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Dr. Ruth Lunn, Director
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Dear Dr. Lunn:

RE: EXPOSURE IN THE TIRE MANUFACTURING INDUSTRY

I. INTRODUCTION

As promised in the February 28, 2012 comments of the Rubber Manufacturers Association (RMA) on the National Toxicological Program's (NTP) nomination of carbon black for consideration in the NTP's Report to Congress on Carcinogens, this submission communicates available information on air measurements of carbon black in tire manufacturing facilities. The Rubber Manufacturers Association (RMA) is the national trade association representing every major domestic tire manufacturer in the United States. Carbon black is one of the main ingredients in rubber tires.

Neither RMA nor its members performed any "special" monitoring studies in response to the NTP nomination. Rather, as described in more detail below, RMA gathered data from five RMA member companies that have tire manufacturing facilities located in the United States. These companies provided worker exposure air monitoring data that they already possessed in their files and which were created in the normal course of business. RMA then compiled the data in an anonymous format. The only carbon black exposure data that were widely available were collected utilizing the National Institute for Occupational Safety and Health (NIOSH)

Method 5000 (*i.e.*, a gravimetric measurement of total dust concentration).¹ As explained more fully below, only limited carbon black data are available utilizing the Institute of Occupational Medicine (IOM) particulate collector (used for measuring inhalable sized carbon black/other particulate) or utilizing the Occupational Safety and Health Administration (OSHA) ID-196 particulate measurement method² from some companies. However, these data were very limited in quantity and the concentrations cannot be compared to data from a “total dust” sample collected for carbon black utilizing NIOSH Method 5000. Therefore, such data are not included in this submission. Additionally, a variety of other airborne particles are present in most tire manufacturing facilities. Total dust measurements, therefore, are regularly performed to determine total particulate exposures in areas where carbon black concentrations are expected to be low and inseparable from other (non-carbon black) particulate matter that make up the total particulate value of the sample.

OVERVIEW OF EXPOSURE TO CARBON BLACK

Exposure to carbon black occurs primarily in the carbon black manufacturing workplace.³ The February 27, 2012 submission to the NTP from the International Carbon Black Association (ICBA) (ICBA 02-27-12 Comments) summarizes exposures in carbon black manufacturing plants.⁴ Exposures to carbon black in carbon black production facilities “vary markedly between

¹ NIOSH Method 5000, version 2, available at <http://www.cdc.gov/niosh/docs/2003-154/pdfs/5000.pdf>.

² OSHA, Carbon Black In Workplace Atmospheres, available at <http://www.osha.gov/dts/sltc/methods/inorganic/id196/id196.html>.

³ International Agency for Research on Cancer, Monographs on the Evaluation of Carcinogenic Risks to Humans, Volume 93 (2010). Carbon Black, Titanium Dioxide, and Talc at 63, available at <http://monographs.iarc.fr/ENG/Monographs/vol93/mono93.pdf> (IARC 2010 Monograph).

⁴ International Carbon Black Association’s Comments on “Request for Public Comment on Nominations and Call for Additional Nominations to the Report on Carcinogens” 77 Fed. Reg. 2728 (Jan. 19, 2012), available at <http://ntp.niehs.nih.gov/NTP/ROC/Nominations/2012/PublicComm/Boyd20120227.pdf> (ICBA 02 27 12 Comments to NTP).

and within any production facility and over time” but employees who handle carbon black are exposed to higher levels than other workers in the plants.⁵ Studies at carbon black facilities have shown a ratio of 0.033 to 0.37 between respirable carbon black particles and total dust particles.⁶ The ICBA 02-27-12 Comments also contain comparisons of respirable dust, inhalable dust, and total dust measurements, which confirm that respirable dust is lower than total dust levels.⁷

Operators in user industries (such as tire manufacturing during the preparation of rubber stock) “are expected to have significantly lower exposures to carbon black than workers in carbon black production.”⁸ Furthermore, workers in the tire manufacturing environment working downstream from the rubber mixing activities, as well as end users of rubber “are unlikely to be exposed to airborne carbon black particles, which are bound within the product matrix.”⁹

OVERVIEW OF A TIRE MANUFACTURING PROCESS

The tire manufacturing production process begins with the handling, weighing and mixing of raw materials, including carbon black, antioxidants, vulcanizing agents and other additives that combine to provide specific characteristics. The precise tire manufacturing process may vary between RMA member companies and within the plants operated by RMA member companies. Separate rubber compounds are used for different parts of the tire. A mixer first combines the various raw materials for each compound into a homogenized batch of black material with the consistency of taffy. The mixing process is computer-controlled to assure

⁵ Id. at 69 and 185.

⁶ Id. at 69 and 71 note in the table.

⁷ Appendix A (Additional Exposure Information) in ICBA 02 27 12 Comments to NTP, *supra* note 4.

⁸ Id.

⁹ Id. and Id. at 185.

uniformity. At this early point in the production process, carbon black becomes chemically bound in the rubber matrix. The compounded materials are then sent to machines for further processing into the sidewalls, treads or other parts of the tire.

Once the various tire components are produced, the components are assembled on a tire building machine. The end result is called a "green" or uncured tire. The "green" tire is placed into a mold and inflated to press it against the mold, forming the tread and the tire identification information on the sidewall. Then it is heated at more than 300 degrees Fahrenheit, vulcanizing it to bond the components and to cure the rubber.

Outside of the tire manufacturing arena, little is known about carbon black concentrations and particle size distribution at tire plants.¹⁰ In tire manufacturing facilities, total dust is a mixture of carbon black and a variety of other particles.¹¹ Generally, the highest concentrations in the air for carbon black exposure at tire manufacturing facilities appear during the unloading and mixing of carbon black and in the cleaning and maintenance of these areas, although these levels may vary between RMA member companies and within the plants operated by RMA member companies.

SAMPLING OVERVIEW

No special monitoring was undertaken to generate carbon black sampling data to submit to the NTP. Rather, RMA obtained from its member companies with plants in the United States all available comparable worker carbon black sampling results (*i.e.*, measurements that utilized a total dust collector and NIOSH Method 5000) from 2006 to 2011. A total of 251 samples were collected at 31 plants operated by five tire manufacturing companies. RMA then compiled and

¹⁰ Id. at 54, 63, and 77.

¹¹ Id. at 54 and 77.

evaluated this information on a blind basis (without identifying the companies or plants from which the data were gathered).

Particulate sampling involves three steps --- collection of the particulates, measurement of the total weight of the particles, and then a conversion of the weight and volume of air into a concentration of the particles (mg/m^3). The two primary methods of sampling (and measuring) for carbon black are (1) the total dust method (as required by OSHA) whereby all carbon black dust, along with any other particulate matter that may also be airborne at the time of collection, is captured onto a pre-weighed filter after first passing through the small housing opening; and (2) the inhalable dust method (as recommended by the American Conference of Industrial Hygienists (ACGIH) whereby all carbon black, along with any other particulate matter that may be also airborne at the time of collection, is captured onto a pre-weighed filter after first passing through an IOM sampler, which prevents (*i.e.*, excludes) all matter larger than that of inhalable size. Both types of samples are analyzed using NIOSH Method 5000; that is, a gravimetric method where any particulate matter captured on the filter is weighed and included in the final result. The results from these two collection devices are not comparable. Although the type of dust measured (total versus inhalable) is important in assessing potential health effects, the primary point for this discussion in this submission is to highlight that total and inhalable carbon black dust measurements cannot be compared. The data in this submission are total dust measurements (See the IARC Monograph and the ICBA 02-27-12 Comments to the NTP for more details on the distinction and relevance of total, inhalable, and respirable dust).

The measurements in carbon black user industries generally are non-specific dust measurements.¹² Neither of the two methods discussed above distinguishes between carbon

¹² Id. at 54, 63, and 77.

black and other particulate matter derived from other raw materials used in the process; they differ only in their size selection. The data being submitted are exclusively total dust measurements (using a total dust collector and NIOSH Method 5000) because there were not enough representative data available using any other methods. Although total dust measurements may still be utilized, there may be more data using these other test and collection measurements in the future.

Conceptually, the highest levels of carbon black exposure within a tire manufacturing plant are generally confined to unloading and mixing areas, as well as cleaning and maintenance of those areas. Thus, health and safety personnel in tire manufacturing companies rely on best professional judgment and process knowledge in selecting locations for personal carbon black sampling. Where other contributors to particulate exposure (*e.g.*, other raw materials in powder form) are present to the degree where they would likely cause a positive carbon black interference, those samples are classified as total particulate (rather than carbon black).

Therefore, while the data presented here are for carbon black exposures (which in some cases may include a positive interference from other particulate present and counted during the gravimetric analysis), members of the RMA have numerous other data points for total particulate exposures within the rubber mixing process and further downstream of the rubber manufacturing process which are even lower than what is expressed within the table for carbon black exposure.

For simplicity, RMA sorted the total dust concentrations measured by frequency of occurrence in the following ranges greater than 3.5 mg/m^3 (the OSHA permissible exposure limit (PEL) 8-hour time weighted average total particulate fraction), 3.5 to 2.65 mg/m^3 (100% of the PEL to 75% of the PEL), 2.65 to 1.75 mg/m^3 (75% to 50% of the PEL), 1.75 to 0.35 mg/m^3

(50% to 10% of the PEL), 0.35 mg/m³ and below (10% of the PEL and below), and nondetectable levels.

Total Dust Concentrations Measured in RMA Member Tire Manufacturing Plants

Data points greater than 3.5 mg/m ³	3.5 mg/m ³ - 2.625 mg/m ³	2.625 mg/m ³ - 1.75 mg/m ³	1.75 mg/m ³ - 0.35 mg/m ³	0.35 mg/m ³ or less	Non-Detections (Detection Limit 0.22 mg/m ³)
12	6	12	112	107	2

Overall, 88.0% of these high-end carbon black measurements were at or below 1.75 mg/m³. In fact, 43.4% of the measurements were at or below 0.35 mg/m³. All of the samples, were collected as part of routine air monitoring/ surveillance programs that serve to affirm acceptable workplace air quality levels and identify out-of-process conditions so corrective actions can be implemented.

CONCLUSION

Overall, these measurements are consistent with the IARC Monograph’s determination that the “results from particulate measurements” in the user industries (including tire manufacturing) “may indicate an upper limit of exposure” (that is, the workers with the highest potential for exposure). Such data do not represent tire plant-wide mean exposures. The data from tire manufacturing facilities in this submission cannot be used to determine mean concentrations on a plant-wide basis. Also, the results are consistent with the IARC conclusion that carbon black exposures in the tire industry and other user industries are expected to be significantly lower than for workers in carbon black production. The tire manufacturing industry has implemented numerous stringent engineering controls to minimize exposure to workers.

As RMA stated in its February 28, 2012 comments, an NTP listing of carbon black would be redundant because carbon black is already listed as a carcinogen by IARC (IARC 2B classification; *Possible Carcinogenic to Humans*) and California OEHHA, and it would fail to further inform United States regulators about any unknown or underappreciated risks. Thus, RMA believes there is limited benefit to an NTP listing. NTP resources may be better utilized addressing other chemicals. The process of developing, peer reviewing, receiving and responding to public comment on a carbon black nomination would consume significant NTP and private sector resources with no demonstrable benefit. In sum, the most efficient and prudent course of action is simply not to include carbon black in the NTP nomination process.

Please contact me at (202) 682-4836 if you have questions or require additional information.

Respectfully Submitted,

[Redacted]

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