Appendix C

2016 Multi-Purpose Lubricant Product Technical Assessment

Background

Multi-purpose Lubricant (MPL) products are defined as lubricants designed or labeled for general purpose lubrication, or lubricants labeled for use in a wide variety of applications.

In 2008, the California Air Resources Board (CARB or Board) approved amendments to the Consumer Products Regulation reducing the volatile organic compound (VOC) limit for MPL products from 50 percent VOC and establishing two technology forcing limits: a 25 percent by weight VOC limit effective December 31, 2013, and a 10 percent by weight VOC limit effective December 31, 2015. Because the limits were technology forcing, the regulation included a provision requiring staff to conduct a Technical Assessment to determine feasibility of the VOC limits prior to their implementation. Solid or semisolid products (primarily greases) were not considered a significant source of VOC emissions, and were excluded from the proposed VOC standard.

In 2011, staff conducted a Technical Assessment for the 25 percent VOC limit. Staff determined that while meeting the 25 percent VOC limit was feasible, it had proven challenging and the reformulation required more time than expected. As a result, in a 2013 rulemaking, the Board approved a three-year extension for the 10 percent VOC limit for MPL products to December 31, 2018, to allow manufacturers additional time to reformulate products once again to meet the 10 percent VOC limit.

Staff has now conducted the Technical Assessment for the 10 percent by weight VOC limit. Below are staff's findings.

Technical Assessment

Requirements

Companies that sell MPL products in California were required to provide data to ARB as part of the Technical Assessment evaluation by March 31, 2017. Data reporting was mandatory for all responsible parties that sold MPL products subject to the VOC limit in California during calendar year 2016.

Industry was required to report company information, including contact information. If a third party formulator was used, third party formulator and formulator contact information was required. Companies were required to report information about current MPL products sold in California during calendar year 2016 and product data on products proposed to meet the future 10 percent VOC limit. A proposed product was defined as a product or formulation that was evaluated to meet the upcoming 10 percent by weight VOC limit.

Reporting companies were required to indicate if the product was in the research and development (R&D) process. If the product was not in R&D, an explanation was required (such as “already compliant,” “discontinued,” etc…). Formula information including ingredients that comprise at least 0.1 weight percent of the product, and the maximum incremental reactivity (MIR) value for each ingredient listed was required. Companies were also required to provide product attribute information and a summary of R&D costs for each product formula in the R&D process. Labels for each reported product were also required.

Results

Fifty-six companies reported MPL data (see Table I) representing a total of about four million pounds of product sold during calendar year 2016. The ten companies with the most sales collectively account for over 95 percent of the MPL market. Staff identified over 120 unique MPL formulas subject to the VOC limit that were reported as part of the Technical Assessment evaluation.

Staff analyzed the MPL data to determine the VOC content and reactivity of the products. Staff also determined the compliant market share and evaluated the readiness of the remaining market share to meet the 10 percent VOC limit. As part of the assessment, staff considered various options to provide manufacturers more flexibility to comply with the VOC requirements.

Broad product types in the MPL category include oils, aerosol greases, food-grade lubricants, and lubricants intended for multiple uses. Oils comprise less than two percent of the MPLs market; these lubricants have not been impacted by progressive implementation of VOC limits (see Table II).

It appears that some manufacturers reformulated their MPL products to comply with 10 percent VOC limit as part of their reformulation to meet the current 25 percent VOC limit. While the data show a number of formulations below the 10 percent VOC limit, these formulas command a relatively small fraction of the MPL market. Products meeting the 10 percent VOC limit currently make up about eight percent of MPL sales (including products reported as oils).

Table I
List of Responding Companies

Company	Company
3M Company	NCH Corporation
Aervoe Industries, Inc	Oatey
Albatross USA	Permatex
AMSOIL	Petro-Canada Lubricants Inc.
Atco International	PJH BRANDS
BG Products, Inc.	QuestSpecialty Corporation
Chase Products Co.	Radiator Specialty Company
CNH Industrial America LLC	Rainbow Technology Corporation
CPC Aeroscience, Inc.	Rust-Oleum Corporation
CRC Industries Inc.	Share Corporation
Cyclo Industries, Inc.	Sherwin-Williams
Ecolab, Inc.	Slide Products, Inc.
Finish Line Technologies, Inc.	Sprayway, Inc
Fiske Brothers Refining Company	Starbrite Inc
Ford Motor Company	State Industrial Products
General Motors Customer Care and Aftersales	STIHL Incorporated
Golden State Supply, LLC	Synco Chemical Corporation
Husqvarna	The Blaster Corporation
International Lubricants, Inc.	The Chemours Company
ITW Pro Brands	THE PENRAY COMPANIES, INC.
John Deere Merchandise, A Div. of John Deere Shared Services, Inc.	The Valspar Corporation
Justice Brothers	Thetford Corporation
Kimball Midwest	Toyota Motor Sales, USA
Lawson Products, Inc.	Warren Distribution, Inc.
LHB Industries	WD-40 Company
Lucas Oil Products Inc.	Wurth USA Inc.
Maxima Racing Oils	Yamaha Motor Corporation USA
MOC Products Company, Inc.	ZEP INC

Staff analyzed company R&D efforts undertaken to achieve the technology forcing 10 percent VOC limit and demonstrate their progress toward meeting this limit. The company updates included the results of the testing and the testing protocols in some cases; information about the raw materials used (using a much more expensive material in some cases); evaluations of the performance of the raw materials; MIR values for VOC or LVP-VOC ingredients evaluated or used; as well as the cost of reformulation efforts. A significant number of manufacturers indicated that despite their best efforts, the 10 percent VOC limit remains the most challenging and costly to comply with. Seventeen new proposed formulas were reported. However, they are still being tested, so the results are uncertain. Several companies expressed their concerns as to

the feasibility of achieving the 10 percent VOC limit and anticipate discontinuing product sales in California.

Staff evaluated the reactivity of MPL products using the formulation information reported by manufacturers. Reactivity refers to the quantification of how different types of compounds contribute to the formation of tropospheric ozone. Some compounds are considered very "reactive" while others are non-reactive or have negligible reactivity to form ozone. The impacts on ozone formation are quantified using the Maximum Incremental Reactivity (MIR) scale. This numeric scale was developed by Dr. William Carter at the University of California at Riverside and is based on modeling analyses and other data derived from smog chamber studies (Carter, 2010).

The Board has already adopted regulations of consumer products based on calculations of their relative ground-level ozone impacts. The Aerosol Coating Products Regulation limits the ozone formation potential (or reactivity) of all aerosol coating product emissions (title 17, CCR, sections 94520-94528). Tables of MIR Values have also been adopted to implement this Regulation.[1]

In general, companies are meeting the 10 percent VOC limit by increasing the low vapor pressure VOC (LVP-VOC) content of these products. These compounds typically displace VOCs. In general, commonly used LVP-VOCs are slightly less reactive than commonly used VOCs in these products.

Analysis of the MPL data indicates that a significant number of formulations from several manufacturers already meet the 10 percent VOC limit. The analysis also shows that these formulations constitute a small percentage of the market. Staff's review of the manufacturers' efforts to reformulate MPL products to comply indicates that significant challenges remain in reformulating over 90 percent of the Multi-purpose Lubricant market.

Therefore, staff has concluded that providing a reactivity-based alternate compliance option to meet a reactivity limit would allow manufacturers additional flexibility to formulate products while preserving the air quality benefit already achieved by the mass-based VOC limit.

[1] Tables of MIR Values, title 17, CCR, Division 3, Chapter 1, Subchapter 8.6, Article 1, sections 94700-94701

Table II
Market Share of Multi-purpose Lubricant Product

Multi-purpose Lubricant Type	Sales Weighted Average VOC Weight Percent	Sales Weighted Product Weighted MIR	Number of Reported MPL Formulas	Number of Companies Reporting MPLs	Percent of Reported MPL Market Represented	Group Mass (lbs/yr)
MPL#	23.2	0.44	97	35	98.1	4,084,590
Oil	0.0	0.00	32	9	1.9	79,428
All	**22.7**	**0.43**	**129**	**41**	**100.0**	**4,164,018**

 # excludes oils

Staff calculated the product weighted maximum incremental reactivity (PWMIR) of the MPL products based on formulation information reported by companies as part of the Technical Assessment. This analysis of the ozone air quality impacts of the emissions from MPL products indicated that as a whole the category has a relatively low reactivity. As shown in Table II, products, which are oils, comprise two percent of the MPL market and have not needed to reformulate to meet progressively stringent VOC limits. Removing the oils, which are zero VOC zero MIR lubricant products provides a more complete view of the reformulation effort results. Once oils are excluded, the sales-weighted average PWMIR of current MPL products compliant with the 10 percent VOC limit is 0.49 grams of ozone per gram of product (see Table III). If that group is extended to include the MPL products compliant with the current 25 percent VOC limit, the sales-weighted average PWMIR of those products is 0.44 grams of ozone per gram of product. The proposed alternate compliance option would create a path to cap the reactivity of products at a level lower than that of the sales-weighted average reactivity of products currently compliant with the 10 percent VOC limit. Based on these results, staff developed the alternate compliance option such that that reformulating product to comply under the option would ensure that the ozone air quality benefits are maintained.

Table III
Product-Weighted Reactivity of
Multi-purpose Lubricant Product (Excluding Oils)

Multi-purpose Lubricant VOC Range	Sales Weighted Average VOC Weight Percent	Sales Weighted Product Weighted MIR	Number of Reported MPL Formulas	Number of Companies Reporting MPLs	Percent of Reported MPL Market Represented	Group Mass (lbs/yr)
0-10	0.6	0.49	37	10	6.3%	257,958
0-25	22.5	0.44	91	31	97.4	3,976,849
0-50	**23.2**	**0.44**	**97**	**35**	**100.0**	**4,084,590**

Summary

When the Board approved the technology forcing VOC limits for MPLs, it was understood that reformulation of products to meet the VOC limits, particularly the 10 percent VOC limit, would be a challenging undertaking. This expectation has been borne out. Nine years into implementation of these limits, nearly all MPLs now meet the 25 percent VOC limit; however, only about eight percent of product meets the 10 percent limit. In fact, many manufacturers have yet to develop formulations that comply with the 10 percent VOC limit while maintaining product functionality. Based on staff's review of the data, it is uncertain whether a significant portion of the market share could meet the 10 percent limit by the December 31, 2018 compliance deadline.

Staff's review of product reactivity reveals that, on a sales-weighted basis, the reactivity of MPL products meeting the 10 percent VOC limit is matched by that of product meeting the 25 percent limit. In view of reactivity considerations, one could say that the ozone air quality benefits of this regulation are being achieved ahead of schedule. In order to lock in these benefits while providing additional compliance flexibility to manufacturers, staff is considering amendments to the Consumer Products Regulation to include an alternate compliance option. This option will be based on a reactivity limit that would ensure air quality benefits equivalent to or better than those achieved by the products meeting the 10 percent VOC limit. Staff is also considering adding a restriction to prevent the use of high GWP compounds in multi-purpose lubricants.

Reference

Carter, W. P. L. "Development of the SAPRC-07 Chemical Mechanism and Updated Ozone Reactivity Scales." Report to the California Air Resources Board, Contracts No. 03-318, 06-408, and 07-730, Revised January 27, 2010 (Carter, 2010)