, can be accessed at http://www.mmh.com/article/top_20_lift_truck_suppliers_2017.
[4] U.S. Environmental Protection Agency, Advancing Sustainable Materials Management: 2014 Fact Sheet (Nov. 2016) (Attachment M).
[5] Avicenne Energy: The Rechargeable Battery Market & Main Trends 2014-2025, March 9, 2015 (Attachment P).
[6] Economic Development Research Group, Inc., *Economic Contribution of the U.S. Lead Battery Industry* (Forthcoming).

provided any opportunity to review the CPHWRI report and provide feedback to the agency ahead of the SCP process.

These concerns are important. In 2016 and 2017, as part of the CPHWRI process, BCI and numerous BCI members presented information to DTSC on the lead battery industry's past, present, and future. Much of that information and the CPHWRI's analysis of that information would be beneficial to the SCP evaluation, yet none of it is publicly available. Additionally, in response to a request from DTSC for industry to engage with the agency on technology enhancement research and development projects, three BCI members submitted proposals to DTSC for public-private partnership projects. Under the project proposals, the companies would work with DTSC to investigate new technologies that would reduce the amount of lead used in batteries, the amount of energy required for charging, and extend the service life of those batteries. Each of these improvements would reduce the number of new batteries required each year and reduce the volume of used battery lead to be recycled, which in turn would reduce potential lead exposures throughout the product life-cycle. These projects not only will result in tangible improvements and reductions in waste streams, but affirmatively demonstrate that industry continues to actively invest in advancing lead battery technologies in ways that directly address the agency's concerns over historical practices. And yet, at the November 6 meeting, DTSC staff gave no clear public indication that it was aware of any R&D by the lead industry, suggesting lead battery technology is stagnant. Moreover, DTSC's background document identifies exposures from lead batteries that fail to recognize the current state of lead battery technology. These actions wrongly distort public perception in favor of alternatives.

Although the CPHWRI Report was due to the Governor in June 2017, BCI is disappointed that DTSC has yet to bring it to publication. And the three companies have yet to hear from DTSC on whether the agency intends to engage with them on the research and development partnership projects. But, more importantly, DTSC appears to be ignoring the Governor's directive to first complete its evaluation through the CPHWRI program prior to initiating the SCP evaluation, which should include completion of the public-private partnership projects DTSC specifically requested from CPHWRI stakeholders. The Governor's instruction recognized that this information is critical to informing DTSC's next step, and DTSC should not proceed further until that program is complete.

III. Lead Batteries Do Not Meet Threshold Criteria for Listing as a Priority Product

Under section 69503.2(a) of the SCP regulation, the Department is required to weigh two primary factors during evaluation of candidate priority products: (1) potential exposure to the chemical in the product and (2) potential for exposure to that chemical to cause significant or widespread adverse impacts to human health or the environment.[7]

In addition to the primary factors that DTSC is mandated to consider, there are several secondary factors considered during an evaluation of a candidate priority product. These are: (1) consideration of the extent to which existing state and federal regulations may be addressing the same concerns, (2) whether the listing would meaningfully enhance protection of public health

[7] Cal. Code Regs., tit. 22 § 69503.2(a).

and the environment, and (3) the availability of safer alternatives that are functionally acceptable, technically feasible, and economically feasible.[8]

As more fully explained below, lead batteries do not meet the threshold criteria required to be listed as a priority product under the SCP regulation.

a. There is no Real-World Potential Exposure to the Chemical in the Product for Consumers

Lead batteries do not create a direct exposure threat to consumers. Lead exposures in California arose predominantly from legacy issues such as historical use of lead in gasoline, paints, and pipes. These uses are largely discontinued and remaining uses are heavily regulated.

Today's lead batteries do not provide any clear pathway to consumer exposure. The batteries are sealed in durable cases that bar exposure to lead during proper use. Additionally, lead batteries used in vehicles are confined to the engine bay, further decreasing consumers direct contact with the batteries. DTSC's background paper mischaracterized the reason lead batteries carry Proposition 65 labels. Those labels are required by a settlement agreement signed by most battery manufacturers to resolve litigation brought by the Mateel Environmental Justice Foundation against several automobile manufacturers, battery manufacturers, and battery distributors. Those labels are primarily driven by the presence of lead content in the product. There was, and has been, no determination that consumers are exposed during typical handling or use.

In addition, the already heavy regulation of industrial lead use at battery manufacturing and recycling facilities means that, in total, lead emissions account for less than 1.5% of all California lead emissions. The majority of emissions of lead come from aviation gas used in piston engine aircraft and power plants. The small percentage of emissions represented by the battery industry does not justify DTSC's attention and resource expenditure when other sources more heavily contribute to the state's overall emissions and provide opportunities for much more substantial reductions.

Finally, DTSC's background paper grossly overstates the risks to consumers from battery failures. The NHTSA report cited in DTSC's "Evaluation of Lead-acid Batteries as a Potential Priority Product" relied on CPSC data now nearly a quarter of a century out of date. The batteries in use in the early 1990s bear little resemblance to the modern designs being manufactured today. As a result of those changes, the same CPSC database for 2015 documents a 93% decrease in reports of potentially lead battery-related incidents.[9]

b. There is no Real-World Potential for Exposure to the Chemical to Cause Significant or Widespread Adverse Impacts to Human Health or the Environment.

[8] Cal. Code Regs., tit. 22 § 69503.2(b)(2), (3).
[9] Data available at https://www.cpsc.gov/Research--Statistics/NEISS-Injury-Data.

Current manufacturing and recycling practices have greatly reduced adverse impacts on both human health and the environment. As discussed below, the lead battery industry is highly regulated at both the federal and state level, and California facilities are subject to the most stringent emission controls in the world.[10]

Those regulations, and the industry's own efforts, have substantially eliminated the potential for widespread impacts. The industry's un-paralleled recycling success means that batteries simply do not go to landfills, and most states (including California) specifically prohibit landfill disposal. The unprecedented high recycling rate also means that the clear majority of lead used to manufacture new products each year is recycled post-consumer lead, dramatically reducing the mining impacts of lead use.[11] Lead batteries also have a low life cycle environmental impact relative to other battery chemistries, with low emissions of carbon dioxide, particulate matter, nitrogen oxides, sulphur oxides, and volatile organic compounds.

These features, coupled with a new California state law (AB 2153) that codifies a proven deposit-refund program, minimizes potential for human exposure or environmental impact associated with improper lead battery management and disposal.

c. A DTSC Listing Would Duplicate Existing Standards and Would Not Meaningfully Enhance Public Health and Environmental Protection.

The SCP Regulation states that DTSC should not duplicate federal or state regulations unless duplication would result in additional public health or environmental benefits.[12] As previously mentioned, the lead battery industry is already heavily regulated at both the state and federal levels. Between Federal and California laws and regulations, no aspect of a lead battery's life cycle is unregulated. These laws and regulations cover lead production, lead battery manufacturing, occupational health for workers during manufacturing and recycling, environmental releases, transportation of new and used batteries, retail sales, wholesalers, recycling collection programs, disposal and wastes, recycling facilities, product labels and consumer warnings, and all other life cycle aspects.

Because of the comprehensive and overlapping state and federal regulations already in place, it is unlikely that a Priority Product listing would result in additional public health or environmental benefits.

Past and current regulations and standards have contributed to a cleaner than decades-ago lead battery industry and listing as a Priority Product is not likely to enhance the quality of public health or the environment because the actions that would result from a listing would be redundant. Manufacturing and recycling facilities operating to modern standards do not meaningfully contribute to community lead exposure. Listing lead batteries as a Priority Product would not

[10] *See* Attachment A.
[11] *See* Linda Gaines, Compare and Contrast: Pb-Acid and Li-Ion Batteries (June 22, 2017) (Attachment K).
[12] Cal. Code Regs., tit. 22 § 69503.2(b).

address historical exposure sites, the cleanup of which is already underway using resources from responsible parties and tax dollars derived from the sale of lead batteries.

IV. There is No Available Alternative Today or in the Foreseeable Future

As an initial matter, because, as discussed above, lead batteries do not meet the threshold criteria for a Priority Product listing, DTSC's apparent focus on certain other battery chemistries is misplaced and premature. Further, the SCP regulation makes clear that DTSC "may also consider whether there is a readily available safer alternative that is functionally acceptable, technically feasible, and economically feasible" prior to listing a product as a Priority Product.[13] Where, as here, there simply is no such alternative, a Priority Product listing is inappropriate.

However, because DTSC has already requested data on potential alternatives, it is important to set the record straight: alternatives must be functionally acceptable, technologically and economically feasible, and should avoid regrettable substitutions. Today and for the foreseeable future, there is and will be no mass-market alternative to lead batteries for starting cars.

DTSC has focused heavily on lithium ion chemistries as a theoretical alternative, but even the most optimistic projections are that it will be years or decades before an alternative automotive battery will be available to the mass market, and then at a significant price premium. To the best of our knowledge, there is no currently available mass-market drop-in alternative to replace lead batteries in cars. There may never be. Presentations during the November 6 workshop confirmed that the envisioned alternatives are unlikely to work with current standard automotive electrical systems and would require entirely new vehicle designs.

Prematurely mandating that California's 30 million or more cars switch from a proven safe and successful battery application to other unproven battery technologies with significant drawbacks would not meet the agency's statutory mandate.

a. A Comprehensive Alternatives Analysis Recently Completed in the EU Found No Alternatives Exist

Other regulators have already taken on this analysis and came to the same conclusion. The European Commission recently published its findings under European End-of-Life Vehicles Directive (Directive 2000/53/EC, the "ELV Directive") that there is no current or foreseeable mass-market alternative for SLI batteries, and that "the use of lead is still unavoidable." EU Directive 2017/2096 (Nov. 15, 2017). Since 2000, the ELV Directive has required the EC to periodically analyze the use of lead batteries in vehicles, and the EU has consistently found that they are essential.

As part of the most recent multi-year effort, the Directorate-General for Environment (DG Environment) retained an independent consultant, the Oeko-Institut, to evaluate lead battery alternatives as well as to review industry input. The industry actively engaged in the Oeko-Institut's review process, and a coalition of industry groups, including EUROBAT (the European

[13] Cal. Code Regs., tit. 22 § 69503.2(b)(3).

battery association), several automobile manufacturer associations (ACEA, JAMA, and KAMA), and the International Lead Association (ILA) performed extensive alternatives analyses and submitted numerous reports and comments to both the Oeko-Institut and DG Environment.

In 2016, the Oeko-Institut issued its report finding there is no viable alternative, and this fall, the DG Environment released its final Directive adopting the Oeko-Institut's recommendation to extend the exemption for lead batteries for another four years. However, it is important to recognize that the report and the directive do not conclude that there will in fact be a replacement at the end of the four-year period, but rather only that another multi-year review will be started at the appropriate time.

The experience of the European regulators, and the rigor by which DG Environment and Oeko-Institut evaluated these products, reveals that DTSC would be merely be duplicating efforts already undertaken by other regulators. It would simply waste valuable California resources to spend years repeating others' work to reach the same conclusions.

b. Premature Mandatory Transitions to Lithium Ion Would be a Regrettable Substitution

DTSC has clearly focused its attention on lithium ion chemistries as potential substitutes for lead SLI batteries. However, even if a lithium ion SLI battery were ever able to be commercially acceptable by matching lead batteries in terms of performance and cost, a feat they do not appear close to achieving, DTSC must also avoid forcing a change that would impose new negative impacts for consumers and the environment.

First, from a safety perspective, there are significant doubts that any "drop in" lithium ion battery could meet the same level of safety required for today's SLI lead battery applications, particularly for those applications where the battery is located in the crash "crumple zone." Crush, impact, and penetration damage are conditions well-known to create short-circuit and fire hazards in lithium ion batteries. But as of today, no voluntary or mandatory safety standard exists for lithium ion SLI batteries; the existing standards are geared towards large-format traction batteries.[14]

Furthermore, lead batteries are designed and tested to provide an emergency supply of power to vehicle safety and egress systems *after* a crash, even when severely deformed and with internal faults. Lithium ion batteries, on the other hand, are intentionally designed to immediately disconnect the cells upon detection of an internal fault (to try to prevent fires), and would be unable to provide such emergency power. This fact is one reason why most lithium-ion powered EV vehicles also contain a lead battery. DTSC should carefully consult with federal and state highway safety regulators to ensure that DTSC's actions do not endanger the lives of California motorists and first responders.

[14] Ruiz, et al., A review of international abuse testing standards and regulations for lithium ion batteries in electric and hybrid electric vehicles; Renewable and Sustainable Energy Reviews 81 (2018) 1427–1452 (Attachment H).

Second, the full life cycle cost and environmental impact of a lithium ion battery are likely higher than an equivalent lead battery. Most of the "green" reputation for lithium ion batteries comes from their potential utility for electric vehicles. However, today's material sourcing and manufacturing processes for the battery product itself are not so "green." It is well documented that the raw mineral resources required to manufacture lithium ion batteries pose significant human health and environmental concerns when mined and/or are considered conflict minerals.[15]

Compounding the supply-side concerns is the end-of-life disposition of used lithium ion batteries. Presenters at the November 6 workshop, and comments from waste management facilities, have noted the safety issues surrounding the bulk collection of used lithium ion batteries – including a history of fires at collection sites. Further, the recycling system for lithium ion batteries is in nascent stages and is today woefully inefficient, and incapable of keeping pace with the volumes of wastes generated for the foreseeable future. Today, less than 5% of used lithium ion batteries are even collected for proper recycling.[16] The other 95% are presumably stored, sent to landfills, or otherwise disposed of improperly. Further, only an estimated 35% of the materials in lithium ion batteries are recoverable, and those recovered materials have little market value.[17] This suggests that, at most, 1.75% of the waste lithium ion battery material is recycled for re-use.[18] And new lithium ion batteries simply don't use that recycled lithium battery material in their construction.

By stark contrast, nearly 100% of lead batteries are collected and recycled. Nearly 100% of the materials in a lead battery (namely the lead, plastic, and electrolyte) can be recovered and are valuable for reuse. And most new lead batteries have upwards of 85% or more recycled content.

Because it is good policy and good for the earth, the recycling capacity and efficiency for lithium ion batteries hopefully will someday increase to match the success of the lead battery industry. But prematurely forcing millions of California vehicles to switch to that battery chemistry would merely over-tax an already under-performing recycling system and would add tremendous volume to the 95%+ of lithium batteries that already go straight to landfills.

Finally, from an economic perspective it is unclear whether lithium ion chemistries can ever be as cost-effective as lead batteries. As numerous presenters acknowledged on November 6th, even the most optimistic projections for lithium ion batteries show a significant cost premium for equivalent functional performance. Today, that premium is at least a 10-fold increase in price. And while lithium ion battery prices may indeed come down, the lead battery industry is not stagnant either. New lead battery designs reduce the amount of lead and other raw materials required to provide the same performance, and will extend the service life of lead batteries, both

[15] *See* Attachment O, Press coverage.
[16] Heelan et al., Current and Prospective Li-ion Battery Recycling and Recovery Processes (2016) (Attachment I).
[17] Linda Gaines & Jeff Spangenberger, *Recycling of Automotive Li-ion Batteries* (2017) (Attachment J).
[18] Even if one believes the lithium ion battery promoters' untested suggestion that lithium ion SLI batteries would last twice as long as a comparable lead battery, and weigh somewhat less, a rough estimate suggests that switching all California vehicle battery sales to lithium ion batteries would result in an additional 275 million pounds of potentially hazardous waste sent to California landfills or slag heaps each year (8 million lithium ion batteries x 35 lbs. each x 98.25% un-recovered materials).

of which may help further reduce the already low lifetime cost of lead batteries. It is doubtful lithium ion based chemistries will ever catch up. Forcing this unnecessary switch would place a burden on consumers and could disproportionately affect low income residents who depend on used vehicles for daily transportation.

In sum, while lithium ion batteries exist for other applications, they simply are not safer, functionally acceptable, technically feasible, or economically feasible for vehicle starting applications. Under DTSC's regulations, an alternative should meet all four of these criteria to support a Priority Product listing. Lithium ion batteries meet none of them.

V. BCI Response to DTSC's Lead Battery Evaluation and Public Workshop Presentations

On October 23, 2017, DTSC issued its "Evaluation of Lead-acid Batteries as a Potential Priority Product" that provided an overview of the Department's initial research to determine whether lead batteries should be evaluated as a potential priority product. There are numerous errors and misleading statements in the background paper, and as the stakeholder most directly impacted, we are including as part of our comment package a paper rebutting those misstatements.

Additionally, during the November 6 Workshop at DTSC, there were a few key misstatements that are addressed below:

a. Dr. Williams stated during her presentation that the E.U. Battery Directive did not deal with lead batteries. We believe Mr. Williams unintentionally misspoke, and that it is likely she intended to simply note that the ELV Directive is the primary regulation governing vehicle batteries, with the Battery Directive taking a secondary role. The Battery Directive certainly applies to lead batteries (including vehicle batteries) along-side numerous other chemistries, except to the extent the ELV Directive takes precedence as to vehicle batteries (for example, the Battery Directive prohibits landfill disposal of lead batteries not otherwise collected pursuant to the ELV Directive).

b. Dr. Robert Spotnitz's presentation included incomplete or inaccurate information.

1. On Slide 14, Dr. Spotnitz asserts that "Li-ion is superior to Alkaline and Pb acid on nearly every metric except price." This statement is not true with regard to many metrics which Dr. Spotnitz failed to address such as operating temperatures, safety, fire risk, and cold cranking amps. There thus are obvious critical metrics on which lithium ion batteries under-perform.

2. On Slide 17, Dr. Spotnitz posits certain advantages of lithium ion batteries compared to SLA lead batteries, many of which misrepresent lead batteries. For example, he states that lithium ion batteries have the advantage of "no servicing or watering required." Yet, modern SLA batteries similarly do

not require servicing or watering. Similarly, the temperature range features described for lithium ion batteries also apply to lead batteries.

c. Mr. Perry Gottesfeld's presentation mischaracterized the export of used lead batteries for recycling.

1. On Slide 13 and in his oral remarks, Mr. Gottesfeld spuriously suggested that the increase of exports of used batteries to Mexico was an attempt by industry to avoid U.S. regulation. His assertion is factually untrue. As the CEC report Mr. Gottesfeld points to itself recognized, and as Ms. Garza of JCI informed the stakeholder meeting during her presentation, the vast majority of the increase in exports was due to Johnson Controls opening two recycling facilities in Mexico to be geographically near key vehicle manufacturing facilities. Mr. Gottesfeld also failed to recognize that Mexico has dramatically updated its environmental protection regulations in recent years.

2. On Slide 23, Mr. Gottesfeld alleges that "[t]here are very few lead recycling plants with adequate emission controls." This is flatly untrue. All currently operating U.S. facilities meet EPA and local state standards. And the Mexican recycling facilities to which the majority of U.S. used batteries are sent operate to an equivalent level.

d. Dr. Menahem Anderman's presentation contained numerous misstatements or misrepresentations; each is addressed below.

1. On Slides 12, 16 and 17, Dr. Anderman suggests that two companies have existing "drop-in" replacements for lead SLI batteries. To the best of our knowledge, none of the products referenced by Dr. Anderman are currently available in a mass-market format for purchase by the public as a "drop-in" replacement. Dr. Anderman, nor any other presenter, provided any evidence that a "drop in" is currently available. And the examples DTSC points to in the Background paper, are similarly not "drop in" replacements.

2. On Slide 13, Dr. Anderman states that lithium ion batteries contain "no toxics." On Slide 21, Dr. Anderman asserts that all constituents other than lithium metal are "non-toxic." These claims are simply incorrect. Lithium ion batteries contain numerous toxic substances, including metals such as cadmium and cobalt, halogens, and other toxic constituents, and are capable of releasing toxic and hazardous gases (such as hydrogen fluoride gas) during failures.[19]

[19] Larsson et al, Nature Scientific Reports (11 April 2017) (Attachment G).

3. On Slide 19, Dr. Anderman states that lithium batteries could be placed in the passenger cabin or open cargo area. While the slide acknowledges the risk of electrolyte fumes, he did not acknowledge that existing safety standards such as SAE J6469 and J2289, strictly forbid placement of lithium batteries in passenger areas due to the toxicity and flammability of those gasses.

4. On Slide 20, Dr. Anderman presents a "cost savings" calculation. Among the factors he lists is a "Weight save value." The referenced 10 kg weight savings apparently refers to the weight difference between two batteries of approximately the same form factor. Dr. Anderman's value therefore fails to consider the additional weight required to implement additional rigid crash structures to protect lithium batteries and the weight of battery management systems.[20] These additional features likely negate any weight savings gained from switching batteries.

VI. Supplemental Materials Submitted with BCI Comments

As previously mentioned, BCI is including as part of its comment package, the following supplemental materials for the record:

a. Existing Assessments of Lead Batteries Compared to Alternatives Assessment Factors (and Exhibits)

b. BCI Paper Identifying and Correcting Misstatements in DTSC's Work Plan Implementation – Evaluation of Lead-acid Batteries as a Potential Priority Product

c. BCI, Understanding Blood Lead Levels

d. June 2017 joint ILA/EUROBAT/BCI news release: Lead and Lead Battery Industries Announce Ambitious New Targets to Protect Workers

e. BCI Most Recycled Infographic

f. BCI Fact Sheet- Vital Power: Advanced Lead Batteries

g. Larsson et al., Nature Scientific Reports (11 April 2017)

h. Ruiz, et al., A review of international abuse testing standards and regulations for lithium ion batteries in electric and hybrid electric vehicles; Renewable and Sustainable Energy Reviews 81 (2018) 1427–1452.

i. Heelan et al., Current and Prospective Li-ion Battery Recycling and Recovery Processes (2016)

j. Linda Gaines & Jeff Spangenberger, *Recycling of Automotive Li-ion Batteries* (2017)

[20] In contrast to lead batteries, lithium ion batteries require complex computerized management system to monitor and balance the charge in each individual cell to prevent failures.

k. Linda Gaines & Qiang Dai, *Compare and Contrast: PB-Acid and Li-ion Batteries* (June 2017)

l. Final EU Commission Directive 2017/2096

m. U.S. Environmental Protection Agency, Advancing Sustainable Materials Management: 2014 Fact Sheet (Nov. 2016)

n. BCI-member CPHWRI proposals submitted to DTSC

1. Doe Run Proposal
2. Hammond Group Proposal
3. Advanced Battery Concepts Proposal

o. Press coverage

1. *Electric Car Growth Sparks Environmental Concerns*, Financial Times (July 2017)
2. *Electric Cars are not Necessarily Green*, Scientific American (May 2016)
3. *Extraction of Metals for Electric Cars Causes a Lot of Pollution*, South China Morning Post (Aug. 2017)
4. *Major Push to End the Hidden Human Toll and Pollution Behind Smartphone and Electric Car Batteries*, World Economic Forum (Sept. 2017)
5. *Nickel Mining: The Hidden Environmental Cost of Electric Cars; The Extraction of Nickel, Mainly Mined in Australia, Canada, Indonesia, Russia and the Philippines, Comes with Environmental and Health Costs*, The Guardian (Aug. 2017)
6. *Tesla's Electric Cars Aren't as Green as You Might Think*, Wired (March 2016)
7. *The Rise of Electric Cars Could Leave Us with a Big Battery Waste Problem*, The Guardian (Oct. 2017)

p. Avicenne Energy: The Rechargeable Battery Market & Main Trends 2014-2025, (March 2015)

Respectfully submitted,

/s/
Mark O. Thorsby, CAE
Executive Vice President, Battery Council International

Attachments

cc: Meredith Williams
Karl Palmer
Grant Cope