Notice of Deficiency for U.S. Tire Manufacturers Association (USTMA) Consortium's Preliminary Alternatives Analysis Report Dated March 25, 2024

The Department of Toxic Substances Control (DTSC) has completed its review of the Preliminary Alternatives Analysis (AA) Report (Report) for 6PPD in Motor Vehicle Tires prepared by Tracey Norberg on behalf of the USTMA 6PPD Alternatives Analysis Consortium. While the Report is close to compliant with Article 5 chapter 55 of title 22 of the California Code of Regulations, DTSC has identified some deficiencies, which are described in this notice. The Consortium should address these deficiencies prior to resubmitting a revised Report to DTSC, due on July 22, 2024.

All code section references are to the Green Chemistry Regulations and Safer Consumer Products (SCP) Regulations, found in chapter 54 and chapter 55, respectively, of title 22 of division 4.5 of the California Code of Regulations (CCR).

1. COMMENTS ON THE PRELIMINARY AA REPORT

1.1 Priority Product Information

In general, this section provided helpful and required information on the Priority Product, the role of 6PPD, and key legal and performance requirements. There were only minor comments and questions about this section.

In Section 3.2, please rephrase or augment the latter part of the paragraph on p. 9, "*This same paper also suggested a link between this newly discovered chemical and potential impacts to coho salmon attributed to roadway stormwater runoff containing, among other things, 6PPDQ. In laboratory experiments that exposed coho salmon to 6PPDQ in water under certain conditions, Tian et al. (2021, 2022) observed mortality patterns similar to those in wild salmonids found near sources of urban road runoff and discharge by Scholz et al (2011)*." These sentences do not adequately capture the strength of evidence provided in Tian et al., 2021, nor the subsequent research that has demonstrated the 6PPD-quinone is lethal to coho at extremely low concentrations. The reported 24-hour LC50s (or median lethal dose) range from 0.04 - 0.095 µg/L (see ITRC[1]). DTSC's Product-Chemical Profile for

[1] ITRC, 2023. What We Know: 6PPD and 6PPD-quinone. https://6ppd.itrcweb.org/wp-content/uploads/2023/09/6PPD-Focus-Sheet-Web-Layout-9.pdf

Motor Vehicle Tires Containing 6PPD (Priority Product Profile)[2] says the following, "The chemical compound 6PPD-quinone, a reaction product of 6PPD, is acutely toxic to coho salmon, including juveniles, and kills fish just a few hours after exposure. 6PPD-quinone has been identified as the causal agent in urban runoff mortality syndrome (URMS) observed in the Puget Sound area of Washington state, and it kills coho salmon as they migrate upstream, before they are able to spawn."

Section 3.4.7 (p. 18) discusses the potential and prolonged timeline for implementing an alternative on a global scale. USTMA has made it clear in our discussions that an alternative will likely be deployed around the world. DTSC encourages the Consortium to include a discussion whether, after research is completed and decisions have been made about alternatives that are chemically safer and safe in tires, there might be a way to first deploy the tires with alternatives on the West Coast of the U.S. This could expedite protection of coho salmon while the supply chain is still in the process of building capacity to implement the safer alternative(s) globally.

1.2 Scope & Identification of Possible Alternatives and Relevant Comparison Factors

Methods used in the Report

Subsection (h) of CCR section 69505.7 requires that a Preliminary AA Report describe any analytical tools, models, and software used to conduct the stage-one AA – including qualitative analytical tools – and discuss any of their limitations. Please provide additional information on the methods that were used to assess the performance and hazards of alternatives. The following are examples of where more details on methods are necessary:

Table 5.11 cites "expert judgement" of individual Consortium members as the rationale for assessing the performance of some alternatives with regard to reactivity with ozone, migration rate, and staining. Please clarify whether these experts were just "eyeballing" a chemical and estimating its efficacy, or whether any of them used models or software to predict the performance of an alternative.

Section 5.2.1 states that molecular size was used as a guide for the ability of a chemical to migrate through rubber. Please include general guidance on the desired range for the molecular size to help substantiate these decisions.

Section 4.5.1 states that "suggested alternative antiozonants" identified were screened for technical feasibility and scored numerically, with results provided in Appendix F. On page 23, a score of 3 was assigned for alternatives for which "feasibility data are lacking but the chemical structure is promising". Please expand on what structural features make an alternative "promising" and whether these evaluations were based on expert judgment or models. If models were used, please specify which ones.

[2] DTSC, 2022. Product-Chemical Profile for Motor Vehicle Tires Containing 6PPD. https://dtsc.ca.gov/wp-content/uploads/sites/31/2022/05/6PPD-in-Tires-Priority-Product-Profile_FINAL-VERSION_accessible.pdf

In addition, the "compound effectiveness" score (assumed to be equivalent to the "technical feasibility" score referred to in the main text) was not provided for three compounds in Appendix F and instead states "no data but expected to perform similar to <*a compound with information*>". Please add text detailing the basis for your determination that compounds without effectiveness data would have similar performance characteristics as other, better characterized chemicals. See the following examples.

- Flexzone 8L (CAS No. 139-60-6): Compound Effectiveness entry in Appendix F states "No data but expected to perform similar to 77PD".
- UOP 688 (CAS No. 15233-47-3) and UOP 288 (CAS No. 103-96-8): Compound Effectiveness entries in Appendix F state "No data but expected to perform similar to 7PPD".

Section 4.5.2.2 includes the two chemical mixtures listed below as possible non-PPD chemical alternatives for consideration, but there is no description of how these mixtures were assessed in the hazard evaluation (Section 5.1.1). Please describe your approach for assessing mixtures in the Report and ensure that all chemicals are clearly accounted for in the assessment.

- an ether and phenol blend of 3,9-dicyclohex-3-enyl-2,4,8,10-tetraoxaspiro[5.5]undecane (trade name Vulcazon AFS; CAS No. 6600-31-3) and 2-methyl-4-6-bis((octylthio)methyl)phenol (trade name Irganox 1520; CAS No. 110553-27-0)
- a nitrone and phenolic antioxidant mixture of α-C-4-hydroxy-3,5-dimethylphenyl-N-isopropyl (nitrone as a class with no CAS) and 2,2'-methylenebis[6-(1-methylcyclohexyl)-p-cresol (trade name Lowinox WSP; CAS No. 77-62-3)

Alternatives Identification

The scope of alternatives presented in the Report is large and wide ranging. However, the Report does not address all the potential alternatives identified in the Priority Product Profile[3] (Profile) or provided on the SCP website, as required by CCR 69505.5(b)(1)(B). The Report must either include all alternatives referenced on the SCP website and the Profile or provide an explanation for why such alternatives were not viable for consideration. Please incorporate the following alternatives into the Report:

- **Gallates** beyond rambutan extract (e.g., propyl gallate, butyl-gallate, and pentyl gallate). These were included in the Berkeley Center for Green Chemistry's Greener Solutions Report on 6PPD Alternatives[4]. DTSC notes that USTMA was a partner in this collaborative course-based research project.

[3] Ibid.

[4] Boxer, E., Heras, E., Hollenbeck, K., Rigutto, G., Rossomme, E., Wilson, J. 2021. Saving coho salmon: Alternatives for 6PPD in tire manufacturing. https://bcgc.berkeley.edu/sites/default/files/6ppd_in_tires_final_report_fall_2021.pdf.

- **Coating or physical barriers**[5] to prevent ozone from reaching the tire surface. Please evaluate whether this alternative would be feasible for any or all parts of the Priority Product. A question on coatings and barriers was included in the survey on alternatives that USTMA sent to Consortium members, but the results were not discussed in the text, other than the comment in Appendix F that waxes are only effective for static ozone protection.

- DTSC recommends consideration of carbon nanotubes as a potential alternative. U.S. EPA gave a Small Business Innovation Research (SBIR) grant to Molecular Rebar Design LLC for their work using carbon nanotubes to prevent ozone-related microcracks in rubber. Links to this award have been recently posted on the DTSC website. Carbon nanotubes may share some features with graphene.

Other Comments on Alternatives Identification

Appendix F identifies an ether and phenol blend of Vulcazon AFS (CAS No. 6600-31-3) and Irganox 1520 (CAS No. 110553-27-0), however in Tables 5.1, 5.2, and 5.8, only Irganox 1520 is included. Please include the hazard screen for Vulcazon AFS or clarify that the possible alternative being evaluated is truly a single chemical.

Section 4.4.3 discusses some drawbacks to ethylene propylene diene monomer (EPDM), including corrosion of equipment, potentially troublesome air emissions, incompatibility with other tire additives, and interference with rework. Please provide references to support this information.

Adverse Public Health Impacts

While Table 4.4 identifies factors associated with public health impacts, it also includes additional factors that are not identified in the Green Chemistry Hazard Trait Regulations (22 CCR ch. 54), such as acute mammalian toxicity, respiratory and skin sensitization, and organ toxicity. Since acute mammalian toxicity and organ toxicity are discretionary factors, they should both be identified as such. Therefore, the note that follows acute mammalian toxicity ("Not included as a SCP hazard trait but included at preparer's discretion") should also be appended to organ toxicity.

DTSC recommends that additional factors added by the preparers that are toxicological endpoints for hazard traits identified in 22 CCR chapter 54 (skin and respiratory sensitization) be discussed with those hazard traits. Separating the hazard trait from associated toxicological endpoint is confusing and the determinations of relevance do not align. For example, skin sensitization (which is considered relevant) is a toxicological endpoint for dermatotoxicity (which is considered potentially relevant). Please incorporate skin sensitization into the dermatotoxicity factor and change the relevance from "potentially" to "yes". Likewise, respiratory sensitization should be incorporated under respiratory toxicity and the relevance should be changed from "no" to "yes".

[5] DTSC, 2022

Immunotoxicity is stated as “unclear” however, Section 5.1.1.3 (Group B Endpoints) states that respiratory and dermal sensitization would be considered relevant under this endpoint. Since respiratory and dermal sensitization are both considered relevant, the immunotoxicity hazard trait should also be considered relevant. Please change the “unclear” designation to “yes”.

Life Cycle Segments

In Table 4.4, (p. 3 of the Table), “End-of-life disposal” is deemed “potentially” relevant with “most tires…recycled to energy or other uses.” Page 31 also states that “most tires are reused or recycled at the end of their useful life” with a “relatively small portion of the tire waste stream…currently disposed of in landfills or incinerated.” This is inconsistent with Figure 4.2 and p. 27 which state that 45% of end-of-life tires are landfilled. Please address this inconsistency and further consider the impacts of landfilled tires.

Further, please clarify the difference between tire derived fuel burned in kilns in the Reuse and Recycling section (4.7.10) and incineration discussed in End-of-Life Disposal (4.7.11). Please clarify whether 6PPD is emitted when burned, persists in the ash, or is destroyed during combustion (identifying any relevant combustion products). Please elaborate on what happens to the ash after burning (e.g., landfilled as solid waste or hazardous waste, etc.).

The conclusion of the Manufacture section (p. 30) states, “it appears unlikely that changing the antidegradant will not have a material difference…”. Based on this statement it is unclear whether the intent is to state there is a material difference or not. Please clarify this statement.

Relevant Exposure Pathways

In Section 4.6.3 (p. 27), potential hazard, toxicity, or risk should not influence or determine relevance of the exposure pathway. Please focus the discussion on *potential exposures* to 6PPD, its possible alternatives, 6PPD-quinone, and potential transformation products of alternatives, regardless of potential hazard, toxicity, or risk. In addition, with regards to this statement on p. 27, “No data are available for the transformation products of the possible alternatives, other than 77PD,” please note that Cao et al., 2022 and Johannessen et al., 2022 were cited in Section 4.6.3, both of which provide exposure data on rubber-derived quinones formed from PPD antioxidants. Please address this inconsistency or clarify the quoted statement.

In Section 4.6.3 (p. 27) the statement “no dermal sensitization risk from 6PPD in tires after curing” requires a reference. Herve-Bazin et al. (1977) identified cases of sensitization to IPPD, where likely occupational exposure occurred from cured tires.

For each life cycle segment in subsections of 4.7 (pp. 27-32), please include a statement about potential exposure. While Table 4.5 does discuss potential exposures across each life cycle segment, please also include a statement on associated exposure pathways in the narrative.

In Section 4.7.10 (p. 31), please expand on the potential for exposure of retread facility workers. Workers are considered a sensitive subpopulation as defined by CCR 69501(a)(64).

In Table 4.5, (p. 15 of the Table), the basis for relevance of the potential exposure to the Chemical of Concern and alternatives during the manufacturing, use, storage, transportation, waste, or end-of-life management practices [CCR 69503.3(b)] states to "refer to Table 4.4 for the lifecycle step-by-step consideration." Table 4.4 does not include consideration of the storage of the product and alternatives; please expand upon this. In addition, in Table 4.5, the requirement to evaluate exposure through "Household and Workplace Presence" [CCR 69503.3(b)(3)] is related more to *presence* rather than *use*, as household use of the product is already considered under "household and recreational use" [CCR 69503.3(b)(4)(d)]. Please expand upon the product's household and workplace *presence*. For example, motor vehicle tires would be *present* in many automotive-related workplaces. Motor vehicle tires could also be argued to have household presence (e.g., attached garages) and potential for exposure. Depending on the selected alternative, off-gassing and migration out of the product should be considered, as they could result in human exposure.

Conceptual Models (Figures 4.2 and 4.3)

Please separate hazard and risk from the conceptual exposure model to focus solely on potential exposure pathways to the candidate chemical and its alternatives. Please also remove the classification scheme for "Low or No Hazard, No Data, and Potential Hazard" from the qualitative assessments of Potential Health Outcomes at the end of the model. The purpose of the exposure model is to elucidate potential and complete exposure pathways that should be considered across the lifecycle of the product.

See Figure 1 as an example of the suggested changes described in this paragraph. For "Rubber Tire Usage," potential exposure routes of the Chemical of Concern, its alternatives, TRWP, and ozonation products should include roadway/surface runoff/stormwater, waterways, soil, and air. Please include both human and ecological exposures for all of these pathways, which should be reflected in the model. While the effects of airborne tire road wear particles may not be well characterized, exposure assessments suggest tire chemicals are ubiquitous in the air of urban environments and that rubber-derived quinones are ubiquitously present in urban runoff, roadside soils, and air particles. Therefore, soil and air should be included in the model downstream of Tire Road Ware Particles / Ozonation. Please include a dotted line from "aquatic species" to "general public" because aquatic species may be consumed by humans and the potential for human exposure to 6PPD and its transformation products through this pathway has yet to be characterized.

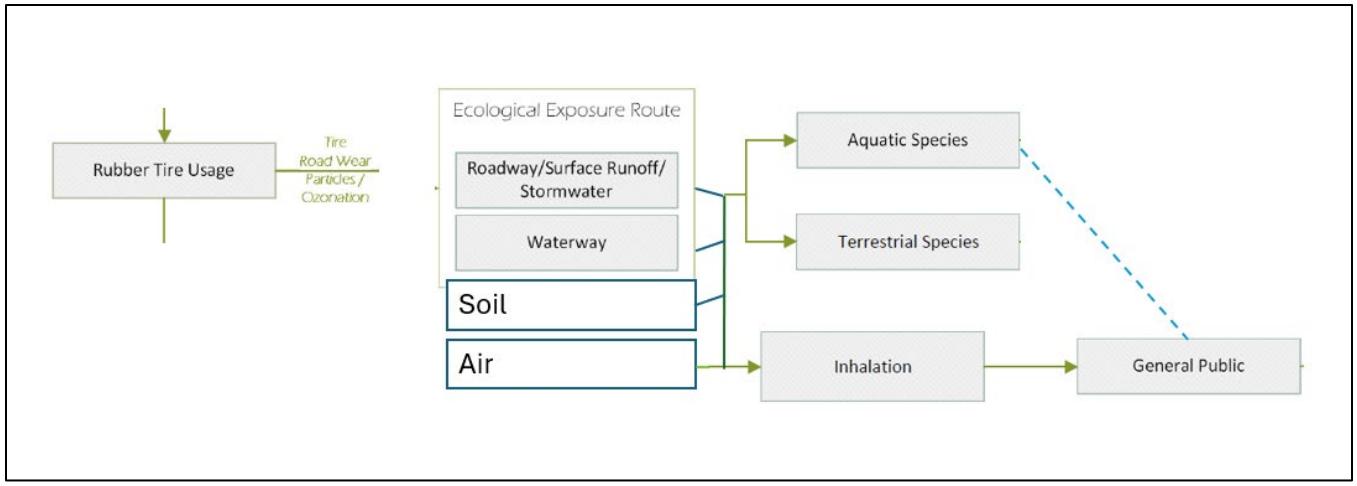

Figure 1. Suggested revised exposure model.

Please use the term "General Public" in Figure 4.3. This figure uses the term "Consumers" but "General Public" is more accurate since exposures would be widespread and not limited to those who purchase and use tires.

1.3 Comparison of Alternatives

Hazard

Please define the scope of aquatic toxicity and terrestrial toxicity regarding the organisms (e.g., taxa or trophic levels) and endpoints (e.g., mortality or other effects) considered in the evaluation of data.

The ecological impacts section of Table 4.4 indicates that acute or chronic toxicity of "the product, its constituents, or its likely breakdown products…" is a relevant factor. However, the relevance for the environmental hazard traits nested under "Other adverse effects…" was indicated as unclear. If acute or chronic toxicity is relevant, then DTSC expects that one or more environmental hazard traits, particularly those called out in the Priority Product Profile (i.e., Wildlife Survival Impairment and Loss of Genetic Diversity, including Biodiversity), are also relevant. DTSC recommends evaluating each environmental hazard trait independently (as the human health hazards were evaluated) and changing each hazard trait's relevance from unclear to yes depending on the endpoints considered under acute or chronic toxicity. Alternatively, the Consortium may provide additional explanation in the Report for why the relevance of these hazard traits is unclear.

Section 5.1.1.3 for reactivity in biological systems states "due to the lack of definition for this endpoint under the SCP regulations" data gaps were assigned for all possible alternatives evaluated. The Green Chemistry Hazard Trait regulations (CCR Title 22 Division 4.5 Chapter 54) define reactivity in biological systems as "the occurrence of rapid reactions with molecules in the body that lead to alterations in critical molecular function and ultimately adverse health outcomes." The final statement of reasons for

the Green Chemistry Hazard Traits (p. 61 of 135) states that the reactivity in biological systems hazard trait is "addressing negative health outcomes" and the initial statement of reasons[6] states that reactivity in biological systems, as a non-organ directed toxicity "affect fundamental toxicological processes and are associated with other toxicological hazard traits." Toxicological endpoints include, but are not limited to, covalent binding to or oxidation of cellular macromolecules and *in vivo* generation of reactive oxygen species or oxidative stress. The Priority Product Profile identifies 6PPD-quinone as a respiratory toxicant in coho salmon partly through oxidative stress mechanisms. SCP also notes that corrosivity would be associated with the reactivity in biological systems hazard trait along with other toxicological hazard traits depending on the organ or tissue affected (e.g., dermatotoxicity if skin was the impacted organ) as stated in the FSOR for the Green Chemistry Hazard traits (p. 93 of 135). Given this clarification, DTSC recommends re-evaluating whether a data gap is merited for this hazard trait for all potential alternatives.

Footnotes on p. 67 and Table 5.8 note that a Consortium member disagreed with using 6PPD as a read across for IPPD. If the members have additional information or a better analog for read-across, the members are welcome to discuss better approaches with SCP.

Performance

The Report provides a structured method to compare and screen out alternatives based on hazard, exposure potential, and performance criteria (page 59). The selection process in the first stage AA allows for eliminating alternatives with greater or equal potential adverse impacts than 6PPD. No further paring down of alternatives is required. The submitted Report applies additional performance criteria and penalization for data gaps, and this may unduly limit the pool of potential alternatives to be further considered in the second stage AA.

The Performance section of the Report relies on the phrase "…based on expert judgment". This does not provide a clear rationale. Per CCR 69505.5(e), responsible entities may eliminate alternatives from further consideration as long as the reason for doing so is explained and supported by information. Thus, expert judgment rationale must be further explained in the Report when eliminating alternatives.

Footnote 6 in the Report (p. 9) states, "*IPPD reacts too fast with ozone leading to premature depletion*…". The comment on p. 60 reads, "…*Consortium members have questions regarding the long-term protection ability of IPPD. IPPD is not a persistent molecule in a rubber compound. One Consortium member's observation is that IPPD rapidly loses its effectiveness in tires. In most cases, this antiozonant would be ineffective before the tread is depleted, resulting in failure to meet consumer expectations."* These comments, along with the concern expressed about IPPD's other undesirable characteristic, e.g., staining, make it difficult to justify why IPPD is selected as an alternative to carry forward into the second stage AA. Please better explain the selection of IPPD for the second stage AA.

[6] https://oehha.ca.gov/media/downloads/risk-assessment/gcisor121710.pdf

In a separate but related issue, is the reaction with ozone "too fast" or is IPPD's migration out of the rubber "too fast"? The conclusion statement in section 6.2 (p. 60) can be interpreted either way, although the footnote clearly implicates the fast reaction as problematic. This may be pertinent because substantially faster migration, coupled with IPPD's comparatively higher water solubility may lead to different exposure patterns.

Section 5.2.2 (p. 49) states that CCPD and 77PD were scorchier than 6PPD but "[a]ll other material were acceptable." Please clarify whether CCPD and 77PD were outside the acceptable parameters or whether, despite their scorchiness, they could still be made to work.

The Report used three categories of performance information to discuss if further consideration or performance testing is warranted in the second stage AA. However, the conclusion to exclude certain potential alternatives from further consideration is generally not well explained or justified. For example, please provide more explanation of how expert judgment was used to conclude that further consideration is not warranted for CPPD (CAS 101-87-1), 6QDI (CAS 52870-46-9), DOPD (CAS 101-67-7), and 44PD (CAS 101-96-2) in Table 5.11.

In Table 5.11 (p. 48), the "Performance Test Results" for ether plus phenol blend of Irganox 1520 (CAS No.110553-27-0) and Vulcazon AFS (CAS No. 6600-31-3) state, "samples containing very high levels of phenolic compound had good dynamic ozone performance in sidewall," but goes on to state that, "At these levels probably causes oxidation based on expert judgment." D. Dall'abaco et al 2018 (a patent) is the only reference cited to support this information, however it is unclear whether the "expert judgment" is also supported by this citation. Since the "no" for further consideration appears to rely solely on this expert judgment, please provide additional supporting information. Since the screening hazard results for Irganox 1520 are favorable for further evaluation in a second stage AA and the only reason for excluding this alternative appears to be based on this performance screen, please include additional rationale for excluding Irganox in the second stage AA.

The scores in Appendix F for some chemicals are not consistent with the narrative description in the initial screening of alternatives. For example, the compound effectiveness for 77PD is 1 (i.e., data indicates it doesn't work), yet it gets considered further along in this AA process. The chemicals listed in the next few rows (p. 198: CAS 139-60-6; CAS 15233-47-3; and CAS 103-96-8) state that they are expected to perform similarly to 77PD or 7PPD, and were reported as commercial antiozonants in the 1970s, but the Report does not justify why they are not included in the comparison in this first stage of the AA process.

1.4 Conclusions of the Stage One AA

The Report demonstrates that the Consortium members have initially considered a plethora of options to find safer alternatives to 6PPD, most of which were rejected for one reason or another (e.g., data gaps). However, the Consortium should consider carrying over a broader range of potential alternatives into the second stage of AA. Evaluating a wider range of alternatives may be beneficial

because several of the selected alternatives have documented issues (e.g., the Report's own statements about the ineffectiveness of IPPD; and current information indicates that neither 7PPD nor 77PD meet Washington State's hazard criteria for safer alternatives to 6PPD[7]). Additionally, the Report defines the hazard criteria for *preferable* as 30% less than the CSI score of 6PPD, but only 77PD and graphene meet that threshold. Carrying over a larger pool of possible alternatives into the second stage AA, as well as considering mixtures, may lead to identifying alternatives with better performance than IPPD, as well as potentially lower CSI scores. If the alternatives are found to not be viable, they can be screened out in the second stage AA per CCR 69505.6(d). It may be worthwhile to provide more tiering among the "eliminated possible alternatives" listed in section 6.3.

Subsection (j)(1) of 22 CCR 69505.7 requires that this Report provide clear rationale of the selection decision. The following suggestions would help clarify the rationale.

- The ultimate decisions on the performance of most alternatives seem to be based on the perceived ability to migrate through the rubber matrix to the surface of the tire. Yet graphene, which "does not migrate in rubber" (p. 61) and "may not completely eliminate the need for 6PPD or another antiozonant in tread" (p. 61), will be carried through to the second stage. Please elaborate on why graphene might be a more appropriate alternative to pursue than other non-migratory chemicals that were dismissed. Some of the non-migratory chemicals such as 2,4,6-Tris-(N-1,4-dimethylpentyl-p-phenylenediamino)-1,3,5-triazine (TAPDT; CAS 121246-28-4) are described as "data rich" (Table 5.8) and have a preferable CSI scores (e.g., 30% lower than 6PPD), but were eliminated from further consideration even as components of mixtures that could lower the concentration of 6PPD or other anti-degradants.
- On a related note, the Report stated that in sidewall compounds, the use of graphene may make it possible to reduce the amount of 6PPD (p. 50), indicating that mixtures may help reduce exposure to 6PPD or 6PPD-quinone. Such a mixture would be a valid alternative in the SCP process (see subsection (a)(10) of 22 CCR 69501.1). Mixtures of alternatives or mixing 6PPD with an alternative may be worthy of further consideration in the second stage AA. Please provide stronger rationale for the general exclusion of antidegradant mixtures – both those with 6PPD and those without – or discuss these mixtures in your revision.
- 7PPD's reproductive toxicity does not meet Washington State's hazard criteria for 6PPD alternatives. Some studies suggest that 77PD does not meet Washington State's criteria because of aquatic toxicity concerns. Please explain whether or how this factored into the Consortium's decision-making process.

[7] Consortium members have told DTSC that any alternative identified through its regulatory process will be deployed nationally and likely, globally. Thus, we recommend the Consortium consider the requirements of other states, such as Washinton's hazard criteria for safer alternatives, even if they are not used by DTSC to evaluate AAs.

1.5 Workplan

Please be aware that the one-time, 90-day extension request related to unforeseen circumstances may be made up to 60 days prior to the due date of the Final AA Report, pursuant to CCR 69505.1(c). Whereas the "extended due dates" discussed in CCR 69505.7(k)(1)(B) are required in the Work Plan section of the Report. These extended due dates allow for, in part, greater time for regulatory safety or performance testing on multiple alternatives. The request for extended due dates must include a detailed explanation of why additional time is needed. This information will allow DTSC to make a determination on the appropriate due date of the Final AA Report pursuant to CCR 69505.9(b)(4).

1.6 Uncertainty Analysis

The uncertainty analysis was generally helpful to see how the various analyses affected the preparers' decision making. While SCP's process does not require analyzing how the selected- and "tier-2" alternatives (those listed exclusively on p. 62) would fare with respect to Washington State's Hazard Criteria for 6PPD alternatives, such an analysis is likely critical for identifying safer alternatives that can be deployed nationally or globally. SCP's AA process is meant to help with the real-world deliberations involved in selecting safer alternatives, especially in those product uses that will lead to broad dispersion of the chemical in ecosystems and urban areas, alike.

DTSC listed 6PPD in Motor Vehicle Tires as a Priority Product, in large part, due to the aquatic toxicity of its transformation product, 6PPD-quinone. However, the modified-CSI system used in the Report scores acute aquatic toxicity much lower than human toxicity endpoints. Given the widespread nature of TRWP and their associated chemicals, the preparers should augment the uncertainty analysis with additional discussion about how the Consortium will consider these differentially weighted CSI scores.

2. ADDITIONAL CONSIDERATIONS

In this Section, DTSC provides additional comments and recommendations to help improve certain areas of the Report for clarity or accuracy.

- The Report states, "The California SCP regulations (AA in general) do not allow Consortium members to incorporate a quantitative estimate of health risk […] in making decisions about whether alternative should be selected" (Section 5.1.1.1, p. 33). The SCP Regulations and Alternatives Analysis do not prohibit considering risk. The Alternatives Analysis process in the SCP Regulations specifically requires considering both hazard and exposure information when selecting alternatives.
- Despite the lack of quantitative risk estimates, DTSC notes there are several statements regarding risk in the Report. Please clarify in Section 5.1.1.1 that risk is discussed qualitatively as supporting information throughout the Report and provide citations to support these "risk" statements.

- Because one of the selected alternatives is a nanomaterial, please consider adding a discussion of particle size and implications for potential exposure and hazard. See Sass, Heine, and Hwang, 2016[8] for one example of how to apply GreenScreen methodology to nanomaterial chemical hazard assessment.
- For the second stage AA please estimate the amount of 6PPD and alternative chemicals needed as a point of comparison for relative exposure potential.
- Notes for Tables 5.5, 5.6 and 5.7 refer to the report as an Abridged AA and spray foam insulation. Please edit the notes for these tables accordingly.
- In Tables 5.1, 5.2, and 5.3, please change the header "Current Priority Product Candidate Chemical" to "Current Priority Product Chemical of Concern".
- In Table 5.1, please add a legend for the color coding associated with hazard scores (i.e., very high, high, moderate, or low).
- Appendix F would be significantly improved by consistent scoring. For example, for effectiveness a higher score is favorable while for commercial availability and quality of data a lower score is preferable. This makes it more challenging to quickly identify those alternatives that are more promising.
- In section 4.5.1 (Approach for Identification of Alternatives), the Report cites "Sandstrom, 1992" in the first paragraph when describing the SCP Regulations. We believe this citation is an error. Please correct this citation if needed.

[8] Sass J, Heine L and Hwang N. (2016). Use of a modified GreenScreen tool to conduct a screening-level comparative hazard assessment of conventional silver and two forms of nanosilver. Environmental Health. 15:105. doi: 10.1186/s12940-016-0188-y.