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Docket Management Facility (M–30)
U.S. Department of Transportation
West Building Ground Floor, Room W12–140
1200 New Jersey Avenue SE, Washington, DC 20590

SUBJECT: Office of Hazardous Materials Safety, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation Advanced Notice of Proposed Rulemaking: Hazardous Materials: Volatility of Unrefined Petroleum Products and Class 3 Materials, [Docket PHMSA-2016-0077 (HM-251D)]

The American Petroleum Institute (API) offers the following comments on the Pipeline and Hazardous Materials Safety Administration's (PHMSA) Advanced Notice of Proposed Rule Making (ANPRM) PHMSA-2016-0077 (HM-251D), "Hazardous Materials: Volatility of Unrefined Petroleum Products and Class 3 Materials." API is a national trade association that represents almost 640 members involved in all aspects of the oil and natural gas industry, including producers, refiners, suppliers, pipeline operators and marine transporters, as well as service and supply companies that support all segments of the industry. API members are deeply committed to safe, secure, and environmentally responsible operations which reduce potential risk to the public, as well as employees, contractors, and operations.

Safety is the core value of the industry and we continue to work with PHMSA and the Department of Transportation (DOT) to ensure we are operating in a manner that protects our workers and communities, promotes safe practices, and improves our ability to deliver critical products around the nation to meet consumer demand. The Federal hazardous materials transportation law (49 U.S.C. 5101et seq.) directs the Secretary of Transportation to establish regulations for the safe and secure transportation of hazardous materials in commerce, as the Secretary considers appropriate. API and our members do not believe this proposal will enhance safety in transportation. Our collective focus should be on preventing accidents. The product being transported has no part in the causes of accidents. New unilateral vapor pressure limits during transportation will not mitigate or reduce the severity of accidents; it could, however, put upward pressure on prices and could hamper domestic production, job creation, and tax revenue to communities. Proper infrastructure maintenance and transportation practices are the only ways to reduce accidents.

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General Questions

The Need for Supporting Science

API and its members are committed to the safe transportation of crude oil and petroleum products, and support sound science and risk based regulations, legislation and industry practices that have a demonstrated safety benefit. API is extremely concerned that PHMSA has suggested establishing vapor pressure limits for unrefined petroleum products and potentially all Class 3 flammable liquid hazardous materials that would apply during the transportation of these materials by any mode. Based on available data, there is currently no scientific basis to support such a consideration of vapor pressure limits. As PHMSA notes in the ANPRM, the study commissioned from Sandia National Laboratories to review available crude oil chemical and physical property data literature to characterize and define tight crude oils based on their chemical and physical properties and to identify properties that could contribute to increased potential for accidental combustion has yet to be completed. The study is only in stage 2 of four. Per the ANPRM addressing the first stages of the study:

> "An important outcome of the review was formal recognition of the wide ranging variability in crude oil sample type, sampling method, and analytical method, as well as the acknowledgement that this variability limits the adequacy of the available crude oil property data set as the basis for establishing effective and affordable safe transport guidelines."

The incompleteness of the government study alone should give pause to PHMSA's efforts. Additionally, the Sandia study has no scope to determine the effectiveness of vapor pressure limits for potentially all Class 3 flammable liquid hazardous materials. If a vapor pressure limit were imposed for all Class 3 flammable liquids, this would potentially fundamentally change how all these products are classified and packaged, pulling in a universe of products that PHMSA has not addressed in this ANPRM. It should also be noted that PHMSA has already recognized in regulation API's Recommended Practice 3000, *Classifying and Loading of Crude Oil into Rail Tank Cars,* which specifically addresses sampling, testing, and classification issues. API members are actively participating in the Sandia study to provide the samples necessary to complete the study, which we feel could provide the scientific basis for any considered changes to the U.S.' Hazardous Materials Regulations (HMR, CFR 49 Parts 100 To 185). Any determinations to make changes to the HMR or the requirements for the transportation of these products not based on sound science and data would not achieve the proposed rulemaking objectives and could potentially cause significant, prolonged disruptions to supplies that are critical to the North American economy.

The impetus of this ANPRM, the request by the Office of the New York State Attorney General in their Petition (P-1669), P–1669, to add a new paragraph (a)(6) to existing § 174.310 requiring all crude oil transported by rail to have a Reid vapor pressure (RVP) of less than 9.0 pounds per square inch (psi) at 100 °F, V/L ratio of 4/1, is based on a false premise. The petition states "the high volatility of certain forms of crude oil, and of Bakken crude oil in particular, has contributed to the large explosions and severe fires that have resulted from train crashes and derailments in

recent years." However, as stated in the comments above, there is no available science to support this conclusion. Former PHMSA Deputy Administrator Timothy Butters[i] and NTSB Chairman Chris Hart have both spoken to this point. According to Chairman Hart, "Our accident investigation experience, from the ones that we have looked at, has not indicated that volatility is a significant issue" Hart said in an interview with KFGO News. "The biggest contributor to a large explosion or fire is how much product is released, rather than the volatility of the product."[ii] In the ANPRM, PHMSA has specifically requested relevant or other empirical support for a volatility standard. It is the position of API and our membership that no such support exists in the available data.

Science and experience demonstrate that Class 3 materials ignite and burn within the range of their flammability limits, given an ignition source. The Vapor Pressure of Class 3 materials, whether zero, 40 psia (approx. the Liquid-Gas definitional threshold at standard conditions), or higher, is immaterial. Packages/containers of Class 3 liquids (such as tank cars or cargo tanks) can potentially rupture (heat induced tearing and deflagration events) when impacted with enough velocity during a derailment or when subjected to pool fires resulting from loss of containment. The net force and the sparks generated in train wrecks caused by track, equipment, and/or human failures are the primary factor contributing to the expected degree, consequence, or magnitude of a release or the likelihood of a fire during an accident. API recognizes the genuine concerns generated by several high profile rail incidents starting in 2013, but the science, lessons learned and investigations have all failed to reveal any connection between the vapor pressure of the product and the outcomes of the incidents. The causal association of a rise in the movement of one type of product (specifically crude oil produced in the Bakken shale formation) and the intensity of an incident is without scientific merit. It is necessary, based on the questions repeatedly asking for evidence in the ANRPM, to reiterate that neither PHSMA, NTSB, the Canadian government, nor the Sandia study (funded by PHMSA, Transport Canada and the U.S. Department of Energy) has found evidence to suggest that reducing the vapor pressure of a product would reduce the risk of death or damage from fire or explosion in the event of an accident.

Globally Harmonized Transport Regulations

There is no scientific reason to diverge from the transport hazards classification & identification processes set forth by the United Nations Model Recommendations on the Transport of Dangerous Goods (UNMR). Per international agreement, PHMSA is obligated to ensure harmonization with these standards regarding the transport of Dangerous Goods/Hazardous Materials (DG/HazMat). The UNMR are designed to enhance global trade, economic development, improve safety and compliance-enforcement capability while simplifying training requirements for multi-modal cross regional transport of DG/HazMat. The need for repackaging, re-marking, re-documenting at national borders or between modes is eliminated. Incorporation of a VP threshold for the definition of Class 3 Liquids versus Division 2 Gases will be highly disruptive and extremely costly.

Vapor pressure should be considered as one property of a flammable liquid when choosing the appropriate package. Current United Nations (UN) standards for the transportation of dangerous goods (TDG) use boiling point, vapor pressure and flash point to define a flammable liquid as a Class 3 DG/HazMat. Specifically, the substance should "have at 50 °C (122 °F) a vapor pressure of not more than 300 kPa (43.5 psia) or is not completely gaseous at 20 °C (68 °F) and at standard pressure of 101.3 kPa (14.7 psia)."[iii] Current DOT standards require a design to meet these limits, while the typical vapor pressure of crude oil is lower than 14.7 psia near atmospheric (at 100 °F with V/L ratio of 4/1). If anything, current tank car design standards go far and above to provide a safe package for flammable liquids in transportation. API and our members, through our advocacy to promote the adoption of the CPC 1232 petition car and later comments on the DOT 117 tank car regulated in DOT HM-251, have long supported the adoption of the safest, achievable package to ensure the safe delivery of our products. Thus, if there is to be a vapor pressure limit put in place, it should be a limit placed on what the package can handle in a safe manner and not a vapor pressure limit placed on the product being transported. It is also important to recognize that U.S. regulations for hazardous materials and their packages are currently developed in harmony with other North American partners to ensure there is continuity for commerce across our borders. Unilateral changes to these standards will impact international commerce if there is no longer harmonization between U.S., Canadian and Mexican regulations for the transport of hazardous materials.

In addition, the UN standards have been agreed upon by the UN Subcommittee of Experts on the Transportation of Dangerous Goods (TDG) and were created with the understanding that "with different regulations in every country and for different modes of transport, international trade in chemicals and dangerous products would be seriously impeded, if not made impossible and unsafe. Moreover, dangerous goods are also subject to other kinds of regulations, e.g. work safety regulations, consumer protection regulations, storage regulations, environment protection regulations."[iv] Unilateral or arbitrary changes to the HMR domestically which are not in harmony with UN TDG requirements will severely impact trans-border shipments of these products. This will also create significant regulatory uncertainty if shippers' and carriers' expectations of what is in the package are not aligned as commerce crosses borders.

The Operating Environment

Current practices in the oil and natural gas industry to remove dissolved gases from crude oil after production are carried out exclusively for operational or market requirements (excluding the NDIC vapor pressure standard). Further, these dissolved gases are themselves valuable commodities that producers wish to recover and sell. In some instances, dependent on existing infrastructure, and the available markets and price, operators may elect to remove these lighter molecules at the wellhead for processing and sale. In other instances, operators may elect to move the lighter molecules as part of the unrefined petroleum. Regardless of the existence of lighter molecules within crude oils, products are and can still be classified and transported safely under existing regulations even given the variability of product characteristics across North

America and even within the same shale plays or conventional production fields. There is no evidence to show that the approved packages and classification schemes for flammable liquids are inadequate and thus no need for a vapor pressure limit. In each of the crude by rail accidents cited by the NY Attorney General there was no evidence that the product was misclassified per the HMR.

Conformance to current DOT regulations for rail, as well as truck, pipeline and vessel have been proven by the safety record of the oil and natural gas industry to deliver products safely across all modes. **Applying a vapor pressure limit to all modes would materially alter the products being transported and could have many unintentional consequences that could potentially disrupt the oil and natural gas supply chain.** The industry, and PHMSA, would need to potentially reevaluate the current system to determine whether the package specifications were still appropriate for a materially altered product. In the pipeline industry, vapor pressure is a function of the engineering and design of the pipeline, the intended resulting product, as well as the specification of the downstream customer. Changing the vapor pressure requirement during transportation could impact the existing supply chain if the end user's operations are configured for a product with a different vapor pressure, particularly as needs change between summer and winter fuels. The oil and natural gas supply chain is an extremely complex system based on market demands, engineering and design standards, product specifications, existing infrastructure and government regulations. Any change to the vapor pressure requirement during transportation is likely to have more wide ranging impacts than are conceived of in this ANPRM.

The oil and natural gas industry takes a very pragmatic approach to risk management to ensure safety throughout the supply chain. In addition to the myriad of regulations from OSHA, EPA, DOT, PHMSA, TSA, DHS and state agencies, the industry develops voluntary consensus standards to improve safety, develops consensus-based approaches to emerging challenges, and shares that information broadly across a global industry. API and our members participate in our own American National Standards Institute (ANSI)-approved standards development processes, as well as in groups such as the UN Subcommittee of Experts on the Transportation of Dangerous Goods, the Crude Oil Quality Association, the Canadian Crude Quality Technical Association, ASTM International, and others that study ways to improve the understanding of the characteristics of crude oil and natural gas, and the classification and appropriate packaging for dangerous goods and flammable liquids. The long history of research and collaboration amongst the experts from these groups, and the experiences within the industry, also does not support the linkage between a limited or lower vapor pressure and improvements in safety. What they have revealed is the importance of understanding the characteristics of the products and the importance of maintaining the quality of the products from the wellhead to the refinery.[v]

In terms of what characteristics should be considered for classification, the HMR sets out the following definition in 173.115 Class 2, Divisions 2.1, 2.2, and 2.3 - Definitions:

> (a)Division 2.1 (Flammable gas). For the purpose of this subchapter, a flammable gas (Division 2.1) means any material which is a gas at 20 °C (68 °F) or less and 101.3 kPa

(14.7 psia) of pressure (a material which has a boiling point of 20 °C (68 °F) or less at 101.3 kPa (14.7 psia)) which
(1) Is ignitable at 101.3 kPa (14.7 psia) when in a mixture of 13 percent or less by volume with air; or
(2) Has a flammable range at 101.3 kPa (14.7 psia) with air of at least 12 percent regardless of the lower limit. Except for aerosols, the limits specified in paragraphs (a)(1) and (a)(2) of this section shall be determined at 101.3 kPa (14.7 psia) of pressure and a temperature of 20 °C (68 °F) in accordance with the ASTM E681-85, Standard Test Method for Concentration Limits of Flammability of Chemicals or other equivalent method approved by the Associate Administrator. The flammability of aerosols is determined by the tests specified in paragraph (l) of this section.[vi]

Vapor pressure is a threshold criteria used to determine a Class 3 liquid from a Division 2 gas but is not on its own a variable useful for the determination of transport classification. If a vapor pressure limit is set below current levels, the more volatile compounds would have to be removed from crude oil and transported in pressurized tank cars or pipelines as a separate stream of flammable liquids or gases. The safety of the materials involved does not change. Additionally, this proposed rule has the high probability of stranding products due to a potential lack of authorized transportation equipment. The current logistics market is based on the locations of existing refining capacity and not remote refining at every well or commingled facility. This rule will not significantly reduce the primary hazard of the unrefined crude oil, as it will remain a flammable liquid regardless of vapor pressure. We do not see any safety benefit from this practice which has the potential of reducing the economics of marginal production due to increased transportation costs. PHMSA's current attention on crude transportation should be focused on preventing accidents through proper infrastructure maintenance and by improving operating practices. Preventing the accidents through proper infrastructure maintenance and operating practices are the only ways to reduce accidents. The product itself has no part in the causes of the accidents. Focusing on vapor pressure to mitigate or reduce severity will not achieve the desired results.

Safety Questions

The current HMR adequately addresses the risks associated with flammable liquids containing gases. Part of determining the applicable shipping package is an analysis of when a flammable substance should be classified as a liquid or as a gas. In current regulation, that differentiation point is its physical state at 68 °F (20 °C) and 1 atmosphere of pressure.[vii] . A gas is also a material with a vapor pressure great than 43.5 psia (300 kPa) at 122 °F (50 °C)[viii]. The UN Sub-Committee of Experts on the Transport of Dangerous Goods has considered and rejected taking up the task of making changes to crude oil classification, implying the existing classifications are adequate. It may be of more benefit to focus on the modes of transportation and the safety of transportation methodologies for crude oil rather than trying to make a useful flammable material less flammable (and therefore less suitable for its intended purpose).

Testing vapor pressure to delineate between gases and liquids works only for pure component hydrocarbon systems. It does not work for mixtures of hydrocarbons. For mixtures the test should be based upon the state of the mixture (gas or liquid) when at 68 °F (20 °C) and 14.7 psia (101.3 kPa) (i.e. the same criteria used in the definition for "dead" and "live" crude oils from ASTM D6377). For specific examples as to why this vapor pressure is problematic for delineation of gases and liquid, see the paper "Predicted Effects of Crude Oil Properties on Railroad Tank Car Survival in a Pool Fire" June 24, 2014 issued by the API Crude Oil Physical Properties Ad-Hoc Group (COPP AHG). In terms of testing unrefined petroleum products not completely gaseous at 68 °F (20 °C) but having a vapor pressure greater than 43.5 psia (300 kPa) at 122 °F (50 °C), these products should, by definition, be subjected to the testing in § 173.115(a)(2) to determine whether that material should be classified as flammable gas. API and our members strongly believe that PHMSA should not consider adopting a new Hazardous Materials Table (HMT; § 172.101) entry for petroleum crude oil with a high concentration of dissolved gases similar to entry UN3494, "Petroleum sour crude oil, flammable, toxic," as there is no evidence to date that it will make the transport of crude oil any safer. Additionally, DOT has already taken steps in upgrading tank car standards and should remain consistent with that approach and not attempt to redefine hazardous liquid classification without scientific support for the change.

API believes current hazardous communication practices provide community responders with adequate information about crude oil and associated products. Specifically, the Emergency Response Guide lays out the correct response procedures for flammable liquids. Changing the vapor pressure of a Class 3 flammable liquid would have no impact on the appropriate response procedures but it would incur significant changes to the documentation and guidance required if the packing group and package were changed. If PHMSA were to change the threshold for vapor pressure of all Class 3 materials to 9 psia it could force any material that is currently Class 3 in the range from 9 RVP to ~ 40 psia RVP into a Division 2 classification. The potential effects of this change across the supply chain include:

- Significant changes to the authorized package/container type allowable;
- Loading and outage instructions must be changed;
- Basic shipping descriptions change;
- MSDS Section 14 Transport Information requirements change;
- Markings, labels, and placards must change;
- Documentation (and supporting IT systems) would require changes;
- Industry's and PHMSAs training programs for the HMR/49 CFR would require revision.

The changes and uncertainty created by arbitrary and unilateral changes to current Dangerous Goods/HAZMAT regulations could create even more unintended consequences than those listed above, none of which have been noted in PHMSA's ANPRM. Based on these omissions in the ANPRM it is unclear whether or not the consequences of including 'potentially all other class 3 flammable materials' has been fully thought through by PHMSA.

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Vapor Pressure Questions

Solely using vapor pressure for classification and packaging is not useful for determining the packaging of flammable liquids. It is only relevant for determining the classes "Liquid" or "Gas". Vapor pressure is not capable of discerning the concentrations of species in the vapor phase. It only measures (through the ideal gas law, PV=nRT) the pressure for the molecules that are present in the volumetric space. Given the relationship between the exponentially decreasing vapor pressure of neat hydrocarbons species with increasing linear carbon number, many diverse mixtures can have the same vapor pressure but behave vastly different when ignited (see "Predicted Effects of Crude Oil Properties on Railroad Tank Car Survival in a Pool Fire" June 24, 2014 issued by the API Crude Oil Physical Properties Ad-Hoc Group.).

The question of whether or not there is a unit of measure for how much dissolved flammable and non-flammable gases contribute to the vapor pressure, volatility, and flammability of crude oil is without scientific merit. There are almost no non-flammable gases in crude oil (only things like nitrogen and oxygen), therefore we can treat all crude oil gases as flammable. The relationship between quantity of gases and vapor pressure is governed by Raoult's law, which states that the total pressure of a mixture of hydrocarbons is the sum of the individual component hydrocarbon pure vapor pressure multiplied by its mole fraction in the mixture. However, since the vapor pressure of the neat hydrocarbons by carbon number (and weight) is a decreasing exponential function, a very small amount of a light/low carbon number hydrocarbon can heavily weight the mixtures resulting vapor pressure. On this basis, vapor pressure is a poor predictor of dissolved gas concentration in crude oil. And again, all hydrocarbons in crude oil are flammable.

If PHMSA requires Class 3 flammable liquids to have a vapor pressure lower than 9 psia, the existing supply chain may need to be modified to include treatment between production (removal from the ground) and interim storage or transportation. This potentially costly exercise for operators is unnecessary, as we have previously noted that currently authorized transportation equipment is already overdesigned. API is not aware of any other nation that specifies a vapor pressure limit on the transport of any flammable liquid other than the U.N. limit and definition in 49 CFR 173 for the transportation classification of liquid/gas flammables, which is a classification criteria, not a safety measure. Imposing a vapor pressure limit on Class 3 flammable liquids deviates from the regulations currently published for classification of hazardous materials in 49 CFR 173. Several organizations have and are studying this issue. While numerous organizations have collected data (including PHMSA, Sandia National Laboratories, NDPC, API, Transport Canada, CCQTA, and various companies in the oil industry), none to date have found scientific evidence that vapor pressure ties to outcomes in accidents. Most of this data focuses on transportation of crude oil by rail. It is API's position that it makes more sense to improve the methods to transport it safely. Currently Sandia National Laboratories s is studying the flammability and transportation issues relating to crude oil. Therefore, PHMSA should not impose an RVP limit before the study has concluded and only then if there is a clear scientific basis for doing so.

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Packaging Questions

API does not believe further limiting the filling capacity would be an effective method for reducing the risks associated with Class 3 hazardous materials containing dissolved gases. Modelling performed by multiple organizations (ARR, API COPP AHG) indicates a detrimental effect for partially filled containers with dissolved gases. In such cases, the gas preferentially collects in the vapor space. The larger the vapor space, the more vapor can be collected. It is a better result to leave the gases dissolved in the liquid and to following the requirements of API RP 3000 *Classifying and Loading of Crude Oil into Rail Tank Cars*, to determine the loading target quantity (LTQ) for overfill prevention.

Conclusion

API believes prevention of flammable liquid transport incidents involves addressing the root causes of the accidents (e.g., track, equipment, and human failures) rather than changing the physical & chemical properties of the transported materials. API asserts that it makes more sense to invest in and improve the methods to transport crude safely, than to impose new unilateral RVP limits which will not reduce accidents or casualties and are not based on any scientific evidence. API appreciates the opportunity to comment and looks forward to further discussions with PHMSA and DOT to ensure any regulations are based on provable improvements in safety and sound science.

Regards,

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[i] https://www.nrt.org/sites/2/files/Written%20Statement%20on%20Bakken%20Petroleum%20Hearing%20with%20House%20SandTCommittee.pdf
[ii] http://kfgo.com/news/articles/2015/sep/17/ntsb-chair-no-evidence-that-bakken-oil-is-more-volatile-than-other-crude/

[iii] https://www.unece.org/fileadmin/DAM/trans/danger/publi/adr/adr2011/English/Part2.pdf
[iv] http://www.unece.org/trans/danger/danger.html
[v] http://www.coqa-inc.org/docs/default-source/education-subcommittee/api-crude-quality-tf.pdf?sfvrsn=2
[vi] https://www.law.cornell.edu/cfr/text/49/173.115
[vii] 49 CFR 173.115
[viii] 49 CFR 171.8