PART C

PUBLIC COMMENTS AND ARB/OEHHA STAFF RESPONSES TO PART A AND PART B OF THE PROPOSED IDENTIFICATION OF DIESEL EXHAUST AS A TOXIC AIR CONTAMINANT REPORT

PUBLIC COMMENT AND
SRP VERSION

Prepared by the Staffs of the Air Resources Board and the
Office of Environmental Health Hazard Assessment

February 1998

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Part C

Summary of Comments Received and our Responses on the May 1997 SRP Version of the Diesel Exhaust Part A Report

Natural Resources Defense Council

Janet Hathaway, August 22, 1997

1. Comment: ARB's exposure assessment may underestimate exposure to diesel exhaust.

Response: We have indicated in the Executive Summary on pages ES-11 and ES-14 and in Part A on pages A-53 through 55 where we believe our exposure calculations may be underestimated. Primarily, the exposure estimates may be underestimated because we do not account for other routes of exposure such as deposition on water and vegetation and particle precursor emissions from diesel engine exhausts.

2. Comment: ARB estimates ambient diesel exhaust exposure based solely on diesel particles - excluding vapor and gas-phase diesel constituents.

Response: There are limited or no data available to quantify the gas/vapor phase component of diesel exhaust emissions. We have, however, used existing data to enhance our discussion on the gas/vapor phase constituents of diesel exhaust throughout the report. We will also incorporate results from the CE-CERT study, which has an extensive analysis of the gaseous components of diesel exhaust, into our final draft report.

3. Comment: Data collected for the San Joaquin Valley may not adequately represent the other air basins.

Response: Individual scaling factors were used to account for different quantities of emissions in other air basins. For example, data taken in the San Joaquin Valley indicate that 2.1 percent of the PM_{10} inventory come from diesel engines (Appendix B, page 72). In Sacramento, the percentage is 2.65. To adjust for the varied diesel exhaust sources and activity in Sacramento, a scaling factor was used of 1.26 (2.65/2.1). The Sacramento Valley estimate would then be obtained by using the additional scaling factor of 1.26 above and beyond the method used for the SJV. Until more research is done to estimate sources and activity specific to other air basins in California, we believe that the above method is the best approach.

4. Comment: ARB's PM_{10} emission projections may underestimate Californian's actual inventory. ARB's projections are inconsistent with other data and trends, including historical increases in diesel usage.

Response: We recently updated the exposure analysis to reflect the use of the most recent motor vehicle emissions inventory model, EMFAC7G, to project diesel exhaust PM_{10} emissions. This model incorporates the U.S. EPA's Part 5 Model emission factors, which account for more realistic driving conditions like speed correction factors and temperature. The data we used to project emissions of diesel exhaust PM_{10} considers the diesel vehicle activity (vehicle miles traveled), growth in vehicle population, and fuel consumption and is California specific. While it is true that we have projected an increase in growth and diesel fuel use for years 2000 and 2010, it is offset by the control measures adopted by the ARB and U.S. EPA (see page A-34).

5. Comment: Exposure to the atmospheric transformation products of diesel exhaust, which may increase the mutagenicity and the carcinogenicity of diesel exhaust is not considered.

Response: We have enhanced our discussion on the atmospheric transformation products of diesel exhaust into our report (see page A-12). We have also included a discussion of a new study that examined a new class of mutagenic compounds found in diesel exhaust into the Executive Summary (page ES-6) and Part A (page A-13) of the report.

6. Comment: ARB's exposure assessment is based on average activity patterns and fails to evaluate potentially higher exposures for young Californians.

Response: ARB's exposure assessment did not use "average activity patterns." We used all of the activity pattern data from both our adult and children's activity pattern studies in the analysis. This includes all 2000 actual children's activity diaries in our statewide data base. Thus, the additional time children spend outdoors was included in the inputs used to develop the population estimates (see page A-50 and Appendix D).

7. Comment: ARB's exposure assessment didn't account for higher diesel exhaust exposures typically experienced in poorer neighborhoods (near freeways, railroad tracks, etc.).

Response: We are not aware of any data collected in those areas that may have potentially higher diesel exhaust exposures. It does seem reasonable that exposures in those neighborhoods may be greater than the general population, however, we have no data available that indicate that exposures to diesel exhaust may be higher in such neighborhoods.

8. Comment: ARB's exposure assessment fails to consider routes of exposure other than inhalation.

Response: We did not calculate exposure from other routes because we do not have data to support a multi-pathway approach. We have enhanced the discussion in our report to indicate that there may be higher risk from exposures by other routes (see Executive Summary, page ES-11 and Part A, page A-55).

9. Comment: The range of diesel exposures - not just the averages - should be presented in the exposure assessment and considered in the risk assessment.

Response: For our indoor and total exposure assessment, we used distributions throughout the analysis, not just an average value. We report our numbers in mean and standard deviation, along with the shape of the distribution. We have provided tables in the report that reflect the full ranges of exposure (see page A-50 to A-53 and Appendix D).

10. Comment: ARB underestimates the migration of diesel exhaust into indoor air. Many Californians have indoor environments which do not filter diesel exhaust.

Response: We used the available data on filtration in buildings and other information to develop our penetration estimates. As summarized in Table 4 on page 16 of Appendix D, we used different penetration factors and six exchange rates for different types of buildings. Penetration estimates were based on factors such as the degree of filtration such buildings typically have (Tables C3-C5). Residences, for example, were assumed to have very little filtration of particles, because most outdoor air enters homes unfiltered, and filters used for recirculated air typically filter only minimal amounts of fine particles.

Engine Manufacturers Association

Glenn F. Keller, December 12, 1997

1. Comment: The ARB should not list whole diesel exhaust as a TAC. The Executive Summary states that the first step in the AB 1807 identification process is to determine if a substance is toxic. Diesel exhaust is a not a substance, but rather a complex mixture of substances, many of which are non-toxic. We recommend that you be consistent through both Parts A and B of the report in clarifying that diesel exhaust particulate matter is the constituent of concern in your TAC analysis.

Response: Under state law, the Air Resources Board is to identify a substance as a toxic air contaminant if it determines the substance is "an air pollutant which may cause or contribute to an increase in mortality or and increase in serious illness, or which may pose a present or potential hazard to human health." Under this same law, an air pollutant may include groups of substances such as soot, gases, particulate matter, smoke, or any combination (Health and Safety Code section 39013). The ARB has already identified groups of substances such as chromium and chlorinated dioxins and dibenzofurans as well as several groups of substances that are listed as TACs by the ARB and hazardous air pollutants by the U.S. EPA (Table III-1, page A-7).

In our review of diesel exhaust, we are examining the overall toxicity of the exhaust. The reason we are doing this is because the exposure experienced in most health studies, particularly the human studies, has been to the overall exhaust. The International Agency for Research on Cancer, the National Institute for Occupational Safety and Health , and the United States

Environmental Protection Agency have also evaluated diesel exhaust in this way. Until more research is done to identify specific causes of toxicity in diesel exhaust, we believe this approach provides the best public health protection.

We have also made it clear that our exposure analysis is based primarily on exposures to diesel exhaust particulate matter in the Executive Summary, pages ES-7 and ES-11, and in Part A, pages A-2, A-22, and A-40.

2. Comment: Use of whole diesel exhaust versus diesel exhaust PM should be used consistently throughout the report.

Response: We have made these corrections throughout the report. However, there are cases where we talk about diesel exhaust as a whole and are not specifically referring to our exposure analysis based on diesel exhaust PM_{10}.

3. Comment: Appropriate emphasis on chemical species found in diesel exhaust should be noted throughout the report. The majority of exhaust components exist as nitrogen, carbon dioxide, oxygen, and water vapor.

Response: We have enhanced our discussion on the characterization of the compounds found in diesel exhaust in the Executive Summary (page ES-6), in Part A, pages A-1, A-5, and A-6, and have added a paragraph to qualify the information presented in Appendix A.

4. Comment: The sentence on page A-2, line 1, states that diesel particles constitute the majority of risk: this is less certainly known than the term "constitute" implies.

Response: We have changed the language on page A-1, and throughout the report, to indicate the diesel exhaust particles carry many of the harmful organics and metals present in the exhaust. The term "constitute" has been removed from the sentence.

5. Comment: The paragraph on pages A-4 and A-5, and Table II-1, both inadequately describe the TACs for two reasons: both the table and text must "stand alone" because either may be quoted separately, and that the table and text include the accurate qualifiers- 1) that not all diesel engines emit all of the listed substances, and 2) that determining the magnitude of these substances in the exhaust is essential in order to accurately assess the potential health hazard.

Response: Both the text and the Table have been revised to include language that states that further research is needed to determine the contribution of many of these substances to atmospheric diesel exhaust exposures (see page A-6 and Table III-1 on page A-7).

6. Comment: The sentence on page A-2, second paragraph "... may promote cancer..." overstates present knowledge.

Response: We have removed the language "... may promote cancer..." from the sentence on the former page A-2. The text now reads "Diesel exhaust particles carry many of the harmful organics and metals present in the exhaust" (page A-1).

7. Comment: The statement on page A-10 "... SOF of the diesel exhaust particle is mutagenic, carcinogenic, or both" is overstated.

Response: We have revised the sentence to read "... several studies show that portions of the SOF of the diesel exhaust particle contains substances which are mutagenic, carcinogenic, or both" (page A-13).

8. Comment: The sentence on page A-17, paragraph 4, beginning with "Furthermore, diesel exhaust-induced lung cancer in laboratory animals..." should be dropped because of the current state of knowledge regarding the mechanisms of the rat data.

Response: We have removed the sentence on page A-17 "diesel exhaust-induced lung cancer in laboratory animals" from our exposure analysis. This is covered in OEHHA's health risk assessment document.

9. Comment: On Page A-29, paragraph 3, lines 3 and 5, "... toxic portion..." and "... toxic exposure ..." are overstatements because the toxic nature of diesel emission portions is under investigation. The bullets on page A-29 should remove the statements that PM is the primary carrier of the risk and that diesel exhaust PM is the cause of most of the lung tumor induction in animals.

Response: We have revised the bullets on page A-40 to reflect that diesel exhaust PM contains many of the toxic components of the exhaust and that diesel exhaust PM contributes a significant portion of the exposure to whole exhaust. We have also removed the portion of the sentence stating that diesel PM is associated with most of the lung tumor induction in animals. The mutagenic health effects from exposures to diesel exhaust particulate matter are covered in OEHHA's health risk assessment report.

10. Comment: The emissions reported by ARB on page A-2, and throughout the report, should include more combustion source acknowledgment than just diesel engines.

Response: We have included general statements about emissions from other combustion sources throughout the report (see Executive Summary, pages ES-6 and ES-11, and Part A, pages A-1 and A-6).

11. Comment: The statement, on page A-6 "... a significant portion...," overstates diesel contribution, and is not consistent with the data in Table IV-4, which states that particles are about 4 percent of PM_{10}.

Response: We have removed the sentence on page A-6 of the report (revised page A-8).

12. Comment: The statement on page A-6 regarding the emissions of diesel engine versus gasoline engine exhaust particulate matter is outdated. New diesel engines have better particle controls and thus the ratio of diesel exhaust PM_{10} to gasoline exhaust PM_{10} emissions is lower. Appendix C, of the Part A report, show the ratio of diesel to gasoline particulate matter is about 10:1 (compared with 50 to 200 times stated in Part A).

Response: The near source exposure estimate of 10:1, diesel to gasoline emissions, is based on ambient air concentrations taken from three 24-hour samples at two monitoring sites near a freeway in Los Angeles and the number of gasoline vehicles versus diesel vehicles. It is inappropriate to use these numbers to estimate the particle mass differences of diesel vs. gasoline engine emissions. We have, however, included more recent data from the 1996 World Health Organization report which states that diesel-fueled vehicles may emit particles at about 20 times greater than gasoline-fueled vehicles (see Executive Summary, page ES-6, and Part A, pages A-1 and A-8).

13. Comment: The statement on page A-47, paragraph 3, "fine carbonaceous PM" contributes to global warming is incorrect.

Response: We have removed the statement on fine particles contributing to global warming from our report.

14. Comment: On pages A-48 to A-51, the explanation of the atmospheric reactions involving PAH and PAH-derivatives are not unique to diesel exhaust. This section needs to be modified to reflect the contribution of diesel engines to these reactions.

Response: We have added a sentence to section B, Chapter VI (Atmospheric transformations of PAH and PAH-derivatives) stating that PAH are a product of incomplete combustion from a number of sources.

Western States Petroleum Association

Jeff Sickenger, August 22, 1997

1. Comment: Cal/EPA should rewrite the current Executive Summary in the form of a risk characterization using the Untied States Environmental Protection Agency's "Guidance For Risk Characterization" as the outline.

Response: We have re-written the Executive Summary as a result of comments received on the May 1997 draft report. It includes a summary of ARB's Part A exposure assessment and OEHHA's Part B health assessment of diesel exhaust. It also includes an assessment of risk and characterization of the general population's exposure to diesel exhaust. We believe that the

information presented in the Executive Summary and the Technical Support Documents Part A and Part B utilizes the best scientific approach in evaluating the exposures and health effects to diesel exhaust.

2. Comment: ARB should not list whole diesel exhaust as a toxic air contaminant because diesel emissions would be most effectively managed on a constituent-by-constituent basis.

Response: Although many researchers believe that the exhaust particle constitute the majority of the risk from exposures to diesel exhaust, the exposures actually experienced in most relevant health studies, both human and animal, has been to whole diesel exhaust. In addition, both the International Agency for Research on Cancer and the National Institute of Occupational Safety and Health have done their analyses on whole diesel exhaust. No diesel control measures are being proposed in this report. If diesel exhaust is identified as a toxic air contaminant, it will enter the control phase, or risk management phase, where the need for, and appropriate degree of controls will be assessed through a full public participation process.

3. Comment: Cal/EPA should evaluate the difference between historical locomotive diesel exhaust composition and present day diesel exhaust from heavy-duty on-road sources since the exhaust composition is likely to have significant differences.

Response: There is limited data on the exhaust emissions from pre-1970's locomotive engines to make a comparison to the exhaust of present day diesel engines. However, diesel fuel and exhaust are complex mixtures. The regulation ARB adopted to reformulate diesel fuel was specifically designed to reduce the total amount of emissions from older fuels (pre-October 1993). Even after the reformulation, the myriad of constituents and the complexity of the fuel and exhaust remain. It is our belief that the same holds true for the comparison of historical locomotive diesel exhaust and present day diesel exhaust from heavy-duty diesel vehicles. That is, although the exhaust emissions may have decreased in mass, the exhaust composition remains a complex mixture of organic and inorganic compounds.

4. Comment: ARB should eliminate, or at least segregate, the data on diesel exhaust composition from residual fuels (No. 4 and No. 6).

Response: Our exposure assessment, including emissions inventory and fuel data, is based on distillate number 2 diesel fuel (see page A-22).

5. Comment: The use of population-weighted average can be misleading and controls need not be based on this number.

Response: The population-weighted average exposure is weighted more heavily on the air basin that is the most populated. Thus, it represents a diesel exhaust particulate matter level for the majority of California's population. No controls are being proposed for the identification of diesel exhaust as a TAC. The identification phase of the air toxics program in California is separate

from the risk management phase. In the risk management phase, the ARB will conduct a needs analysis to determine if controls are necessary to reduce or eliminate the potential health risks to diesel exhaust exposure.

6. Comment: The exposure assessment should include use of an exposure distribution rather than a single population-weighted estimate.

Response: See response to NRDC comment 9. We used exposure distributions in all of our calculations. The ambient outdoor population-weighted exposure distributions were provided as a mean and standard deviation for each air basin and for the state. Those distributions for the South Coast, San Francisco Bay area, and the state were used to estimate population indoor and total air exposure distributions for those regions as described in Appendix D of the Part A document. Distributions were always used as inputs, and the exposure results are provided as distributions as well. Percentile values have been added to the revised report to better reflect the distributions used and obtained.

7. Comment: Characterization of uncertainty needs to be enhanced - specifically for near source exposures.

Response: Ambient data near sources are not included in our analysis. Therefore, there will be locations where the concentration is higher than those provided in the population distribution. There is limited data on near source exposures, and more data are needed to truly reduce the uncertainty. Without measurements, we are uncertain of the magnitude of the higher exposures.

8. Comment: A new interpolation scheme is needed to calculate ambient concentration patterns more accurately.

Response: Every model has limitations. In this case, the interpolation model does not interpolate when data is scarce. Sensitivity studies show population weighted average is insensitive for areas where ambient data are scarce. Intuitively this makes sense because monitors tend to saturate areas where the population is highest. We are willing to review and consider any alternative interpolation schemes submitted to us that may improve our analysis.

9. Comment: ARB should use a more recent base year (1995) to calculate exposure concentrations.

Response: In the current version of the report, we have estimated exposure concentrations for the year 1995. However, it is important to know that these numbers are based on emissions inventory extrapolations and not the extensive calculations used in estimating the 1990 exposure numbers. The foundation of our ambient exposure is based on CMB studies on data collected in 88-89 for SJV, 86, 88-89 for SCAB, and 91-92 for SFBA. As such, we based our emission inventory and analysis on 1990. Until such time that data similar to the CMB studies are available for more recent years, we have no basis for preparing our ambient exposure on a different base

year.

10. Comment: Use more recent motor vehicle emissions inventory model, EMFAC7G.

Response: We have updated our exposure analysis both in this version of the report and at the July 1, 1997, public workshop to reflect the incorporation of EMFAC7G1.0.

11. Comment: The exposure assessment should be adjusted downward due to indoor-outdoor differences.

Response: As discussed in Appendix D, the indoor-outdoor differences are fully integrated into the indoor and total air exposure calculation process. The available data on indoor-outdoor air exchange, particle penetration rates, building infiltration of particles, and other factors have been utilized fully to develop estimates of diesel particle concentrations inside various types of indoor locations. The major gap is that elevated "near source" exposure information is not available for use in the exposure estimation; such data would be expected to increase the estimated population exposure levels.

12. Comment: Additional high-side roadway ambient concentration bias may still be present.

Response: The monitoring sites are placed in locations that would not be exceedingly influenced by motor vehicle traffic. The ambient monitors are used to determine whether criteria pollutant ambient air quality standards are achieved and maintained. They are sited in accordance with federal and state requirements, which means that they are not overly influenced by freeway traffic. The sites are used to collect data for carbon monoxide (CO) and ozone. If the monitors are sited too close to "busy roadways" we will overestimate the CO concentrations and underestimate the ozone concentrations (nitric oxide ozone scavaging).

California Cotton Ginners and Growers Association

Roger A. Isom, August 20, 1997

1. Comment: The ARB should not identify diesel exhaust as a toxic air contaminant until the necessary studies can be done on using current day diesel engines and cleaner burning diesel fuel. Specifically, the ARB should delay action on the identification of diesel exhaust as a toxic air contaminant until the ARB-contracted studies, Bioassay and Chemical Characterization of the Vapor-Phase of Heavy-Duty Diesel Exhaust Using Reformulated Fuel and Evaluation of Factors that Affect Diesel Exhaust Toxicity, be done.

Response: We believe that there is sufficient scientific evidence to move forward with the identification of diesel exhaust as a TAC. Additional studies may add to the scientific knowledge, but are not necessary for the identification of diesel exhaust as a TAC. However, we will incorporate the results from the U.C. Davis study and the U.C. Riverside, CE-CERT study into

our final draft report. The CE-CERT study evaluates the diesel exhaust emissions from a current day heavy-duty diesel engine using three fuels: a pre-1993 diesel fuel, a 10 percent aromatic fuel, and an alternative formulation fuel.

Detroit Diesel Corporation

John W. Duerr, August 22, 1997

1. Comment: If the ARB designates diesel exhaust to be a TAC, then it will unjustifiably implicate diesel engines as a health concern in a way that will do irreparable harm to Detroit Diesel Corporation.

Response: No control measures are not being proposed in this report. Any consideration of control measures will be made only after a thorough public process including public workshops, meetings with affected industries, and local air pollution control districts.

2. Comment: The risk estimates presented in the report do not meet the requirements of being "based on sound scientific knowledge, methods or practices" and are "consistent with current scientific data."

Response: We believe that the conclusions in our report on the evaluation of the exposure and health effects are based on the best available scientific data and risk assessment methods and practices. The process used in California to identify a substance as a TAC involves extensive outreach including numerous public comment periods, workshops, meetings with affected industries, a review by the independent Scientific Review Panel (SRP), and consideration by the Board at a public hearing. Diesel exhaust entered the TAC identification program in 1989. Since that time, there has been two public comment periods, three workshops, a conference, and two updates at public meetings with the SRP. After this third comment period, we plan to meet with the SRP in late April to formally discuss the diesel exhaust identification report. If the SRP approves of the report's scientific conclusions, it will be presented to the Board for their consideration at a public meeting.

3. Comment: The report's conclusions are over generalizations of the scientific data. The majority (over 99 percent) of exhaust emissions are composed of carbon dioxide, water vapor, nitrogen, and oxygen. The remaining (less than 1 percent) of the exhaust is made up of oxides of nitrogen, carbon monoxide, sulfur compounds and carbonaceous soot. The report should clearly state this, and clarify that the exhaust emissions may vary depending on such factors as engine technology, fuel composition, and engine maintenance and operating conditions.

Response: We have added language to the report to enhance our discussion on the composition of diesel exhaust and how the exhaust composition could vary depending on such factors as engine technology and fuel composition (see Engine Manufacturers Association comment 3).

4. Comment: The Health and Safety Code specifically states the identification of a substance, not groups of compounds.

Response: See response provided in similar comment given by the Engine Manufacturers Association (see comment 1).

Joint Comments from Consortium of 32 Industries

August 25, 1997

1. Comment: The listing of whole diesel exhaust as a TAC effectively eliminates any flexibility in the risk management process and could have significant economic implications to industries that depend on diesel-fueled equipment.

Response: The identification of diesel exhaust as a TAC will not result in any economic impacts. If diesel exhaust is identified as a TAC under California law, it enters the risk management phase of the program. In this phase, the ARB conducts a needs analysis to determine if any regulatory action is necessary. In the needs analysis, the ARB looks at factors such as present and future emissions and the associated risks, already existing controls or emission standards, physical and chemical characteristics, available control technologies, associated costs for reducing emissions, and potential health, safety, and environmental impacts associated with the implementation of a control measure. Any consideration of control measures will be made only after a thorough public process including meetings with the affected industries, and public workshops. A ban on the use of diesel fuel in California is not an option that would be considered.

Southern California Gas Company

Michael J. Murray, July 1, 1997

General Public Comment

Steve Soriano, August 21, 1997
Jonathan Southard, July 19, 1997
Karin Steele, July 20, 1997
Richard Schmidt, July 21, 1997
Barbara Teare, July 22, 1997
Elena Goldstein, July 20, 1997
Laura Louttit, July 23, 1997
John Waugh Wright, July 24, 1997
Paul R. Teare, July 25, 1997
Brian Gordon, July 29, 1997
Walter Rivers, August 2, 1997
Mary Meays, August 4, 1997
Cin Greyraven, August 5, 1997

32 Person Signatures, August 8, 1997
Autumn Summers, August 12, 1997
Ken Russell, August 12, 1997
James Miller, August 12, 1997
22 Person Signatures, August 18, 1997

1. Comment: The ARB should proceed with the identification of diesel exhaust as a toxic air contaminant.

Response: The ARB is proceeding with the process to identify diesel exhaust as a TAC. The ARB continues to evaluate the exposure and toxicity of diesel exhaust in a full open public process, and will, if diesel exhaust is identified as a TAC, assess the need for future control in a similar open public process.