December 15, 2017

Barbara A. Lee, Director
California Department of Toxic Substances Control (DTSC)
1001 I Street
P.O. Box 806
Sacramento, California 95812-0806
calsafer@dtsc.ca.gov

Sent Electronically to: CALSAFER.DTSC.CA.GOV

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

Dear Director Lee:

The Alliance of Automobile Manufacturers[1] (Auto Alliance) and the Association of Global Automakers, Inc.[2] (Global Automakers) appreciate the opportunity to comment on the California Department of Toxic Substances Control's (DTSC or Agency) consideration of lead-acid batteries (LABs) as a potential Priority Product under California Safer Consumer Products (CSCP) Program 2015-2017 Priority Product Work Plan. Together, our associations include nearly every company selling new vehicles in the United States (US).

Our members are deeply concerned about the State of California's rationale in pursuing the potential listing of LABs as a Priority Product. While California has experienced issues with the recycling of these batteries in the past, the targeting of the entire automotive battery supply chain for the past mistakes of an individual "bad actor" does not represent a science-based, data-driven approach to remedy any outstanding concerns associated with the product.

Having expressed these concerns, the remainder of our comments relate to the technical aspects of meeting the criteria for Priority Product listing under the CSCP regulations to explain why we believe that DTSC should not designate LABs as a Priority Product.

In its consideration of LABs as a potential Priority Product, DTSC must take into account the primary factors[3] identified in the Safer Consumer Products regulations:

- Potential exposure to the Candidate Chemical(s) in the products; and

---

[1] Auto Alliance members are BMW Group, FCA US, Ford Motor Company, General Motors Company, Jaguar Land Rover, Mazda, Mercedes-Benz USA, Mitsubishi Motors, Porsche Cars North America, Toyota, Volkswagen Group of America, and Volvo Cars of North America. For additional information, please visit http://www.autoalliance.org.

[2] Global Automakers' members are Aston Martin, Ferrari, Honda, Hyundai, Isuzu, Kia, Maserati, McLaren, Nissan, Subaru, Suzuki, and Toyota. Please visit www.globalautomakers.org for further information.

[3] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (a).

- Potential for one or more exposures to contribute to or cause significant or widespread adverse impacts to human health or the environment.

In addition to the primary factors, DTSC must consider various secondary factors,[4,5] including:

- The extent to which existing state and federal regulations may be addressing these concerns;
- Whether the listing would meaningfully enhance protection of public health and the environment; and
- Availability of safer alternatives that are functionally acceptable, technically feasible, and economically feasible.

The regulations state that DTSC must consider "one or more" of a number of factors, only one of which is intended use (another is market presence).[6] DTSC should consider all relevant factors in the aggregate to make a sound decision about a Priority Product listing. DTSC should also consider whether the action is in line with other environmental goals and agency activities in California. For the CSCP Program to have the best chance of success, new Priority Products should be those for which the benefits and likelihood of a beneficial impact on human health or the environment merit the use of limited departmental resources.

The following comments provide a systematic consideration of each of the various mandated evaluation factors and conclude that DTSC should exclude LABs from the Priority Product designation under the CSCP Program.

THERE IS MINIMAL POTENTIAL EXPOSURE TO THE CANDIDATE CHEMICAL IN THE PRODUCT[7]

In its evaluation of LABs as a potential Priority Product, DTSC must consider two key prioritization principles, the first of which is whether there is potential exposure to the candidate chemical(s) in the product-chemical combination.[8] Therefore, DTSC must consider the likeliness of lead exposure.

First, it is important to note that lead exposures in California predominantly arise from historical uses such as in leaded gasoline, paint, and water supply components. Other exposures stem from legacy point sources that have resulted in a localized area of pollution. According to the EPA's *Report on the Environment*, "the majority of lead emissions nationally are associated with combustion of leaded aviation gasoline by piston-driven aircraft; and locally elevated levels of airborne lead are usually found near

[4] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (b)(2).
[5] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (b)(3).
[6] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (1)(A).
[7] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (a).
[8] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (a)(1).

industrial operations that process materials containing lead."[9] This suggests that lead release and lead emissions are *not* associated with the current use of LABs, and thus LABs would present a low risk of exposure.[10] Additionally, lessons learned from past issues have created modern systems that allow for cleaner, safer, and more efficient practices. Today, there is minimal potential for environmental releases because LABs are highly regulated and extensively recycled.

Highly Regulated

The current system for managing LABs is highly regulated. California-based manufacturing and recycling facilities are required to comply with strict federal[11] and local[12,13] lead emissions standards. Therefore, although legacy lead releases may still be a matter of concern, the current federal and California environmental and occupational safety laws, as well as DTSC regulations, have already addressed potential risks from LAB recycling and disposal. Compliance with, and enforcement of, these requirements ensures these activities are performed safely and without environmental harm. Other existing regulations of LABs are discussed further below.

Highly Recycled

There is minimal potential for environmental exposure as LABs are the most highly recycled consumer product.[14] This exemplary recyclability can be attributed to two main factors: a high battery return rate and a "clean closed loop recycling process."[15]

Today's recycling of LABs is an established, technically and economically feasible process. Most batteries are returned for recycling due to current established practices and also the high economic value of LABs. On November 15, 2017, the Battery Council International (BCI) released their new National Recycling Rate Study, which shows that "lead batteries have a recycling rate of 99.3 percent."[16] This almost perfect rate of recycling is "attributed to industry investment in a state-of-the-art closed-loop collection and recycling system that keeps 1.7 million tons of batteries out of landfills annually."[17]

According to DTSC, "retailers are required to accept the trade-in of a spent lead-acid battery by a consumer upon purchase of a new one, (Health and Safety Code section 25215.3), and certain dealers may accept them without a purchase..."[18] Also, the

---

[9] "National air quality and emissions trends report—2003 special studies edition." (EPA/454/R-03/005). US EPA. 2003. https://nepis.epa.gov/Exe/ZyPDF.cgi/0000335Q.PDF?Dockey=0000335Q.pdf.

[10] This point is also supported by a 2014 study by ERA Technologies that concluded that batteries are not the major source of lead emissions in the European Union (EU). "Executive Summary, based on ERA Study: Ecological and economic efficiency analysis on the permanent review of restrictions on lead within the European ELV Directive (2000/53/EC) and the RoHS directive 2011/65/EU," ERA Technology Report, 2014.

[11] 40 C.F.R. pt. 63, Subpart PPPPPP; 40 C.F.R. pt. 63, Subpart X; 40 C.F.R. pt. 60, Subpart KK, 40 C.F.R. pt. 60, Subpart L.

[12] http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1420.pdf?sfvrsn=4 accessed December 5, 2017.

[13] http://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1420-1.pdf accessed December 5, 2017.

[14] US EPA. "Advancing Sustainable Materials Management: 2014 Fact Sheet." p. 4, (November 2016). Retrieved from: https://www.epa.gov/sites/production/files/2016-11/documents/2014_smmfactsheet_508.pdf

[15] Battery Solutions retrieved from: https://www.batterysolutions.com/recycling-information/how-are-batteries-recycled/.

[16] http://c.ymcdn.com/sites/batterycouncil.org/resource/resmgr/docs/BCI_201212-17_RecyclingRate_.pdf.

[17] http://batterycouncil.org/blogpost/1190989/289655/Study-Finds-Lead-Batteries-Are-Most-Recycled-Consumer-Product.

[18] https://www.dtsc.ca.gov/HazardousWaste/upload/FS_DutyOfficer_LeadAcidBatteries1.pdf.

California Lead Acid Battery Act of 2016 (LAB Act)[19] imposes a fee on the purchase of a new replacement lead-acid battery, and a fee on sales of a lead-acid battery to a dealer, wholesaler, distributor or other person in the State of California. The purpose of the new LAB Act is to reinforce the already existing practice of proper battery recycling. High return rates of used batteries prevent batteries from being illegally dumped or disposed into landfills.

Lead-acid batteries are recycled through “clean closed loop recycling.” Closed loop recycling is defined as a production process in which post-consumer waste is collected, recycled, and used to make new products.[20] Recycling facilities use state-of-the art-technologies in an environmentally safe closed-loop system to deliver recycled material for the production of new batteries. Therefore, the lead-acid battery recycling process can be repeated indefinitely, to the point that new lead batteries comprise materials that have been recycled many times over without loss in quality. In fact, more than 85% of a typical LAB is comprised of material that is recycled from older batteries.

In comparison, such a recycling infrastructure for alternative chemistry batteries is either not as established as the existing recycling infrastructure for LABs, or the process and infrastructure do not exist. Lithium ion (Li-ion) batteries provide an example of this issue. While “lithium ion” is often used as a specific term, it refers to a technology with many variants, and as a result, the recycling processes for Li-ion technologies also vary. The idea of a “one-size fits all” Li-ion recycling process is not currently feasible and will take many years to develop. It will require a general convergence of Li-ion battery chemistries, development of flexible processing facilities, and initial battery design techniques that facilitate recycling.[21] Long-term, repeated viability of recycled battery-grade materials from Li-ion recycling processes have not been proven. Furthermore, unlike LAB recycling, the recycling process for Li-ion may not result in cost-stabilization for the key constituents such as lithium and cobalt.

The same is true for other non-lead battery chemistries. Recycling of these alternative materials is limited and not sufficient to meet demand.[22] Therefore, Li-ion and other alternative chemistry-based batteries do not achieve the same efficient LAB recycling rate and it is currently unknown whether they ever will. Furthermore, segregating LABs and other alternatives, such as Li-ion, would need to be fully scrutinized. In certain situations, “inclusion of Li-ion batteries in the input stream of secondary lead smelters has resulted in fires and explosions.”[23] Further research is needed to ensure safety throughout the recycling process for any potential alternatives.

Another important consideration is that while lead used in LABs is largely obtained from an efficient and regulated recycling process, key components used in alternative batteries,

[19] California Health and Safety Code Section 25215.
[20] http://www.businessdictionary.com/definition/closed-loop-recycling.html.
[21] https://energy.gov/sites/prod/files/2015/06/f23/es229_gaines_2015_o.pdf.
[22] Sonoc and Jewiet 2013. (https://ac.els-cdn.com/S2212827114004296/1-s2.0-S2212827114004296-main.pdf?_tid=7d24b676-d6d5-11e7-8054-00000aab0f02&acdnat=1512159988_2b939fd34ccebbffc5fa018b1ec3291a).
[23] https://www.sciencedirect.com/science/article/pii/S2214993714000037#bb0090.

such as lithium-based technologies, must be mined or extracted, leading to potential natural resource depletion.

In addition to environmental exposure, DTSC must consider that even critics of lead recycling generally accept that processing performed under strict regulatory controls has minimal effects on recycling facility workers or the public. For instance, the first stated environmental concern with lead recycling is often the energy intensity required for processing, rather than exposure.[24]

Lead Is Physically Isolated

There is a minimal potential for consumer exposure to lead from LABs. Because LABs are almost entirely enclosed in durable cases and are located under the hood away from passengers, there is virtually no pathway for consumer exposure to lead during product use.

Figure 1.

Typical Lead-Acid Battery

In fact, the US Environmental Protection Agency (US EPA) chose to exempt LABs under the Toxic Substance Control Act (TSCA) Inventory Reporting because LABs are free from known lead emissions during normal product use and have very limited potential for release or exposure.[25]

THERE IS MINIMAL POTENTIAL FOR LEAD EXPOSURE FROM LABs TO CAUSE SIGNIFICANT OR WIDESPREAD ADVERSE IMPACTS TO HUMAN HEALTH OR THE ENVIRONMENT[26]

The risk of adverse impacts is dependent on both exposure and hazard. As discussed earlier, there is minimal potential for environmental exposure, and human exposure is not expected during typical product use scenarios.

[24] https://www.livestrong.com/article/148664-what-are-the-environmental-issues-for-battery-recycling/.
[25] See 40 C.F.R. § § 720.30(h)(5), 710.4(d)(3)-(6), and 711.10(b).
[26] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (a).

It is widely recognized that lead exposure can lead to adverse health effects, and that children are the key vulnerable population.[27] But LABs are not children's products, are not products that could foreseeably be used by children, and in fact are located inside the vehicle engine compartment or other inaccessible areas where children should not be present for a host of reasons. While this section of the regulations addresses the potential for adverse effects should exposure occur, DTSC should not look solely at specific populations in isolation when considering exposure risk.

In addition, there is a minimal potential for consumer exposure to lead from LABs. Because LABs are almost entirely enclosed in durable cases and are located under the hood away from passengers, there is no pathway for consumer exposure to lead during product use or replacement. And, as discussed above, the US EPA has exempted LABs under TSCA Inventory Reporting, because these batteries are free from known lead emissions during normal product use and have very limited potential for release or exposure.[28]

Lastly, lead exposures at large have been steadily decreasing for decades,[29] with no indication that LABs are a major contributing factor. As noted in a 2003 report by the US EPA, the majority of lead emissions nationally come from various sources including leaded aviation gasoline, and localized areas of elevated airborne lead are usually found near industrial lead processing operations, such as smelters.[30]

MANY EXISTING STATE AND FEDERAL REGULATIONS ARE ALREADY ADDRESSING CONCERNS ABOUT LEAD-ACID BATTERIES[31]

The CSCP regulation states that priority product designation should not duplicate existing federal or state regulations without conferring additional public health or environmental protection benefits.[32] Many federal and state laws currently regulate LABs, including the US EPA.

State Regulation

The states have created a robust network of regulations that support the sound management of the production, sale, and recycling of LABs. Every single state has some

[27] ATSDR (2016). https://ptfceh.niehs.nih.gov/features/assets/files/key_federal_programs_to_reduce_childhood_lead_exposures_and_eliminate_associated_health_impactspresidents_508.pdf.
[28] See 40 C.F.R. § § 720.30(h)(5), 710.4(d)(3)-(6), and 711.10(b).
[29] https://www.epa.gov/air-trends/lead-trends accessed December 5, 2017.
[30] US EPA. 2003. National air quality and emissions trends report—2003 special studies edition. EPA/454/R-03/005. Research Triangle Park, NC. https://nepis.epa.gov/Exe/ZyPDF.cgi/0000335Q.PDF?Dockey=0000335Q.pdf
[31] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (b)(2).
[32] "The required or proposed regulatory response substantially duplicates one or more requirements of another California State or federal regulatory program or applicable treaties or international agreements with the force of domestic law without conferring additional public health or environmental protection benefits." Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69506.9(b)(6)(B). Exemption from Regulatory Response Requirements.

form of regulation on LABs that covers the disposal, the duties of retailers and wholesalers, and the preparation and distribution of these products.[33]

As noted above, the California LAB Act imposes a fee on the purchase of a new replacement LAB, and a fee on sales of a lead-acid battery to a dealer, wholesaler, distributor or other person in the state of California. The intention of these provisions is to encourage proper battery recycling. Furthermore, the LAB Act states that "[e]xisting law prohibits a person from disposing, or attempting to dispose, of a lead-acid battery at a solid waste facility or on or in any land, surface waters, watercourse, or marine waters, but authorizes a person to dispose of lead-acid battery at certain locations."[34] This clearly indicates that the state already has regulations in place to address the stated concerns about LABs. Any action to designate LABs as a Priority Product is not necessary and would result in a misapplication of limited state resources.

Finally, automakers continue to be committed to the goals of reducing emissions from light-duty vehicles in the State of California. One of the ways that manufacturers are doing this is by making advancements in technology that support the goal of reducing greenhouse gas (GHG) emissions to 40% below 1990 levels by 2040.[35] Most of these new, zero or low-emission technology vehicles still use and rely on LABs as an integral part of their technology package. Listing this technology as a Priority Product would unduly add additional cost to the vehicle, limit the ability for manufacturers to deploy these cleaner technologies, and would run counter to Governor Brown's stated goals of creating cleaner air for Californians and the Zero Emissions Vehicle (ZEV) Mandate already in place.[36]

LAB batteries have also shown consistent, well-understood performance to state regulations, such as California's Air Resources Board (CARB), where they are grandfathered under pre-existing rules. However, alternative battery technologies would need to comply with increased On-Board Diagnostics (OBD) II requirements mandated by CARB, because of their onboard, microprocessor-driven battery management system (BMS). Currently, for instance, there is very little existing OBD-compliant Li-ion 12V BMS expertise at automotive suppliers, and 12V compliance cannot be copied-and-pasted from higher voltages (*e.g.*, hybrid batteries with outputs of more than 60V). Industry is currently developing alternative battery chemistries to meet these CARB OBD-II compliance requirements.

In summary, an action to list LABs as a Priority Product would go against DTSC's mandate to work with existing state and federal regulatory structures.

---

[33] https://batterycouncil.org/?page=State_Recycling_Laws.
[34] https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB2153.
[35] "Governor brown establishes most ambitious greenhouse gas reduction target in North America" https://www.gov.ca.gov/news.php?id=18938
[36] "More zero-emission vehicles will mean better air quality, Gov. Jerry Brown promises while signing new laws." *Los Angeles Times*. October 10, 2017

Regulations Governing Workplace Exposure
Occupational exposure is regulated by both the federal government (OSHA) and the State of California (CalOSHA). These regulations establish action levels that trigger workplace exposure monitoring and also set a limit for workplace lead exposure.[37] Because California already has regulations in place to address the potential health hazards of occupational lead exposure, designation of LABs as a Priority Product on that basis would represent a statutorily prohibited duplication of existing regulatory action.

Regulations Governing Materials Management
LABs are also highly regulated under the U.S. Resource Conservation and Recovery Act (RCRA).[38] In addition to requirements for management, tracking and disposal and recycling of LABs domestically, the US EPA has also developed RCRA regulations that control transboundary shipments of hazardous wastes, including LABs. Products with hazardous components that cannot be fully contained and transported in a safe manner face much greater regulatory scrutiny than is the case with lead-acid batteries, whose self-contained nature means that they do not present a risk of exposure to any hazardous components. LABs travel not only across state lines but also across international borders to be used in vehicles and other consumer products, attesting to the safety and minimal risk of exposure with these products.

THE LISTING OF LABs AS A PRIORITY PRODUCT WOULD NOT MEANINGFULLY ENHANCE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT

Listing LABs as a Priority Product would not meaningfully enhance protection of public health and the environment because this action would be redundant to other efforts happening both federally and internationally.[39] As discussed earlier, a variety of state and federal agencies have already assessed these products. Furthermore, a similar analysis has been conducted in Europe. Lastly, automakers are already aggressively pursuing alternatives.

Duplication of European Efforts
In Europe, the End-of-Life Vehicle (ELV) Directive 2000/53/EC (Directive) was adopted by the European Commission in September 2000 with the objective of limiting waste from ELVs and their components. The Directive restricts use of lead and other heavy metals. Manufacturers, importers, and distributors must provide and validate systems to collect ELVs and reuse or recycle parts. The Directive focuses on an analysis of the availability of alternatives, and requires the European Union (EU) countries to report on implementation of the Directive to the European Commission every three years.

[37] See https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/OHB/OLPPP/CDPH%20Document%20Library/ligi.pdf.
[38] https://archive.epa.gov/epawaste/hazard/web/html/oecd-slab-rule.html.
[39] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (b)(2).

The Directive restricts the use of lead in vehicles, but due to ongoing studies substantiating the lack of feasible alternatives,[40] it provides exemptions for specified uses of lead. LABs have been exempted since the Directive's adoption in 2000 and have continued to be exempted in subsequent reviews every three years. These exemptions include the recent 2016 exemption that followed a thorough EU review that took place from 2014 through 2016.

This year, the Directorat General for Environment (DG ENVI) proposed continuance of a LAB exemption. The final vote by the European Commission approved the proposal, and the decision was published on November 16, 2017 in the "Official Journal of the European Union."[41]

From these multiple reassessments of lead-acid batteries, it remains clear that no viable alternative has been identified in the EU process and exemptions continue to be issued for almost all uses. This history shows it would be a waste of DTSC's resources to embark down a similar pathway of evaluation, only to reconfirm that LABs are an essential product for which no feasible alternatives exist.

Automakers are already working to find new battery technologies, and imposing the onerous requirement of the SCP Alternative Analysis (AA) may actually be counterproductive. Automakers and their suppliers need to continue their on-going internal company efforts to find alternatives without being bound to a more defined process. An AA would not only be duplicative, but divert limited resources from advancing technology that could eventually become a suitable alternative.

The efforts of automakers and their suppliers should be supported to allow for these new technologies to be developed, tested, and validated on a reasonable timeline. Lithium-ion battery technology itself is evolving quickly, with new chemistries becoming available regularly. These developments would make an initial AA study obsolete, and would therefore necessitate the start of a new AA.

THERE ARE NO AVAILABLE ALTERNATIVES THAT ARE FUNCTIONALLY ACCEPTABLE, TECHNICALLY FEASIBLE, AND ECONOMICALLY FEASIBLE[42]

Although automakers have made significant innovation and progress in alternative technologies, LABs remain the only technologically viable mass-market option available for conventional vehicles, as well as for start-stop and micro-hybrid vehicles.

---

[40] Additionally, a 2016 Öko Institut report confirmed that LABs have no replacement, are still essential, and recommended continuing the exemption. (http://ec.europa.eu/environment/waste/elv/pdf/20160414_ELV_Final_Gen_Ex_2c__Ex_3_Ex_5.pdf accessed December 5, 2017.)

[41] Commission Directive (EU) 2017/2096 of 15 November 2017 amending Annex II to Directive 2000/53/EC of the European Parliament and of the Council on end-of life vehicles (Text with EEA relevance.) http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017L2096&from=EN

[42] Division 4.5, Title 22, California Code of Regulations Chapter 55. Safer Consumer Products § 69503.2 (b)(3).

In considering whether to list LABs as a Priority Product, DTSC must evaluate several factors, including functional acceptability, technical feasibility, and economic feasibility.

When evaluating functional acceptability and technical feasibility, alternative technologies would need to match traditional LABs in terms of reliability, safety, and other factors. To establish whether these criteria can be met by possible alternatives, a lengthy development time is required. A conservative estimate of development time is at least 54 to 80 months. The development time depends on a variety of considerations, including the types of alternative materials available, the type and function of the component, and the meeting of safety requirements.

Safety

Perhaps the most important consideration when developing any new technology for an automobile is safety. Automotive safety encompasses a large and complex area of issues, including regulatory compliance, testing, customer protection, reliability, and more.

Currently, LABs comply admirably with a variety of state and federal safety laws and regulations, including those mandated by the National Highway Traffic Safety Administration (NHTSA). LABs have demonstrated a time-tested, safety track record.[43]

To provide a safe and reliable vehicle, and to meet compliance responsibilities, extensive and time-consuming testing of any new technologies will be required. Numerous mechanical, electrical, environmental, and chemical tests are called for by various standards and regulations in the US and abroad.[44] These testing standards must be met, including those set by the Organization for Standardization (ISO), the Society for Automotive Engineers (SAE) and the International Electrotechnical Commission (IEC); these organizations provide safety testing standards such as SAE J2464, J2929, UL 2054, ISO 26262, and others.

The regulations require that DTSC consider the availability of *safer* alternatives that are functionally acceptable. Therefore, DTSC should consider all aspects of safety, including *physical* safety, when evaluating LABs as a potential Priority Product. It has a responsibility under the law—and to the public—to conclude that alternatives to LABs are as safe as LABs when performing analogous functions.

For example, vehicle and electrical architecture and design standards are closely linked to LAB functionality. LABs are typically placed within the engine bay, under the hood of the vehicle. This is a high-heat area, which requires a thermal management solution for integration. Therefore, alternative chemistry batteries must perform these same functions; a suitable alternative thermal management system does not yet exist.

[43] "Lead-Acid Batteries for Future Automobiles," Garche et al. 2017.
[44] Ruiz V, Pfrang A, Kriston A, Omar N, Van den Bossche P, Boon-Brett L. 2018. "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(1): p1427-1452.

For these reasons and others, various types of vehicle testing must be performed on any alternatives before they could be incorporated into a vehicle design. LABs have a long-proven history of incorporation in vehicles, and a known record of reliability and durability under a variety of use scenarios.

Reliability

Vehicles must have reliable performance at low and elevated temperatures. LABs have a robust cranking charging ability in cold climate—with no associated safety issues.[45] Evidence that alternatives can meet similar requirements is quite limited. To use Li-ion chemistry as an example, most Li-ion batteries that use electromagnetic compatibility (EMC)-based electrolytes have a higher freezing point than LABs. Furthermore, charging at low temps can be a challenge for Li-ion chemistries. Special control systems that limit charging rates and state-of-charge (SOC) at cold temperatures may need to be developed for Li-ion batteries. Limiting SOC with these control systems could adversely affect "next-start" capabilities. Li-ion batteries may require thermal solutions for ultra-cold or ultra-hot environments, as can be found in automotive uses, including areas where California drivers may use vehicles (from Death Valley to the Sierra Nevada Mountains). Currently, very few suppliers have a cost-effective Li-ion technology capable of cold-cranking a vehicle to an SAE standard. It is likely to be several years before key cold and hot performance attributes are reliable and widely available.

Technical Feasibility Issues

Another reason that listing LABs as a Priority Product will not meaningfully add to existing efforts to protect public health and the environment is because, as stated already, automakers and battery manufacturers are already aggressively pursuing alternatives. But to date, no technically feasible "drop-in" solution has been identified. For example, a recently published book on future vehicle battery design,[46] authored by representatives of various automotive companies and automotive suppliers, describes the various research that has been conducted (in some cases for over a decade) by automakers and battery manufacturers to investigate possible alternatives.

In addition to safety and reliability considerations, there are many other complexities to changing the battery chemistries in a complex durable good such as an automobile. In its "Evaluation of Lead-acid Batteries as a Potential Priority Product" background document,[47] DTSC stated that a "drop-in alternative to the 12V lead-acid battery entered the car market with the 2015 Mercedes S65 AMG Coupe (approximately 50,000 in Europe) …" While this example shows that there is the potential to provide an alternative, the Agency should understand this battery was designed for a specific case, and cannot be considered a "drop in" technology for other vehicles. Mercedes was able to design this expensive battery for a single application in a high-end vehicle as a means of reducing weight, but has not been able to justify applying it to other vehicles. This

[45] https://batterycouncil.org/search/all.asp?bst=cold+start
[46] "Lead-Acid Batteries for Future Automobiles," Garche *et al*. 2017.
[47] http://www.dtsc.ca.gov/SCP/upload/Batteries_workshop_Background_Doc.pdf.

technology could not translate easily across original equipment manufacturers (OEMs), or even across models within Mercedes because there are a number of issues to resolve first, such as wiring and harness connections, size considerations, safety concerns, power, cold-cranking time, battery management, discharge characteristics, and sensors, just to name a few.

Additionally, OEMs use many different chemistries in batteries, further complicating the matter. Each OEM develops a unique Li-ion battery to function in its specific vehicle lines and this technology is not transferrable across model lines or across OEMs.

While LABs are common and can be replaced easily, this is not the case for alternatives. For example, LABs and Li-ion batteries have extensive differences in the charging algorithm, charging rate, and charging current. These specifications also vary depending on the inclusion of optional vehicle features. Potential aftermarket replacement batteries may not exist, may not contain a "charge controller" and could be of poor quality, which would impact Li-ion battery functionality with a vehicle's wiring harness and generator.

Other technical problems include addressing "board net voltage." Board net voltage refers to the on-board electronics of vehicles, which operate at 12V.[48] On board net voltage will "control electronics, entertainment, navigation and safety devices like airbags or door lock systems...The vehicle electrical system has developed over decades in parallel and together with the 12V lead acid starter battery."[49] Because current automotive components have been developed for a reliable and consistent 12V power supply, changing a vehicle's system voltage could require extensive redesigning of the generator, engine controllers, and potentially many other devices. In addition, control algorithms, entry and exit points, and interfaces between components would need to be reconfigured while still complying with regulations mandated by other governmental entities such as the US EPA, CARB, and regulatory agencies.

Replacement Parts

Another important consideration in assessing the availability of LAB alternatives pertains to replacement parts. The average age of automobiles on the road today is over 11 years.[50] Automakers are required to maintain replacement part availability for 15 years.[51] Therefore, even if LABs were no longer in new vehicles, a stock for existing vehicles would still be required for at least another 15 years. This would mean that LABs would still need to be produced for the foreseeable future and any potential alternatives would not be used by the full vehicle fleets for many years.

Implementation Time

---

[48] EU Directive, Annex II, Stakeholder Consultation Questionnaire: Exemption No. 5 "Lead and lead compounds in components: Batteries" 12-10-2014.

[49] EU Directive, Annex II, Stakeholder Consultation Questionnaire: Exemption No. 5 "Lead and lead compounds in components: Batteries" 12-10-2014.

[50] The R.L. Polk Co., Vehicles Getting Older: Average Age of Light Cars and Trucks in U.S. Rises Again in 2016 to 11.6 Years, IHS Markit Says, available at http://press.ihs.com/news_releases/automotive. May 19, 2017.

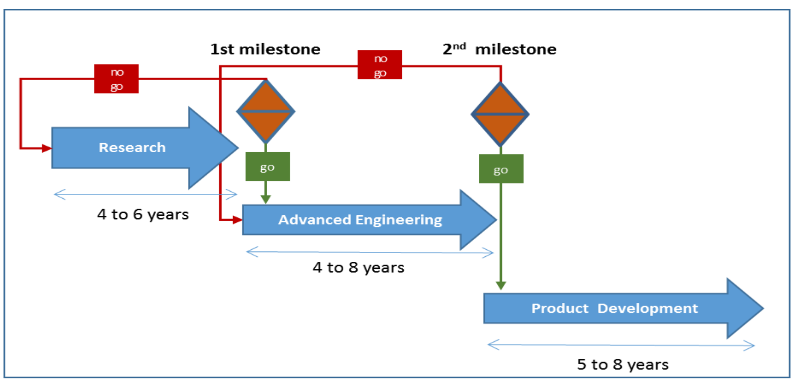
[51] FAST Act, Public Law 114-94, Dec. 4th, 2015.

A conservative estimate of the time needed for implementation of an alternative-chemistry battery is well over ten years. Considerations start with the manufacturing infrastructure. Existing plants may need to be completely replaced or existing factories may need to be re-tooled to a new purpose. Employees would need training. These major changes would require sufficient financial investment.

Next, alternative technology resource issues must be addressed. Due to increased demand, the availability of alternative substances is unknown. Also, as discussed earlier, recycling applications for Li-ion batteries are not well known, are not yet widely commercially available, and are currently often unique to the many individual Li-ion chemistries.

Significant time will be required to overcome these obstacles. Alternatives need sufficient change-over periods. For example, airbag systems took about two decades from the first pilot applications in luxury cars to the wider application in mass-volume production. Another reason extensive time would be required to incorporate any alternative technology is because OEMs use staggered vehicle introduction schedules. New vehicles are introduced on staggered schedules with approximately five-year development schedules. Refreshed vehicles are introduced on staggered schedules with approximately four-year development schedules.

Figure 2.



Steps Before Alternative Battery Meets Mass Market OEM Requirements

Economic Feasibility

In considering whether to list LABs as a Priority Product, DTSC must consider economic feasibility. Economic feasibility considerations include implementation costs, battery costs, and potential consumer costs for existing vehicles.

Implementation costs include manufacturing infrastructure and vehicle redesign costs. Manufacturing infrastructure represents a significant cost of new technology implementation. As mentioned earlier, existing plants may need to be completely replaced or existing factories may need to be re-tooled to a new purpose, and employees could need training.

Vehicle redesign costs include the need for battery management systems, which would drive new communication and control requirements. There would also be additional shielding and housing increase system level costs. For example, due to engine heat, many vehicles would need to be redesigned to move batteries from the engine compartment to the passenger compartment.

Economic feasibility considerations also include battery costs. It is would be difficult to assess cost on a per-vehicle basis. No data has been identified on the use of alternative battery chemistries in conventional vehicle applications (e.g. starting the engine, running the lights, etc.). There is no single battery chemistry that addresses all issues—certain batteries work in certain applications.

A recent report by Öko Institut[52] summarized pricing information for various battery chemistries across various vehicle classes. The report covered direct costs only; additional secondary-factor costs were not considered. LABs remain the most cost-effective battery technology on a kWh basis.

Figure 3.

Vehicle Class	Battery Chemistry		
	Lead-acid	Nickel	Lithium-ion
Class 1 Conventional	50-150 €/kWh 6-18 €/kW	700-1400 €/kWh 90-180 €/Kw	600-1200 €/kWh 118-236 €/kW
Class 2 Hybrid	100-200 €/kWh 10-20 €/kW	800-1400 €/kWh 27-47 €/kW	800-1200 €/kWh 30-75 €/kW
Class 3 EV	100-250 €/kWh 10-25 €/kW	400-500 €/kWh 910-1140 €/kW	300-450 €/kWh 100-200 €/kW
Class 4 PHEV	(not provided)	(not provided)	800-1200 €/kWh 30-75 €/kW

Cost Comparison for Battery Chemistries Across Different Vehicle Classes[53]

[52] Adapted from Öko Institut 2016 http://ec.europa.eu/environment/waste/elv/pdf/20160414_ELV_Final_Gen_Ex_2c__Ex_3_Ex_5.pdf (accessed November 1, 2017).
[53] *Id.*

Battery life-cycle and ELV costs are important considerations also. Other chemistries are significantly more expensive to recycle at this time. With limited, zero, or negative market value for materials recovered at end of life, other battery chemistries, like Li-ion, currently present little to no financial incentive to recycle when compared with LAB recycling. Other life-cycle costs for alternative-chemistry batteries are not known, such as for raw materials, production, and ELV.

Examples of other cost considerations include finding robust thermal solutions for packaging an alternative-chemistry battery (such as Li-ion) underhood, which would be over-and-above battery premium costs.

There is possible instability in raw materials cost for Li-ion alternatives due to the questionable availability of new lithium deposits.[54] Li-ion batteries are composed of rare-earth elements, which are not typically sourced in the US. This increased demand for rare-earth elements could dramatically increase if Li-ion batteries were made mandatory. As noted earlier, widespread availability of recycling to battery-grade lithium does not yet exist.

Economic feasibility considerations also include costs to the consumer. The total increase alternatives would have on the total cost of new vehicles is unknown.

These factors increase the total cost of ownership of older vehicles. Switching of battery types in older vehicles would be highly impractical as older vehicles do not have the required control systems, thermal solutions, or crash solutions to accept a “drop-in” Li-ion battery. Batteries are typically replaced every three to five years over the life of a vehicle. Therefore, increased cost of Li-ion batteries may significantly increase the cost of owning and maintaining a vehicle.

In addition to cost considerations on traditional internal combustion engine (ICE) vehicles, listing LABs as a Priority Product would have an adverse cost effect on the already tenuous business case for various types of electric vehicles (*e.g.*, hybrid vehicles, battery only vehicles) which use LABs for 12V net stabilization. For the auto industry to help California in meeting Governor Brown's greenhouse gas reduction goals, it is critical to rapidly develop the mass market for high-efficiency and ZEVs, and thus placing LABs on the priority could have adverse effects on the environment.

Conclusion

In conclusion, we urge DTSC not to list lead-acid batteries as a Priority Product because there is minimal risk for lead exposure and thus minimal potential for significant or widespread adverse impacts to public health or the environment. Furthermore, there are extensive existing state and federal regulations addressing lead and LABs, therefore, listing of LABs as a Priority Product would be duplicative. Extensive evaluation of LAB alternatives has already been done in Europe, so a Priority Product designation is unlikely

[54] https://www.greentechmedia.com/articles/read/is-there-enough-lithium-to-maintain-the-growth-of-the-lithium-ion-battery-m#gs.VKfw2AE.

to lead to new meaningful information related to protection of public health and the environment. Lastly, we have shown that, at this time, there are no widely-available alternatives that are functionally acceptable, technically feasible or economically feasible.

Thank you for considering the issues we have raised in these comments. Please do not hesitate to contact us with questions or if we may provide additional information. We look forward to working with DTSC as it moves forward with this process.

Best Regards,

Stacy Tatman
Director of Environmental Affairs
Alliance of Automobile Manufacturers
202.326.5551
statman@autoalliance.org

Amandine Muskus
Manager of Environment & Energy
Association of Global Automakers, Inc.
202.650.5555
amuskus@globalautomakers.org