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Response to Comments Submitted by International Truck and Engine

Comment I: OEHHA Has Failed to Develop Uniform Criteria for Listing Tier 1 TACs, Resulting in Inconsistent Treatment of TACs.

Comment Ia: Although OEHHA points to five criteria in its Prioritization as its “guide” in selecting the Tier 1 TACs,¹ OEHHA fails to provide any explanation as to how they have interpreted these criteria, and even more worrisome, fails to establish a method of weighing various risk factors against each other (*e.g.* severe effects with a potentially lesser exposed population versus less severe effects with a potentially greater exposed population). Asked whether a TAC that exacerbates asthma or one that causes neural, developmental impairment would get a higher listing, Dr. Melanie Marty, Chief Air Toxicologist at OEHHA responded, “if I had my choice, I think I’d rather have asthma than developmental neurotoxicity. I mean, that’s about all you can do to weigh that kind of an issue.”² Yet without a specific, clear methodology for conducting a comparative analysis of the candidate TACs, the process has become haphazard and non-transparent, with inconsistent outcomes.

Response Ia: In the Introduction section of the document, we describe the methods used to prioritize the TACs for evaluation for listing under SB 25. We began with the entire list of over 200 TACs and prioritized them based on estimates of potency and/or noncancer Reference Exposure Levels coupled with measurements or estimates of typical ambient air concentrations. Thus, both considerations of exposure, as required by the statute, and considerations of toxic potency were utilized in prioritizing the chemicals. A high noncancer hazard quotient (ratio of the ambient air concentration to the Reference Exposure Level) or a high cancer risk estimate (product of the unit risk factor and the ambient concentration) would suggest further review. Because many of the RELs and potency factors do not specifically account for differential effects in children, we also evaluated whether the TACs impact specific target organs or have other

¹ OEHHA states that it will use the following criteria as a guide to selecting the Tier 1 TACs: (1) any evidence indicating that infants and children may be more susceptible than adults to the toxicological effects associated with that TAC; (2) the nature and severity of the effect(s), especially irreversible effects; (3) any evidence indicating that, based on current risk assessment methodology, the existing health criteria may not be adequately protective of infants and children; (4) any potential difference in susceptibility of infants and children relative to adults to carcinogenesis based on known information or plausible mechanisms; and (5) extent of exposure and/or the magnitude of risk estimated to occur at concentrations typical of California urban ambient air, and any indication that infants and children may be more heavily exposed to materials contaminated by airborne particles. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, *Prioritization of Toxic Air Contaminants Under the Children's Environmental Health Protection Act*. p. 9-10 (June 2001).

² Transcript of the Meeting of the Scientific Review Panel on Toxic Air Contaminants at 139-140 (April 27, 2001).

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specific toxic effects (e.g., developmental toxicity, exacerbation or induction of asthma) that would have greater impacts in infants and children than adults. The toxicological endpoints of greater concern were neurotoxicity, immunotoxicity, endocrine toxicity, and respiratory toxicity. Concern for these endpoints stems from the relatively long period of development of these organ systems (e.g., up through adolescence), and the potential for prolonged effects from early chemical insult.

We also examined emissions inventory data from the Air Toxics Hot Spots program to estimate the extent of emissions from stationary sources, which gives an indication of whether localized high concentrations might be encountered near sources. Such localized exposures are not reflected in general ambient air monitoring.

Based on all these considerations, thirty-six TACs were selected for focused literature review, while others were deferred to future evaluations. The comment implies the process was non-transparent and haphazard. That is certainly not the case. The comment points out the difficulty of comparing one toxicological endpoint with another, which was discussed at the SRP meetings. Since all chemicals do not act in exactly the same way on the same target organs, then such comparisons are innate in any prioritization and must be done to the best of our ability. We believe we have done just that. We have looked at the entirety of the available information on whether a chemical might cause infants and children to be especially susceptible to illness for each TAC in prioritizing for listing. This was not a haphazard process and is fully explained in the document (see pp. 5-39).

Comment Ib: In these comments, we provide just a few examples of the problems resulting from OEHHA's haphazard evaluation of the candidate TACs. First, OEHHA's criteria requires it to consider "the nature and severity of the effect(s), especially irreversible effects" in the development of its Tier 1 list.³ It seems obvious that a TAC whose primary impact on children is carcinogenic should be ranked higher than a TAC whose primary effect on children is non-cancerous. In some cases, but not in others, OEHHA appears to follow this general principle. For instance, OEHHA has listed PCBs in Tier 1 due to their "developmental toxicity, effects on the immune system, endocrine system, and carcinogenicity," despite the fact that they have been banned for several years.⁴ Severity trumped low exposure.

Yet OEHHA has inconsistently applied the same criteria to benzene and diesel particulate. Benzene, which is *known* to cause a cancer (leukemia) that is on the rise in children, has been removed from Tier 1. In contrast, diesel particulate, which is *alleged* to induce or exacerbate asthma, has been elevated to Tier 1. OEHHA's treatment of these two chemicals cannot be reconciled by any logical or scientific means – nor can it

³ *Prioritization* at 9.

⁴ *Id.* at 35.

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be squared with a statutory mandate to identify those TACs which pose the greatest risk to children.

Not only is benzene *known* to cause leukemia (among other cancers)⁵; the U.S. EPA has found that the cancer risk from current benzene exposures exceeds 100 in a million for tens of thousands of people. Over a *hundred million people* are exposed to levels of benzene that exceed a 10 in a million risk of cancer and *every single person in the entire U.S. population, including every child, is exposed to a level of benzene that exceeds a one in a million risk of cancer.*⁶ In addition to this evidence of the widespread risks of benzene exposure, U.S. EPA has specifically found that there is a “greater risk of leukemia and other toxic effects to children if they are exposed to benzene at similar levels as adults.”⁷ Moreover, both human and animal data support an association between maternal and paternal exposure to benzene and an increased incidence of leukemia in children.⁸ OEHHA, however, removed benzene from Tier 1 because some other epidemiological studies did not find an association between paternal benzene exposure and an increased incidence of leukemia in children, leading OEHHA and the Scientific Review Panel (“SRP”) to conclude that the evidence of differential effects in children is only “suggestive.”⁹

In contrast, diesel particulate is *not* a known carcinogen and has not been included in the Prioritization based on cancer. Rather, diesel particulate is listed primarily because of preliminary evidence indicating a potential linkage between exposure to diesel particulate and inducement or exacerbation of asthma. As is discussed in more detail below, however, the data cited by OEHHA is incomplete and inconclusive. Moreover, there is *absolutely no scientific evidence* to support a conclusion that diesel particulate has any differential effects in children – even assuming diesel particulate does induce or exacerbate asthma. In short, benzene causes a more severe effect (leukemia) and one

⁵ Benzene has been classified as a “known human carcinogen” (category A) under the EPA’s Risk Assessment Guidelines of 1986 and causes leukemia, among other cancers. U.S. EPA. Iris Substance file – Benzene. II.A.1. (January 19, 2000), *available at* <http://www.epa.gov/iris/subst/0276.htm>. Under the proposed revised Carcinogen Risk Assessment Guidelines, benzene is also characterized as a known human carcinogen for all routes of exposure based upon convincing human evidence as well as supporting evidence from animal studies. *Id.*

⁶ EPA Office of Air Quality Planning and Standards. *Draft National-Scale Air Toxics Assessment for 1996*, Figure 5-2. 1996 Risk Characterization: Population whose 1996 exposure exceeded set cancer risk levels based on all source sectors and background. (January 18, 2001).

⁷ EPA. National Center for Environmental Assessment. *Carcinogenic Effects of Benzene: An Update*. p. 41 (April 1998).

⁸ *Prioritization* at Appendix C-2, Benzene – 5-10; 17.

⁹ *Id.* Benzene – 19.

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which is on the rise in children, benzene exposures exceed acceptable risk levels for every member of the population (including all children), and benzene has been shown in some scientific studies to have a differential (greater) effect on children. Yet benzene has been moved to Tier 2. In contrast, there is preliminary evidence that diesel exhaust may induce or exacerbate a less severe condition (asthma) – although likely not at ambient exposure levels – and there is *no* scientific evidence of a differential effect on children, yet it has been moved to Tier 1. OEHHA's inconsistent treatment of these two chemicals simply cannot be squared with its statutory mandate and requirement to engage in reasoned decision making.

Response IB: The comment implies that carcinogenic effects in children should be ranked higher than non-cancerous effects in children. The law requires that we look at TACs to determine which “may cause infants and children to be especially susceptible to illness”. A chemical that is a carcinogen may or may not be more potent in children than adults. Similarly, noncancer toxicological endpoints may or may not be more severe in children than adults. Thus, the comment's implication that all carcinogens should be listed first seems misplaced.

The comment correctly points out that severity of effects is a concern and points to the recommendation to list PCBs as following this principle. The implication is that diesel exhaust particulate matter does not have severe effects. OEHHA considers adverse respiratory health impacts, including exacerbation of asthma in young children, to be severe effects. In addition, this comment fails to point out that diesel exhaust particulate matter is carcinogenic. The comment goes on to describe the cancer risk from benzene as a serious concern. We agree that the cancer risk from benzene exposure should be minimized to the extent practicable. However, diesel exhaust particulate matter is a lung carcinogen and the estimated cancer risks from diesel exhaust in urban ambient air may far exceed the cancer risks from benzene in urban ambient air (by well over an order of magnitude; see South Coast AQMD MATES report). The comment stresses that benzene is a known carcinogen but implies that diesel exhaust particulate matter is not. In evaluating diesel exhaust particulate matter as a TAC, the OEHHA health effects evaluation focused on the more than 3 dozen studies indicating excess risk of lung cancer in occupationally exposed workers. OEHHA concluded that a likely and reasonable explanation for the elevated risk of lung cancer in these occupational cohorts is exposure to diesel exhaust as confounders could not explain the elevated risks. Thus, the epidemiological evidence indicates that diesel exhaust particulate matter is associated with lung cancer in humans.

The comment makes a good point that benzene is a leukemogen. OEHHA remains concerned that since leukemia is the most common form of childhood cancer, we should be very cautious about benzene exposures to children. Thus, while there are a number of pieces of evidence that contribute to the concern that benzene exposure might be worse in children than adults, the epidemiological evidence to date does not strongly support a higher risk of leukemia from benzene exposure of children (or their parents)

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relative to adults. We thus decided that, for this first listing of TACs, we would not place benzene in the first five. This is not the same thing as having no concern over benzene exposures.

Comment Ic: OEHHA’s subjective process also has resulted in diesel particulate being treated inconsistently as compared to formaldehyde. Krzyzanowski, et al. (1990) directly compared the differential respiratory effects of formaldehyde exposure in children versus adults. Despite Krzyzanowski’s findings that children’s lung function was impacted when exposed to low levels of formaldehyde (while adults were not so impacted), OEHHA moved formaldehyde to Tier 2 – while elevating diesel particulate, for which there is *no* evidence to suggest a differential impact in children. OEHHA’s reluctance to associate formaldehyde with inducement or exacerbation of asthma in children is also perplexing given the extensive epidemiological evidence of formaldehyde induced-asthma.¹⁰ Indeed, the National Academy of Sciences itself has identified evidence demonstrating a *differential* impact in children, noting “acute changes in children, especially asthmatics, who were specifically exposed [to formaldehyde] overnight in their bedrooms; morning PEF had decreased significantly with a demonstrable exposure-response relationship.”¹¹

Similarly troubling is OEHHA’s decision to focus on the irritant and asthma-related effects of formaldehyde, for which they concluded “the evidence for differential effects is relatively weak,”¹² without mention of U.S. EPA’s conclusion that more than 100 million people – including children – have a 10 in 1 million or higher cancer risk from formaldehyde exposure.¹³ Indeed, OEHHA’s decision to remove benzene and formaldehyde from Tier 1 is especially worrisome given the fact that of the 32 hazardous air pollutant addressed by the EPA in its Draft *National-Scale Air Toxics Assessment*, the Agency concluded that “those that appear to pose the greatest health threats to individuals (from inhalation exposure) in all parts of the U.S. are chromium, acrolein, *benzene*, *formaldehyde*, and carbon tetrachloride.” (emphasis added).¹⁴

¹⁰ See National Academy of Sciences, *Multiple Chemical Sensitivities: Addendum to Biologic Markers in Immunotoxicology*, p. 23 (1992) (summarizing evidence that led the NAS in 1981 to conclude that formaldehyde causes bronchial asthma in humans).

¹¹ *Id.*

¹² *Prioritization* at 35; *But see*, National Academy of Sciences, *Clearing the Air: Asthma and Indoor Air Exposures*, p. 12 (2000) (noting that “non-specific respiratory tract irritants” can exacerbate asthma).

¹³ EPA, *Draft National-Scale Air Toxics Assessment for 1996* at 95.

¹⁴ *Id.* at 124.

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Response Ic: There is evidence for differential effects of formaldehyde in children relative to adults, but it is relatively weak. OEHHA agree that the Krzyzanowski study indicates a greater response in children in terms of lung function decrement than adults in the same household. Interpretation of this result is somewhat complicated in that the effect is only seen in children who are also exposed to ETS at home. The comment quotes a National Academy of Sciences document as supporting a differential impact on children. This NAS quote is a recounting of the results of Krzyzanowski, and is not a separate study with the same conclusion.

The comment also implies that formaldehyde is associated with exacerbation of asthma. The data on exacerbation of asthma by formaldehyde indicate that only those asthmatics sensitized to formaldehyde from previous occupational exposures respond to formaldehyde with an asthma exacerbation. Thus, this exacerbation does not seem to be applicable to children. For this reason, formaldehyde was not placed in the first listing of up to 5 TACs under SB 25.

The comment also points out that the U.S. EPA’s estimate of cancer risk from formaldehyde in ambient air is relatively high for many people. We agree that this is the case. However, the cancer risk from diesel exhaust particulate matter is even higher. Furthermore, the EPA’s National Air Toxics Assessment quoted in the comment did not evaluate the cancer risks from exposure to diesel exhaust in ambient air.

Comment ID: Finally, OEHHA has acted inconsistently in how it has reviewed one of its statutorily mandated factors, the “extent of exposure and/or the magnitude of risk estimated to occur at concentrations typical of California urban ambient air.”¹⁵ Specifically, OEHHA has refused to consider the impact of extensive existing and planned controls on diesel particulate, claiming that it “was not directed to consider present or potential risk management programs during the prioritization process.”¹⁶ Despite OEHHA’s claim, it is obvious that an analysis of exposure is incomplete without a consideration of existing real-world controls on the chemical – and an analysis of risk cannot occur without consideration of exposure levels. Moreover, in discussions with the SRP, OEHHA has factored the extent of control measures in its evaluation of other TACs. For instance, in its discussion of acrolein, at least one SRP Board member supported placing acrolein in Tier 1 because of “the potency of its irritancy, the scenarios for exposure...and its relative under-attention from a regulatory point of view.”¹⁷ If

¹⁵ *Prioritization* at 10.

¹⁶ OEHHA’s Responses to Comments Submitted by International Truck and Engine Corporation. ITEC – 8 (2001).

¹⁷ Transcript of the Meeting of the Scientific Review Panel on Toxic Air Contaminants at 202 (April 27, 2001).

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OEHHA considers the level of regulatory attention to one TAC, it should consider the level of regulatory attention for all TACs.

Response ID: As noted in response Ia above, OEHHA specifically considered measurements of exposure in ambient air and estimates of emissions from stationary and mobile sources in evaluating TACs for listing under SB 25. The comment appears to imply that we did not consider existing exposures. We did indeed. The comment also seems to think we should consider "real-world controls on the chemical". While there is a large effort undertaken at the present by the Air Resources Board to evaluate management options for reducing emissions of diesel exhaust particulate matter, these controls are not yet in place and will be phased in over several years. Our job is not to evaluate effectiveness of risk management strategies but rather to determine whether we think exposure to a specific TAC will result in differential impacts on infants and children.

Comment II. The Science Does Not Support a Listing of Diesel Particulate in Tier 1.

Comment IIA: OEHHA cites to three reasons for listing diesel particulate in Tier 1: (1) "diesel exhaust particulate contains [polycyclic aromatic hydrocarbons] PAHs"; (2) "diesel exhaust particles contribute to ambient PM10" (particulate matter sized 10 microns or less), and (3) "diesel exhaust particulate can enhance allergic responses, and induce new allergies to airborne allergens."¹⁸ In response to criticisms about OEHHA's reliance on PM and PAHs as its main rationales for listing diesel particulate in Tier 2 in its March Prioritization, OEHHA has since brought asthma-related illnesses to the forefront while simultaneously elevating diesel particulate to Tier 1. It is apparent from the record that asthma is now the primary reason for listing diesel particulate in Tier 1.

We have addressed OEHHA's PAH and PM arguments in previous comments¹⁹; the following discussion explains why the available data do not support a conclusion that diesel particulate induces or exacerbates asthma at ambient exposure levels, or that diesel particulate induces or exacerbates asthma differentially in children as compared to adults.

¹⁸ *Prioritization* at 35.

¹⁹ Additionally, it is important to note that OEHHA is misplaced in its reliance on the Sato, et al. (2000) study to support the bioavailability of PAHs in its Responses to International Truck and Engine Corporation's Comments. In that mutagenicity study, scientists used whole diesel exhaust instead of diesel particulate, such that the study can say nothing about bioavailability of PAHs in diesel *particulate*. Furthermore, there was an absence of mutations at exposure levels far above ambient levels of diesel exhaust. Indeed, mutations were seen only at levels above the threshold of "lung overload," such that the observed mutations in lung DNA were likely the sequellae of lung overload, and not attributable to PAHs per se, either from the vapor or from the particulate phase. Numerous studies have shown that the influx of inflammatory cells into rat lungs produces mutations. See, e.g., Driscoll, K.E., Deyo, L.C., Carter, J.M., Howard, B.W., Hassenbein, D.G., and Bertram, T.A. 1997. Effects of particle exposure and particle-elicited inflammatory cells on mutation in rat alveolar epithelial cells. *Carcinogenesis* 18:423-430.

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The comments make four primary points: (1) the available data show allergic responses only at exposures far exceeding ambient levels; (2) OEHHA has failed to present studies that do not support its findings; (3) much of the data cited by OEHHA does not distinguish diesel particulate from other potential causative agents; and (4) absolutely no evidence exists to suggest that diesel particulate causes differential adverse effects in children.

Response IIA: Exacerbation of asthma and other allergen-related diseases is one of the reasons diesel exhaust particulate matter was listed in Tier 1 of the Prioritization. The other reasons include the higher dose rate of particles to children's lungs, the polycyclic aromatic hydrocarbon content of DEP, the observation of cancer in humans exposed to diesel exhaust, the evidence of lung function decrement in children from traffic studies, and studies of effects of PM₁₀ on infant and child health including mortality. These reasons were not ranked in priority order, and all should be considered important in prioritizing diesel exhaust particulate matter under SB25.

Comment IIB: *The Available Data Show Allergic Responses Only At Exposures Far Exceeding Ambient Levels.* All the asthma and respiratory tract immune effects cited by OEHHA were observed in experiments with exposures far exceeding what anyone would see in Los Angeles, the city with the worst air quality in California. For instance, in one paper cited by OEHHA, Kobayashi et al. (1997) exposed guinea pigs via inhalation to exposure levels that ranged from 300 to 1000 times the estimated average exposure concentration in Los Angeles. Although the study found enhanced allergic responses to intra-nasally administered histamine at an exposure level 1000 times that in Los Angeles, it is significant that there was no effect at a level 300 times the exposures in Los Angeles. In fact, OEHHA also fails to cite studies with lower exposure levels that showed no effect.²⁰ As our June 12 comments have previously explained, OEHHA has also overstated these studies and their support for exacerbation of asthma.²¹

Response IIB: As noted in the response to International's prior comments, diesel exhaust particulate matter causes adverse immune system effects which may result in adverse health outcomes (e.g. possible exacerbation of asthma and allergic rhinitis) (Diaz-Sanchez *et al.*, 2000; and many others, see summary for diesel); these adverse immunological effects are not shared by other model particulates such as carbon black and crystalline silica (van Zijverden *et al.*, 2000). Acute exposures of healthy adult humans to concentrations of diesel exhaust particulate matter (300 µg/m³) approximately

²⁰ See, e.g., A.J. Frew, S. Salvi, S.T. Holgate, F. Kelly, N. Stenfors, C. Nordenhäll, A. Blomberg, T. Sandström. Low concentrations of diesel exhaust induce a neutrophilic response and upregulate IL-8 mRNA in healthy subjects but not in asthmatic volunteers. *International Archives of Allergy and Immunology* 124:1-3:2001, 324-325.

²¹ International Truck and Engine Corporation's Comments to the SRP on Asthma Prevalence in Children and the Role of Diesel Exhaust in Asthma. p. 2 (June 12, 2001).

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one order of magnitude greater than peak diesel exhaust concentrations noted near California freeways demonstrated a marked leukocytic airway infiltration accompanied by enhanced chemokine and cytokine production (Salvi *et al.*, 2000). It should be noted that 300 $\mu\text{g}/\text{m}^3$ was a LOEL (Lowest Observable Effect Level) in this study. Lower concentrations of diesel exhaust particulate matter were not tested, raising the possibility that these effects may be observed at concentrations lower than 300 $\mu\text{g}/\text{m}^3$. Additionally, the study by Frew *et al.* (2001) cited by the commenter as a negative study is in fact a positive study; they observed upregulation of IL-10 production in the bronchial epithelium of asthmatic subjects but not healthy subjects at a PM_{10} concentration of only 108 $\mu\text{g}/\text{m}^3$. The authors stated that the observed IL-10 upregulation may alter the airway biology towards a more allergic phenotype. It is also possible that healthy and/or asthmatic children may be more sensitive to diesel exhaust particulate matter-induced immune system effects than healthy adults. These data indicate that diesel exhaust particulate matter adversely impacts healthy adult immune systems at concentrations close to those observed in cars driving on California freeways (25 $\mu\text{g}/\text{m}^3$), making them very relevant to a consideration of diesel exhaust particulate matter for prioritization under SB 25. In addition, since there is a lag time for particle clearance, cumulative exposures occur routinely just by breathing the air in Los Angeles or other polluted metropolitan areas.

Comment IIC: *OEHHA Has Failed To Present Studies That Do Not Support Its Findings.* OEHHA has also selectively relied upon the database surrounding particulate matter, failing to present studies that contradict its findings.²² Moreover, simple logic strongly suggests that diesel particulate is *not* responsible for the increasing incidence of asthma among children (and the general population). Specifically, the increased prevalence of asthma among children is occurring at the same time that the amount of diesel particulate matter in the ambient air – as well as PM levels – is decreasing

²² See, e.g., G. Berit, P. Gaarder, E. Groeng, R. Leikvold, E. Namork, M. Løvik. Fine particles of widely different composition have an adjuvant effect on the production of allergen-specific antibodies. *Toxicology Letters* 115: 171-181, 2001. OEHHA also confuses whole diesel exhaust with diesel particulate. For example, it cites to diesel exhaust's contribution to other toxins such as benzene as additional support for its listing when, as their own report later states, benzene is a component of diesel *exhaust*, not diesel particulate, the TAC at issue. OEHHA's Responses to Comments from ITEC, ITEC-13. Later, OEHHA states that "while this study [Oosterlee] did not directly measure DEP, diesel exhaust is a major component of traffic-related pollution in the Netherlands, including NO_2 , the pollutant modeled in this study." *Prioritization* at Appendix C-1, Diesel Exhaust Particulate Matter – 17. This in itself seems to support our argument of the numerous other pollutants at work in particulate matter, such as NO_2 , that conflate any attempts to directly implicate diesel particulate.

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substantially.²³ This inverse relationship argues against a causal relationship between diesel particulate (or particulate matter generally) and asthma incidence.²⁴

A more scientific approach to assessing the asthma problem would be to look for factors – whether pollutants or otherwise – that have increased at the same time that asthma incidence has increased. For example, numerous studies have shown an association between obesity and development of asthma.²⁵ Obesity in children has been increasing at a high rate²⁶ – indeed, at a rate similar to the rate of increasing asthma incidence in children. Although it is currently not known whether the increasing incidence of obesity in the U.S. is responsible for increasing asthma rates, studies have suggested that this is the case,²⁷ and such an explanation makes more sense than claiming that rapidly decreasing levels of diesel particulate are causing increased rates of asthma.²⁸

²³ EPA. Emissions Standards Reference Guide for Heavy-Duty and Nonroad Engines. (September 1997). In fact, emissions rates of diesel particulate have decreased 90% since 1980.

²⁴ Casting further doubt on the link between asthma and diesel particulate is the fact that OEHHA estimates diesel particulate to contribute only “5% or so” of the total PM in California. *Prioritization* at Appendix C-1, Diesel Exhaust Particulate Matter - 19. As discussed in our April 6, 2001 comments, this weakens attempts to link diesel particulate to health-related effects from PM generally because of the existence of other air pollutants that contribute 95% of the California PM.

²⁵ *See, e.g.*, Stenius-Aarniala B et.al. Immediate and long term effects of weight reduction in obese people with asthma: randomised controlled study. *British Medical Journal* 320: 827-832, 2000; P.F. Belamarich, E. Luder, M. Kattan, H. Mitchell, S. Islam, H. Lynn, et al. Do obese inner-city children with asthma have more symptoms than nonobese children with asthma? *Pediatrics* 106: 1436-41, 2000. *See also*, note 28.

²⁶ The Weight-control Information Network (WIN), a national information service of the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), National Institutes of Health (NIH) states that prevalence of overweight in children has more than doubled between 1960 and 1994. NIDDK. Statistics Related to Overweight and Obesity, *available at* <http://www.nidDK.nih.gov/health/nutrit/pubs/statobes.htm#11> . *See also*, National Center for Health Statistics. 1999 National Health and Nutrition Examination Survey. Prevalence of Overweight Among Children and Adolescents: United States, 1999, *available at*: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overwght99.htm>.

²⁷ *See, e.g.*, C.A. Camargo, S.T. Weiss, S. Zhang, W.C. Willett, and F.E. Speizer. Prospective study of body mass index, weight change, and risk of adult-onset asthma in women. *Archives of Internal Medicine* 159(21): 2582-8, 1999; S.O. Shaheen, J.A. Sterne, S.M. Montgomery, and H. Azima. Birth weight, body mass index and asthma in young adults. *Thorax* 54(5): 396-402, 1999.

²⁸ Similarly, both the U.S. EPA and the National Academy of Sciences have focused heavily on indoor exposures as the key to the increasing asthma incidence in the U.S. population. *See*, National Academy of Sciences, *Clearing the Air: Asthma and Indoor Air Exposures* (2000). As the NAS notes, “individuals spend nearly all of their time indoors . . . [and] many of the exposures thought to be associated with asthma occur predominantly indoors.” *Id.* at 1. Indeed, the available data show that most people spend only 10% of their time (2.4 hours per day) or less outdoors. *See* National Academy of Sciences, *Multiple Chemical Sensitivities: Addendum to Biologic Markers in Immunotoxicology*, p. 20 (1992) (Table showing contribution of various

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Response IIC: There are now several dozen studies which demonstrate that exposure to diesel exhaust particulate matter enhances the allergic response to allergens. In our search of the literature, we did not find any purely negative studies on allergenicity of diesel exhaust particles, although some studies found effects on one parameter indicating enhanced allergenicity but not necessarily on all parameters measured in the studies. The study cited by the comment in footnote 20 (Frew et al, 2001) is in fact not a negative study (see response IIB). The OEHHA document discusses the uncertainties associated with the adverse health effects reported for the TACs, and includes descriptions of negative studies where appropriate. However, it is not necessary to include a detailed description of every negative study for the prioritized TACs in the literature.

The commenter suggests that a statistical correlation exists between obesity and asthma in children and that exploring such a relationship makes better scientific sense than postulating that a relationship exists between diesel exhaust particulate matter exposure and asthma. Firstly, OEHHA has not stated that diesel exhaust exposure causes asthma or is responsible for the increasing asthma prevalence seen in the U.S. It is generally recognized that asthma causation is multifactorial. The comment cites studies correlating obesity with asthma. There are also studies correlating a number of environmental factors and poverty with asthma prevalence and exacerbation. In addition, assuming that there is a relationship between asthma and obesity, it seems more likely that asthma is a factor in causing obesity, since asthmatic children tend to be less active than healthy children, and lack of exercise has been well demonstrated to be a casual factor for obesity. It should be noted that OEHHA is concerned about exacerbation of existing asthma by diesel exhaust particulate matter and has emphasized that concern in the document. Causation of new cases is much more difficult to evaluate. However, since diesel exhaust particulate matter can enhance allergic responses even to neoallergens, exposure to DEP may contribute to the development of new asthma. OEHHA has also noted in the prioritization document and in its response to comments that no direct epidemiological evidence of differential sensitivity of children to asthma induced specifically by diesel exhaust particulate matter (as opposed to PM₁₀ or PM_{2.5}) has been published. As stated in the introduction sections of our document, asthma is considered by OEHHA to be a disease that impacts children more than adults because: 1) asthma prevalence rates are higher in children than adults; 2) hospitalization rates are highest for 0 to 4 year olds than other age groups; 3) children have smaller airways than adults and thus are more prone to serious breathing difficulty during an asthma attack (resistance is inversely proportional to the fourth power of the radius). The possibility that diesel exhaust particulate matter may exacerbate asthma (and thus differentially impact children) stems from the mechanistic data indicating that diesel exhaust particulate matter exerts specific adverse immune system effects (enhancing allergic responses in the

atmospheric environments to average exposure). Because of their prevalence, indoor air exposures are more likely to be the causative agent in asthma induction or exacerbation than outdoor exposures.

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airway; pages 7-13 in the diesel exhaust particulate matter summary), and the increasing number of studies linking PM₁₀ exposure (of which diesel exhaust particulate matter is a component) with exacerbation of asthma (see pages 18 and 19 of the diesel exhaust particulate matter summary).

Comment IID: *Much Of The Data Cited By OEHHA Does Not Distinguish Diesel Particulate From Other Potential Causative Agents.* There are two areas where OEHHA has particularly speculative evidence for diesel particulate's impact on childhood asthma – the epidemiological studies relating to areas with high traffic (“traffic studies”) and those that link PM generally with asthma. Neither data set has any ability to separate effects of diesel particulate from effects of the numerous other air pollutants involved. For instance, the traffic studies looked at effects near heavily trafficked areas – where diesel particulate is just one of many air pollutants present. The studies made no effort to identify which of the many air pollutants might have been responsible for the asthma-related effects, making these studies far weaker evidence for listing diesel particulate in Tier 1 than the evidence that OEHHA judged insufficient for listing benzene or formaldehyde in Tier 1.²⁹

Similarly, OEHHA points to studies linking PM generally to asthma as support for diesel particulate's link to asthma.³⁰ Yet not one of these studies cited is able to distinguish between the numerous components of PM to know which of the constituents actually is the cause of the effects observed. The only evidence that OEHHA has for attributing any and all harmful effects of PM to diesel is that diesel is a constituent of PM. This ignores the commonly-known complications involved with particle size, distribution and other variables – all of which prevent being able to point to diesel particulate as the causal factor over a number of other PM constituents such as SO₂ or

²⁹ Moreover, if OEHHA continues to rely on the traffic studies, it must also consider other traffic studies which present contrary findings. See, e.g., M.H. Wieringa, P.A. Vermeire, H.P. Van Bever, V.J. Nelen, J.J. Weyler. Higher occurrence of asthma-related symptoms in an urban than a suburban area in an urban than a suburban area in adults, but not in children. *European Respiratory Journal*, 17: 422-427, 2001; T. Hirsch, S.K. Weiland, E. Mutius, A.F. Safeca, H. Gräfe, E. Csaplovics, H. Duhme, U. Keil, W. Leupold. Inner city air pollution and respiratory health and atopy in children. *European Respiratory Journal*, 14: 669-677, 1999; G.P. Bonne, P.K. Mueller, L.W. Chen, B.G. Doddridge, W.A. Butler, P.A. Zawadzki, J.C. Chow, R.J. Troop, and S. Kohl. Composition of PM_{2.5} in the Baltimore-Washington Corridor. Presented at *PM2000: Particulate Matter and Health*, Charleston, SC, January 24-28, 2000; and A.G. Miguel, G.R. Cass, M.M. Glovsky, and J. Weiss. Allergens in Paved Road Dust and Airborne Particles. *Environ Sci Technol* 33(23): 4159-4168, 1999. This study enumerated the components in road dusts (as distinct from exhaust particles) present near Southern California roads, including pollen fragments, animal dander, and molds, all of which were made airborne by passing traffic. The authors concluded that “...paved road dust when entrained into the atmosphere by passing traffic is a source of allergen exposure for the general population...”

³⁰ As discussed in our June 12 comments, even the research literature on the role of PM in asthma exacerbation has many gaps.

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NO_x.³¹ And again, OEHHA's evidence is far weaker than the evidence associated with benzene and formaldehyde.³²

Response IIId: The comment points out the difficulty of evaluating epidemiological studies to pinpoint causative agents. However, the statute requires OEHHA to consider multiple pollutant exposures. Therefore, if there is an association between PM₁₀ and other co-pollutant and an adverse health effect, that information must still be considered. Most of the studies that looked at respiratory health impacts of traffic-related pollutants specifically looked at truck traffic, which in the countries where the studies were done is predominantly diesel-fueled. Truck traffic density was the metric associated with adverse respiratory health impacts. In addition, one of the studies measured PM₁₀ and soot (largely PM_{2.5}) as well as truck traffic density. The strongest correlation with adverse respiratory health impacts in this study (Brunekreef et al, 1996) was with soot. Thus, the comment overstates the problem of being unable to distinguish between the effects of co-pollutant exposure (confounding or effect modification) and underestimates the ability of these traffic studies to provide evidence for particulate pollution as a causative factor in the adverse respiratory health impacts observed in children in these studies.

The comment also overstates the problem of co-pollutant confounding in the PM₁₀ and asthma studies. The comment states that "not one of these studies cited is able to distinguish between the numerous components of PM to know which of the constituents actually is the cause of the effects observed", and notes that this "prevents being able to point to diesel particulate as the causal factor over a number of other PM constituents such as SO₂ or NO_x". There are now a dozen or more studies which evaluated exacerbation of symptoms in asthmatics and air pollution. Many of these studies find a positive association with PM₁₀. These studies were done in Europe, the U.S., Mexico, and British Columbia in areas with very different mixes of pollutants. However, the varied environments studied provide support that the PM₁₀ associations are quite real. The California studies were done in locations that have ozone and NO₂ but very little SO₂ present in the pollutant mix; the British Columbia sites have little ozone, SO₂ or NO₂ in the pollutant mix; East Coast studies have lower NO₂ and higher SO₂ than West Coast cities. While a number of pollutants have been shown to exacerbate asthma in both chamber studies and in epidemiological investigations (SO₂, NO₂, ozone), the fact that positive associations between asthma symptoms and particulate matter are found in studies with very different co-pollutant mixes argues strongly that the exacerbation of symptoms in asthmatics observed in these studies is at least in part due to exposure to PM₁₀. As already noted, SB 25 requires consideration of effects from multiple exposures

³¹ The NAS has identified an association ("sufficient evidence of an association") between high levels of NO_x in indoor air and exacerbation of asthma. National Academy of Sciences, *Clearing the Air: Asthma and Indoor Air Exposures*, p. 9 (2000).

³² Indeed, as discussed above, the NAS has concluded that formaldehyde can cause bronchial asthma in humans. *See supra*, note 11.

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including exposures to Criteria Air Pollutants. Thus, if the effects on asthmatics from air pollutants including PM₁₀ involve interactions, a strong possibility, then this needs to be considered in listing chemicals under SB 25, and is definitely not a reason to exclude listing a TAC under SB 25. In addition, in some of these cities, the ambient PM₁₀ was largely diesel exhaust particulate. Thus, it is difficult to discount the effects as being attributable to something else and that diesel exhaust particulate has no role whatsoever.

Comment III: *Absolutely No Evidence Exists To Suggest That Diesel Particulate Causes Differential Adverse Effects In Children.* Even if diesel particulate is capable of inducing or exacerbating asthma, there is no evidence that diesel particulate has a differential impact on children. Unlike both formaldehyde and benzene, for which there are studies showing differential adverse impacts in children, for diesel particulate, OEHHA relies only on the following speculation: (1) the prevalence of asthma is much higher among children than among adults; (2) the smaller airways of children predispose them to more severe attacks; and (3) children in age group 0 to 4 are hospitalized for asthma more frequently than any other age group.³³ Yet these findings together cannot support a conclusion that diesel particulate has a differential effect on children over adults – and they certainly constitute far weaker evidence of differential effects than is available for benzene and formaldehyde.

As discussed above, the increased prevalence of asthma in children is certainly a concern, but it is difficult to identify a logical justification for attributing this increase to diesel particulate when exposures to diesel particulate have been decreasing dramatically at the same time that prevalence of asthma in children has been increasing. With regard to children's smaller airways and increased breathing rates,³⁴ the American Council on Science and Health has concluded that:

Aside from assumptions about a child's developing body, narrower airways, faster metabolism, and increased breathing rates, no studies are known to exist that support the contention of greater child susceptibility. In fact, the opposite argument could be made - that differential physiological characteristics in children...result in reduced

³³ *Prioritization* at 27-28. The only study cited that provides an actual comparison between children and adults is the Oosterlee, et al. (1996) traffic study. However, OEHHA has admitted that this traffic study is not able to narrow the respiratory impacts of traffic related pollutants down to diesel exhaust specifically and therefore “can’t call it conclusive evidence.” Transcript of the Meeting of the Scientific Review Panel on Toxic Air Contaminants at 165 (May 14, 2001). OEHHA even states that “the precise role (if any) of diesel exposure in the development of atopy has not been defined...” *Prioritization* at Appendix C-1, Diesel Exhaust Particulate Matter – 28.

³⁴ OEHHA has no studies to support this hypothesis, yet cites to their previous review of the prioritization of Criteria Air Pollutants under SB 25 by the Air Quality Advisory Committee. *Prioritization* at Appendix C-1, Diesel Exhaust Particulate Matter – 20-21.

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penetration of DE particulates to the deep lung, and that faster metabolism or lymphatic clearance may result in increased clearance of particulate matter.³⁵

Lastly, the hospitalization data is a far cry from concrete evidence that diesel particulate may cause children to be more susceptible to illness, especially given behavioral complications surrounding such a finding (many parents have greater concern for their smaller children, not necessarily implying the greatest risk group, but merely those that are brought to a hospital for treatment).

Perhaps as a result of the paucity of evidence of differential effects, in the case of diesel particulate, at least, OEHHA has strayed from its statutory mandate. The Children's Environmental Health Protection Act ("SB 25") requires OEHHA to list up to five TACs that "may cause infants and children to be especially susceptible to illness." In the case of diesel particulate, OEHHA has chosen a specific pathology – asthma – that it claims appears differently in children than in adults. OEHHA does not have scientific data linking diesel particulate to increased susceptibility in children but instead has identified what it claims to be a childhood pathology – an action which is outside the scope of its statutory authority. This strategy is similarly unconvincing as support for inclusion of diesel particulate in Tier 1.³⁶

Response III: The comment seems to indicate OEHHA believes that the increased prevalence rates of asthma in children relative to adults is due to diesel exhaust exposure. We have made no such statement nor drawn such a conclusion. The prevalence rate data themselves simply show a higher prevalence of asthma in children relative to adults. Thus children as a population are impacted by asthma, and therefore by TACs that exacerbate asthma, to a greater extent than adults. The argument OEHHA is making that children's smaller airways contribute to a worse outcome for asthma attacks than adults is not predicated upon an exposure difference as indicated in the comments. Rather the smaller airway argument is based on simple physics. The resistance to airflow is inversely proportional to the fourth power of the radius. A larger airway provides less resistance to airflow. If a larger airway constricts, the effect is less dramatic than if a smaller airway constricts. Breathing difficulty during an asthma attack can be a bigger problem in young asthmatics than in adult asthmatics. Finally, the comment implies that children are hospitalized at higher rates due to asthma attacks because parents are more

³⁵ Daland R. Juberg. *School Buses and Diesel Fuel*. American Council on Science and Health. (June 2001), available at http://www.acsh.org/publications/reports/school_buses.html.

³⁶ Moreover, even if it were appropriate for OEHHA to target a childhood pathology rather than TACs that differentially affect children, it certainly would be arbitrary for OEHHA to include diesel particulate on Tier 1 because of its alleged contribution to that pathology, while ignoring formaldehyde – which the NAS has identified as causing asthma, which is ubiquitous in the indoor environments in which people spend most of their time, and which has been shown to specifically impact children.

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concerned about kids and therefore bring them to the hospital. While a number of factors influence who seeks treatment for asthma, hospitalization data reflect a physician's decision to hospitalize, not a parent's decision to seek treatment. Hospitalization is, therefore, not a discretionary event, and only occurs in severe cases. Rather, the fact that 0 to 4 year olds are hospitalized at a greater rate than any other age group corresponds to the physics of resistance to airflow being inversely proportional to the fourth power of the radius.

Comment III: OEHHA's Procedural Defects Have Undermined the Credibility of the SB 25 TAC Listing Process.

OEHHA's decisions surrounding the final comment period and its deference to the wishes of SRP cast doubt on the procedural integrity of this Tier 1 prioritization process. The Prioritization invokes the procedural safeguards of the California Administrative Procedure Act ("APA"),³⁷ which, at a minimum, requires OEHHA to give notice and provide a period for public comment on the revised Prioritization *prior* to its adoption. Yet, in an effort to meet the July 1, 2001 statutory deadline, OEHHA chose to issue the revised Prioritization without providing such an opportunity for public review. Instead, OEHHA adopted the Prioritization subject to a comment period that is scheduled to close on July 13, 2001 – 12 days *after* OEHHA was required by SB 25 to issue the Prioritization. By scheduling a post hoc period of "reconsideration," rather than a meaningful period for public comment, OEHHA violated the APA.

Moreover, despite SB 25's express requirement that OEHHA "establish"³⁸ the Prioritization of TACs, the SRP revised the Prioritization at its June 15, 2001 meeting, and OEHHA merely "rubber-stamped" the revision without engaging in a critical review of the changes made to the TAC listing.³⁹ OEHHA acquiesced in the SRP's revisions to the TAC listing, without further scientific review and absent any oversight by Joan Denton, Director of OEHHA, who was not present at the meeting. By revising the TAC listing, the SRP exceeded its statutory authority to merely "review"⁴⁰ the Prioritization, not to modify the TAC listing on its own accord. At the same time, OEHHA improperly failed to "establish" the Prioritization, contrary to the language of SB 25.

Response III: The comment indicates a misunderstanding of the process of peer review under SB 25 conducted by the SRP, and the activities and results of the June 15, 2001 SRP meeting. Health and Safety Code Section 39669.5 requires OEHHA to establish a

³⁷ The Prioritization invokes these procedural safeguards because it reflects an exercise of quasi-legislative power by OEHHA and qualifies as a regulation under the APA.

³⁸ CAL. HEALTH & SAFETY CODE § 39669.5(a)(1).

³⁹ Although OEHHA entered this meeting with diesel particulate in Tier 2, the SRP members proposed to elevate diesel particulate to Tier 1 and drop benzene and formaldehyde to Tier 2 before OEHHA was even able to discuss its current assessment of diesel particulate.

⁴⁰ CAL. HEALTH & SAFETY CODE § 39669.5(a)(2).

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list of up to five TACs that may cause infants and children to be especially susceptible to illness. OEHHA must provide the list and a report containing its reasons for including the TACs on the list to the Scientific Review Panel. The SRP “in a manner consistent with this chapter[3.5], shall review the list of toxic air contaminants submitted by the office [OEHHA]...” Thus, the SRP must provide comment and develop findings as they do for any Toxic Air Contaminant identification document. There were three meetings of the SRP devoted to discussion of the issues in the OEHHA document and development of the list by OEHHA. OEHHA revised the document per the discussions at the SRP meetings and also per public comment. The SRP did not revise the list. The SRP voted to provisionally approve OEHHA’s proposed revised list at the June 15th SRP meeting pending another public comment period. Thus, the comment’s contention that OEHHA adopted the prioritization prior to public comment is incorrect. OEHHA has not yet adopted the list of up to five TACs. The Director of OEHHA is awaiting the results of the final public comment period and evaluating the information from the most recent SRP meeting before establishing a list.

The comment also appears to imply that the development of the list by OEHHA of five TACs that may cause infants and children to be especially susceptible to illness is subject to the Administrative Procedure Act (“APA”). However, the APA does not apply to the SB 25 listing activity undertaken by OEHHA. That is, the list of five TACs developed by OEHHA is not the adoption of “regulation[s]” as that term is defined by Government Code Section 11342(g). The list created by OEHHA does not subject any entities to any duties. Nor does it in any way limit the activities of any entities. Rather, consistent with the general TAC program, the rulemaking activity will be undertaken by the ARB at such time as it adopts any regulations setting standards regarding this subset of TACs. State agencies are not required to engage in serial rulemaking for a component of a more comprehensive rulemaking effort. This is especially true when, as in this case, the initial component is not itself a “regulation” within the meaning of the APA.