Billing Code

DEPARTMENT OF TRANSPORTATION

Pipeline and Hazardous Materials Safety Administration

49 CFR Parts 171, 172, 173, 174, 175, 176, 177, and 178

[Docket No. PHMSA-2024-0064 (HM-266)]

RIN 2137-AF68

Hazardous Materials: Modernizing Regulations to Facilitate Transportation of Hazardous Materials Using Highly Automated Transportation Systems

AGENCY: Pipeline and Hazardous Materials Safety Administration (PHMSA), U.S. Department of Transportation (DOT).

ACTION: Advance notice of proposed rulemaking (ANPRM).

SUMMARY: The Pipeline and Hazardous Materials Safety Administration (PHMSA) is publishing this advance notice of proposed rulemaking (ANPRM) to obtain stakeholder input on potential revisions to the Hazardous Materials Regulations (HMR) to facilitate the safe transportation of hazardous materials using highly automated transportation systems.

DATES: Comments must be received by **[INSERT DATE 90 DAYS AFTER PUBLICATION IN THE FEDERAL REGISTER]**, to ensure consideration. However, PHMSA will consider late-filed comments to the extent possible.

ADDRESSES: You may submit comments identified by the docket number PHMSA-2024-0064 (HM-266) by any of the following methods:

- *Federal eRulemaking Portal*: https://www.regulations.gov. Follow the online instructions for submitting comments.
- *Fax:* 1-202-493-2251.
- *Mail:* Docket Management System, U.S. Department of Transportation, Dockets Operations, M-30, Ground Floor, Room W12-140, 1200 New Jersey Avenue S.E., Washington, D.C. 20590.

- *Hand Delivery:* U.S. Department of Transportation, Docket Operations, M-30, Ground Floor, Room W12-140 in the West Building, 1200 New Jersey Avenue S.E., Washington, D.C. 20590, between 9:00 a.m. and 5:00 p.m., Monday through Friday, except Federal holidays.

Instructions: All submissions must include the agency name and docket number (PHMSA-2024-0064) or RIN 2137-AF68 for this ANPRM at the beginning of the comment. Note that all comments received will be posted without change to https://www.regulations.gov including any personal information provided. If sent by mail, comments must be submitted in duplicate. Persons wishing to receive confirmation of receipt of their comments must include a self-addressed stamped postcard.

Docket: For access to the dockets to read background documents or comments received, go to https://www.regulations.gov or DOT's Docket Operations Office; *see* **ADDRESSES**.

Confidential Business Information: Confidential Business Information (CBI) is commercial or financial information that is both customarily and actually treated as private by its owner. Under the Freedom of Information Act (5 U.S.C. § 552), CBI is exempt from public disclosure. If your comments in response to this ANPRM contain commercial or financial information that is customarily treated as private, that you actually treat as private, and that is relevant or responsive to this ANPRM, it is important that you clearly designate the submitted comments as CBI. Pursuant to 49 CFR § 105.30, you may ask PHMSA to provide confidential treatment to the information you give to the agency by taking the following steps: (1) mark each page of the original document submission containing CBI as "Confidential;" (2) send PHMSA a copy of the original document with the CBI deleted along with the original, unaltered document; and (3) explain why the information you are submitting is CBI. Submissions containing CBI should be sent to Steven Andrews, 1200 New Jersey Avenue S.E., DOT: PHMSA-PHH-10, Washington, D.C. 20590-0001. Any comment PHMSA receives that is not explicitly designated as CBI will be placed in the public docket.

FOR FURTHER INFORMATION CONTACT: Steven Andrews, Standards and Rulemaking Division, Office of Hazardous Materials Safety, Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation, 1200 New Jersey Avenue, S.E., Washington, D.C. 20590, at 202-366-8553.

SUPPLEMENTARY INFORMATION:

Abbreviations and Terms:

AAM	Advanced Air Mobility
AAR	Association of American Railroads
ADS	Automated Driving System
ANPRM	Advance Notice of Proposed Rulemaking
BVLOS	Beyond Visual Line of Sight Operations
CDA	Commercial Drone Alliance
FAA	Federal Aviation Administration
FMCSA	Federal Motor Carrier Safety Administration
FMCSR	Federal Motor Carrier Safety Regulations
FRA	Federal Railroad Administration
HMR	Hazardous Materials Regulations
HMTA	Hazardous Materials Transportation Act of 1975
IMO	International Maritime Organization
MASS	Maritime Autonomous Surface Ships
MSC	Maritime Safety Committee
NAS	National Airspace System
NHTSA	National Highway Traffic Safety Administration
NPRM	Notice of Proposed Rulemaking
NTTC	National Tank Truck Carriers
RFI	Request for Information

RFP	Request for Proposal
SMS	Safety Management Systems
TSA	Transportation Security Administration
USCG	United States Coast Guard
UAS	Unmanned Aircraft Systems

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I. Executive Summary

PHMSA is publishing this Advance Notice of Proposed Rulemaking (ANPRM) to solicit stakeholder input on the transportation of hazardous materials in highly automated transportation systems. For the purposes of this ANPRM, PHMSA considers highly automated transportation systems as advanced transportation systems that leverage varying degrees of automation, tailored to the system's complexity. The emergence of highly automated technology has the potential to transform how hazardous materials are transported while potentially enhancing safety, efficiency, and reliability. This shift warrants a comprehensive review of the requirements in the Hazardous Materials Regulations (HMR; 49 CFR parts 171-180). PHMSA is publishing this ANPRM to solicit feedback that can be used in performing that review.

II. Background

The HMR was primarily designed with traditional transportation methods in mind. The advent of highly automated transportation systems,[1] ranging in possibility from drones and delivery robots to fully automated freight trucks, introduces new challenges and opportunities that were not anticipated by the original regulatory framework of the HMR. These highly automated transportation systems offer potential benefits, such as increased efficiency and reduced human error, but also raise questions about safety and regulatory compliance under the HMR.

On March 22, 2018, PHMSA published a Request for Information (RFI), titled "Request for Information on Regulatory Challenges to Safely Transporting Hazardous Materials by Surface Modes in an Automated Vehicle Environment."[2] The RFI requested public comment on how the emergence of automated technologies may impact the HMR and the information that PHMSA should consider when determining how to best ensure the HMR adequately account for

[1] *See, e.g.,* USDOT Automated Vehicles Activities, https://www.transportation.gov/AV.

[2] 83 FR 12529 (Mar. 22, 2018).

surface automated vehicles. The RFI also sought comment on the role that surface automated vehicles and their supporting technologies might play in transportation, freight movement, and commerce. PHMSA received 27 sets of comments from various interested parties in response to the RFI, including valuable input from private companies, public safety associations, and trade associations.[3]

On March 14, 2019, PHMSA published a report, titled "Hazardous Materials Transport with Unmanned Systems," that focused on identifying potential hazards and evaluating the current state of highly automated transportation systems in hazardous materials transportation by all modes.[4] While the previously cited RFI focused on highly automated systems in surface transportation, this report broadened the scope to include highly automated transportation systems in all modes. The report outlined likely scenarios for automated hazardous materials transportation and associated risks, taking into consideration the maturity of automated systems in those scenarios. The report considered both risk reductions from utilizing automated systems as well as the unique risks introduced by using automation. The report provided a potential regulatory framework with decision points to help ensure the safe integration of highly automated transportation systems in hazardous materials transportation as well. PHMSA has placed a copy of this report in the docket for this ANPRM and seeks comments on any data within the report that may be useful in the development of an NPRM.

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[3] https://www.regulations.gov/docket/PHMSA-2018-0001/comments. For example, the Association of American Railroads (AAR) suggested that PHMSA review the HMR to identify outdated requirements that might hinder the use of highly automated transportation systems. In contrast, safety organizations, such as the International Association of Fire Fighters (IAFF), expressed concerns about a loss of safety with the potential introduction of highly automated transportation systems moving hazardous materials. Amazon stated that policymakers should ensure that the HMR prioritizes safety, provides clear requirements, and maintains enough flexibility to keep up with the pace of innovation. The National Tank Truck Carriers (NTTC) recommended that PHMSA adopt a performance-based, operator-neutral approach. NTTC added that, while preserving current regulations for human operators where feasible, the Federal Motor Carrier Safety Regulations (FMCSR) and HMR should be updated to establish performance standards that not only maintain the safety requirements for human drivers but also hold automated vehicles—whether driving or assisting in driving—to the same safety standards.

[4] "Hazardous Material Transport with Unmanned Systems," Mar. 14, 2019, available at https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/2020-03/Risk%20Assessment%20of%20HazMat%20by%20UAVs.pdf (accessed Sept. 30, 2025).

On May 16, 2024, the 2024 Federal Aviation Administration (FAA) Reauthorization Act[5] (the FAA Act) was signed into law. Section 933 of the Act requires the Secretary of Transportation to use a risk-based approach to establish the operational requirements, standards, or special permits necessary to approve or authorize an air carrier to transport hazardous materials by unmanned aircraft systems (UAS) providing common carriage under 14 CFR part 135 or successor authorities, as applicable, beginning within 180 days of enactment. In addition, the FAA Act required the Secretary of Transportation to hold a public meeting on the transportation of hazardous materials by UAS. PHMSA and FAA held the public meeting as required on August 22, 2024,[6] and received written comments, which were subsequently added to the regulatory docket.[7]

In addition, FAA—in conjunction with PHMSA—published a *Federal Register* notice to announce the availability of a guidance document titled "Guidance for Transporting Hazardous Materials by UAS" intended for 14 CFR part 135 UAS applicants and existing certificate holders who are interested in or expanding their current authorization for carrying hazardous materials.[8]

On August 7, 2025, FAA and the Transportation Security Administration (TSA) published an NPRM,[9] titled "Normalizing Unmanned Aircraft Systems Beyond Visual Line of Sight Operations," as directed by the FAA Act. FAA's NPRM proposes performance-based regulations under a new 14 CFR part 108, enabling the design and operation of UAS at low altitudes for beyond visual line of sight (BVLOS) operations. Ultimately, this NPRM is intended to provide a predictable and clear pathway for safe, routine, and scalable UAS operations. This includes package delivery operations that can involve the carriage of hazardous materials. The proposed 14 CFR part 108 enabling regulations for hazardous materials package delivery are

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[5] Pub. L. No. 118-63 (codified in scattered sections of 49 U.S.C.).

[6] https://www.youtube.com/watch?v=Me2-rmWFInM.

[7] https://www.regulations.gov/docket/PHMSA-2024-0117.

[8] 90 FR 52133 (Nov. 19, 2025).

[9] *See* Normalizing Unmanned Aircraft Systems Beyond Visual Line of Sight Operations 90 FR 38212 (Aug. 7, 2025).

similar to current requirements for 14 CFR part 135 UAS operators already authorized to load, handle, and transport hazardous materials. In addition, FAA also expects to publish an NPRM titled "Restrict the Operation of an Unmanned Aircraft in Close Proximity to a Fixed Site Facility" proposing to establish criteria and procedures for the operator or proprietor of eligible fixed site facilities to apply to the FAA for a UAS-specific flight restriction.[10]

On April 3, 2025, PHMSA published a Request for Proposal (RFP) to seek a contractor with the expertise, capabilities, and experience to evaluate the safety performance of existing dangerous goods packaging requirements in a UAS environment.[11] The work will account for operational conditions specific to the carriage of dangerous goods via UAS, the corresponding hazards, and the safety performance of existing packaging standards; and identify appropriate risk mitigations. It will also identify potential hazards associated with malfunctions of UAS package containment systems at various cruise altitudes, up to 400 feet above ground level, which could inadvertently drop items during transit. Offers to this RFP closed on July 2, 2025, and a final report must be delivered to PHMSA no later than 21 months after the contract is awarded.

Finally, in June 2025, the President signed Executive Order (E.O.) 14307,[12] titled "Unleashing American Drone Dominance," to enhance U.S. productivity, create high-skilled jobs, and reshape the future of aviation. The E.O. aims to accelerate the safe commercialization of drone technologies and fully integrate UAS into the National Airspace System (NAS). The publication of this ANPRM aligns with the goals of E.O. 14307 and seeks to develop a regulatory framework to facilitate the transportation of hazardous materials via UAS *(i.e.,* drones).

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[10] RIN 2120-AL33, https://www.reginfo.gov/public/do/eAgendaViewRule?pubId=202504&RIN=2120-AL33.

[11] Notice ID 693JK325R0002.

[12] 90 FR 24727 (Jun. 11, 2025).

III. ANPRM Objective

PHMSA works closely with its modal partners in developing modal specific regulations and guidance involved in the transportation of hazardous materials. The primary modal administrations that PHMSA works with are the: (1) Federal Motor Carrier Safety Administration (FMCSA) for the transportation of hazardous materials by highway—*see* 49 CFR Part 177; (2) FAA for the safe transportation of hazardous materials by air—*see* 49 CFR Part 175; (3) Federal Railroad Administration (FRA) for the safe transportation of hazardous materials by rail—*see* 49 CFR Part 174; and (4) United States Coast Guard (USCG), part of the Department of Homeland Security (DHS), for the safe transportation of hazardous materials by vessel—*see* 49 CFR Part 176. In addition, PHMSA works with other administrations and offices within DOT, such as the National Highway Traffic Safety Administration (NHTSA) and the Office of the Secretary of Transportation (OST), on issues related specifically to highly automated transportation systems.

Through stakeholder input to this ANPRM, along with incorporation of its own insights, research, and findings, PHMSA aims to identify necessary HMR regulatory revisions, guidance, legal clarification, and educational resources needed to inform future work. PHMSA is focused on current technologies and practices, and on exploring what might be possible in the future as automation continues to evolve.

Lastly, the Regulatory Flexibility Act (5 U.S.C. 601 *et seq*) requires all federal agencies to assess the impact of their regulations on small entities (*i.e.*, small businesses, small not-for-profit organizations, and small governmental jurisdictions) and consider less burdensome alternatives. As such, PHMSA requests specific comment on any aspects of the ANPRM (for any of the transportation modes) that raise special concerns or considerations for small businesses and other small entities—such as those aspects that would impose high costs or would disproportionately burden small entities. Further, PHMSA requests comment on alternative

approaches it should consider that would achieve the agency's objectives while minimizing costs or impacts to small entities.

IV. Potential Regulatory Updates to the HMR for Highly Automated Transportation Systems

A. Special Permits

While PHMSA is considering regulatory revisions in this rulemaking, any person may currently request relief from the HMR via the Special Permit process—*see* 49 CFR part 107, subpart B. PHMSA notes that as of November 2025, PHMSA has received two applications for a special permit seeking relief from the HMR for highly automated transportation systems. Specifically, these special permits seek regulatory relief from the HMR for the transportation of consumer type products when delivered by UAS. PHMSA seeks stakeholder input on whether any changes to the special permit process are necessary for highly automated transport systems.

B. Shipping Papers and Emergency Response Information

The HMR requires most shipments of hazardous materials to have a shipping paper and emergency response information meeting the requirements in 49 CFR part 172, subparts C and G. Shipping papers and emergency response information are basic communication tools for the transportation of hazardous materials.[13] A shipping paper and emergency response information, which may appear on a shipping paper, must accompany most hazardous materials shipments and be available during transportation.

Specific to the shipping papers, these documents are important because they serve as the principal source of information regarding the presence, identification, and quantity of hazardous materials being shipped. Shipping papers also serve as the source of information necessary to

[13] The HMR defines shipping paper in § 171.8 as "a shipping order, bill of lading, manifest or other shipping document serving a similar purpose and prepared in accordance with Subpart C of part 172 of this chapter." Furthermore, the HMR defines emergency response information in § 172.602(a) as information that can be used in the mitigation of an incident involving hazardous materials and, at a minimum, must contain the information listed in paragraph (a).

comply with other HMR requirements (*e.g.*, correctly placing labels, markings, or placards on a shipment), ensuring the separation of incompatible hazardous materials and limiting the number of radioactive materials that may be transported in a vehicle or aircraft.

Shipping papers and emergency response information also serve to notify transport workers that hazardous materials are present. Shipping papers are the principal means of identifying hazardous materials during transportation emergencies. Firefighters, police, and other emergency response personnel are trained to obtain and review shipping papers and emergency response information when responding to hazardous materials transportation emergencies. The availability of accurate information concerning hazardous materials being transported significantly improves response efforts in these types of emergencies.

Shipments of hazardous materials via highly automated transportation systems may present unique challenges to complying with shipping paper and emergency response information requirements.[14] For example, in comments[15] to the 2019 RFI, AAR suggested that existing rules that mandate a physical shipping paper by rail (*see* § 174.24) could be more efficiently shared electronically through applications like AskRail.[16] In addition, AAR noted that in the event of an accidental release of hazardous materials, § 171.15 of the HMR requires a telephone call to the National Response Center. AAR suggested that PHMSA update the HMR to enable an automated system where highly automated transportation systems can instantly notify responders and stakeholders of an incident while providing detailed information about the location, cargo, and other critical details. PHMSA will consider this comment in development of the NPRM but seeks additional comments on the potential use of automated incident response notification systems.

[14] PHMSA notes that it recently published an NPRM that proposes updates to the emergency response information requirements in the HMR. 90 FR 28563 (Jul.1, 2025).

[15] https://www.regulations.gov/comment/PHMSA-2018-0001-0016.

[16] https://askrail.us/.

Shipments of hazardous materials using highly automated transportation systems may not have humans in the transport vehicle; therefore, a person may not be present to provide the shipping paper and emergency response information to enforcement or emergency response personnel. This presents unique challenges in ensuring that critical safety and compliance information is readily accessible in the event of an incident or inspection. In addition, the use of a highly automated transportation system may introduce different types of informational needs for emergency response personnel. For example, the number and type of package details on a shipping paper may not be necessary when a UAS is only transporting a single package because emergency response personnel will see that there is only one package on the UAS. Emerging technologies may also lead to the automated development, verification, and certification of shipping papers.

PHMSA seeks input from stakeholders on any potential changes to the HMR that may be needed to facilitate the transportation of hazardous materials in highly automated transportation systems as it pertains to shipping paper and emergency response information.

C. Hazard Communication

Hazard communication in the form of marking, labels, and placards is a critical component of safety protocols for employees handling hazardous materials and for emergency responders responding to hazardous materials incidents. These requirements are found in 49 CFR part 172, subparts D (Marking), E (Labeling), and F (Placarding). Properly applied markings and labels ensure that everyone involved in the transportation process can quickly identify the contents of hazardous materials packages and understand any associated risks. Placards provide critical visibility of hazards present on transport vehicles from a distance during transit, allowing emergency responders to quickly assess hazards in the event of an incident. Together, these forms of hazard communication create a standardized system that enhances safety and minimizes confusion in hazardous materials transportation.

Highly automated transportation systems may face a variety of challenges in complying with the hazard communication requirements in the HMR. For UAS package delivery operations in which packages are transported outside the airframe and exposed to the environment at higher altitudes, traditional hazard communication may be subject to differing conditions than traditional transportation. In addition, so-called "last mile" delivery shipments using personal delivery devices or UAS to deliver consumer products may need additional clarification as to when certain marking, labeling, and placarding requirements in the HMR apply.

In its comments[17] to the 2019 RFI, IAFF stated that table 1 and table 2 materials (*see* § 172.504) should never be authorized for highly automated transportation systems when placards are required. IAFF stressed the need for accurate cargo manifests and proper placarding, and it encouraged creating preapproved travel routes to minimize risks to the public and road users when transporting hazardous materials with highly automated transportation systems.

PHMSA notes that, traditionally, transportation restrictions on hazardous materials are often modal and packaging specific and not dictated by the specific type of transport vehicle (*e.g.*, fixed wing aircraft versus rotorcraft). Furthermore, the routing of hazardous materials transportation is generally outside of the scope of the HMR. For example, UAS transportation and areas where they are authorized to fly is the responsibility of the FAA, and routing restrictions applicable to highway transportation of hazardous materials are governed by the FMCSA and State DOTs (though authorized pursuant to the Hazardous Materials Transportation Act of 1975 (HMTA)).

PHMSA seeks information from stakeholders on how the transportation of hazardous materials using highly automated transportation systems may affect the ability of entities to comply with the intent of marking, labeling, and placarding requirements in the HMR. PHMSA

[17] https://www.regulations.gov/comment/PHMSA-2018-0001-0017.

also seeks input on alternatives to the current marking, labeling, and placarding requirements that might be better suited for highly automated transportation systems.

D. Training

Part 172, Subpart H of the HMR requires all persons who meet the definition of a hazardous materials employee under § 171.8 to be trained in the applicable requirements of the HMR. This training must include general awareness/familiarization, function-specific instruction, safety training, security awareness training, and, when applicable, in-depth security training.

As automation technology advances, the roles and responsibilities of hazardous materials employees may evolve, potentially altering the scope and nature of required hazardous materials training. For instance, highly automated transportation systems might reduce direct human interaction with hazardous materials, necessitating new or alternative types of hazardous materials training focused on monitoring and managing automated processes. In addition, should highly automated transportation systems replace trained hazmat employees, an equivalent replacement for hazardous materials training (*e.g.*, safety assurance and certification systems) may be needed to ensure the reliability of the highly automated transportation systems. Consequently, PHMSA may need to reassess and update training requirements to ensure they remain relevant and effective in the context of highly automated transportation systems. This may also include revisions or updates to content in current security awareness training programs to ensure it covers security considerations related to highly automated transportation systems.

PHMSA seeks input from stakeholders on how the transportation of hazardous materials in highly automated transportation systems might affect the training requirements in the HMR, including hazardous materials training requirements in the HMR. PHMSA also seeks input on alternatives to the current hazardous materials training requirements that might be better suited to the transportation of hazardous materials in highly automated transportation system.

E. Security Plans and In-Depth Security Training

Part 172, subpart I of the HMR prescribes requirements for the development and implementation of security plans to address security risks related to the transportation of hazardous materials in commerce. When a person is subject to these requirements, they also are subject to the in-depth security training requirements prescribed in § 172.704(a)(5). These requirements were originally established in the HM-232 final rule[18] stemming from the September 11, 2001, attacks and continuing terrorist threats.

Applicability of security plan requirements—outlined in § 172.800(b)—cover those materials that "present significant security threats." Many highly automated transportation systems may not be subject to security plan requirements based on the type and quantity of hazardous materials they carry. However, highly automated transportation systems carrying certain types or quantities of hazardous materials may "present significant security threats" due to the unique nature of these emerging technologies, including cybersecurity considerations. PHMSA notes that certain modes have—or are proposing—requirements outside of the HMR covering security. For example, the Transportation Security Administration (TSA) is proposing certain security requirements in the aforementioned BVLOS part 108 rulemaking.

PHMSA seeks input on any potential changes to the applicability of security plan requirements—and thus, in-depth security training—to address any significant security threats in highly automated transportation systems.

F. Packaging

The HMR prescribes packaging requirements for non-bulk and bulk shipments of hazardous materials. The general requirements for packaging can be found in 49 CFR part 173, and the requirements for specification and performance-oriented packaging can be found in 49 CFR part 178. Highly automated transportation systems may require new packaging designs,

[18] 68 FR 14510 (Mar. 25, 2003).

performance standards, or rules to work with different automated platforms, which could lead to updates in HMR packaging standards to support these technologies. As technology around highly automated transportation systems evolves, the HMR may also need to be updated to address new risks and ensure that packaging requirements keep pace with these advancements.

PHMSA seeks input on any potential changes that might need to be made to address packaging requirements for highly automated transportation systems.

G. Loading and Unloading

Various sections of the HMR contain requirements addressing the loading and unloading of hazardous materials. The use of highly automated transportation systems may create uncertainty or ambiguity about how the loading and unloading of hazardous materials should occur. For example, § 175.90(a) requires that packages delivered by air be inspected after delivery for evidence of leakage. Such inspections by hazmat employees may be impractical for hazardous materials delivered by an unmanned highly automated transportation system to a private individual's home address.

PHMSA seeks input from stakeholders on how loading and unloading procedures may need to be revised in the HMR to account for hazardous materials being transported by highly automated transportation systems.

V. Highly Automated Transportation Systems by Mode

A. Rail Transportation

The HMR prescribes regulations for the safe transportation of hazardous materials by rail in Part 174 of the HMR. PHMSA is not aware of any highly automated rail systems that are currently transporting hazardous materials in the United States. In early 2024, FRA received a "Petition for Waivers of Compliance"[19] seeking temporary suspension of certain FRA safety

[19] 89 FR 2707 (Jan. 16, 2024).

regulations to use a highly automated rail system, which was later approved.[20] PHMSA recognizes that highly automated transportation systems, like the one outlined in this "Petition for Waivers of Compliance," have the potential to be used in the transportation of hazardous materials.

The HMR has several requirements in part 174 that could pose a challenge to the transportation of hazardous materials using highly automated rail transportation systems. For example, § 174.26 requires that "[p]rior to movement of a train, a railroad must provide the train crew with train consist information as defined in § 171.8 of this subchapter in hard-copy (printed paper) form." There may be other examples within part 174 where PHMSA may need to revise or clarify the HMR to accommodate the potential movement of train cars that do not have train crews.

PHMSA, in collaboration with FRA, is reviewing the use of highly automated rail systems for transporting hazardous materials. As part of this ANPRM, we seek stakeholder input on how these operations could impact the HMR and the rail-specific regulations in 49 CFR part 174.

B. Air Transportation

The HMR prescribes regulations for the safe transportation of hazardous materials by air in 49 CFR part 175. The transportation of hazardous materials by air has traditionally been more limited and restrictive than transportation by other modes to account for the unique risks in air transportation. For example, the authorized quantity of hazardous materials in Column 9 of § 172.101 of the HMT is smaller for passenger and cargo aircraft than other modes. In some cases, products such as dry ice are limited on passenger and cargo aircraft due to the risk of asphyxiation to crew members, a concern that does not apply to UAS since they do not carry crew. In addition, there are more stringent packaging standards (*e.g.*, inner packagings that must

[20] 90 FR 9053 (Feb. 2, 2025).

meet pressure differential requirements) and fewer exceptions for hazardous materials transported by air.

Traditionally, hazardous materials transportation operations have been conducted on a crewed passenger or cargo aircraft. On traditional manned aircraft, hazardous material packages are accepted by operator personnel and manually loaded onto an aircraft at the departure airport. The packages are then flown to the destination airport and manually unloaded.[21] In this system, operator personnel physically inspect all hazardous materials packages before they are loaded onto a traditional aircraft (*see* §§ 175.30 and 175.88) and the packages are protected from external weather conditions. Lastly, the packages are inspected for damage or leakage before being unloaded from the aircraft (*see* § 175.90).

UAS operations introduce alternative scenarios from this traditional process of transporting hazardous materials. UAS operations do not necessarily begin or end at an airport. Some UAS operations are designed for departure at a business parking lot (*i.e.*, package delivery from a convenience store) and delivery to a private individual's home. In addition, UAS may carry hazardous materials packages externally, exposing them to weather conditions, whereas traditional type-certificated aircraft protect the package from such exposure by containing them within the airframe.[22] As previously mentioned, traditional aircraft packages are unloaded by operational personnel, while some UAS are designed to deliver packages by dropping or releasing the package from above ground level. Since UAS are unmanned, there are no crewmembers on the aircraft to access or mitigate a potential incident, but it also means there are no crewmembers potentially exposed to any hazardous materials should there be an inflight incident. Many or all of these transportation functions (*e.g.,* loading, flight to destination,

[21] PHMSA acknowledges that 14 CFR part 133 external load operations (*e.g.*, rotorcraft) allows packages to be transported externally to the airframe and the location of departure and arrival can be at locations other than an airport.

[22] Currently the only authorization for hazardous materials to be transported outside of the airframe are rotorcraft operations (*see* § 175.9(a)).

delivery) may be performed autonomously, with a remote pilot-in-command simultaneously monitoring multiple aircraft.

Currently, operators seeking approval to deliver packages via UAS BVLOS are required to obtain a 14 CFR part 135 certification from FAA. Under this certification, FAA has authorized several operators to conduct package delivery by UAS. In addition, operators that intend to accept, handle, and transport hazardous materials via UAS must obtain an Operations Specification (OpSpec) A055 from the FAA and are subject fully to the HMR. The OpSpec A055 indicates authorization for an air carrier (including a UAS operator) to accept, handle, and transport hazardous materials as cargo (*i.e.*, Will Carry). The OpSpec A055 for part 135 UAS certificate holders specifies the hazardous materials that the operator may transport.

To obtain an OpSpec A055, the operator must have an FAA-accepted hazardous materials manual that documents specific processes and procedures to ensure that hazardous materials are safely and properly handled, stored, packaged, loaded, and carried on board an aircraft in accordance with the HMR. In addition, the operator must have an FAA-approved hazardous materials training program.[23] Upon certification, part 135 applicants must develop and implement a Safety Management System (SMS) to manage safety risks and ensure the effectiveness of safety risk controls in accordance with 14 CFR part 5. In a recent final rule, titled "Safety Management Systems,"[24] the FAA updated the SMS requirements, which included expanding these requirements to certificate holders authorized to conduct operations in accordance with 14 CFR part 135. Before this final rule, a formal SMS was voluntary for part 135 operators, but FAA ensured during the certification process that part 135 UAS applicants had assessed the risks from the transportation of hazardous materials, including the risks to

[23] Operators who are not authorized to accept, handle, and transport hazardous materials (*i.e.*, Will Not Carry) are not issued an OpSpec A055. However, they are still required to have an accepted or approved hazardous materials manual and training program to ensure that the have processes, procedures, and trained personnel to reject hazardous materials (including undeclared packages) from being accepted, handled, and transported. FAA notes that will not carry operators are not subject to the HMR unless offering hazardous materials as a shipper.

[24] 89 FR 33068 (Apr. 26, 2024).

people and property on the ground resulting from the carriage of hazardous materials. As noted earlier, FAA and TSA published an NPRM proposing to establish 14 CFR part 108 and accompanying security requirements. This enabling regulation would establish a new certificated classification for package delivery operators of hazardous materials, similar to part 135 UAS will-carry operations. As proposed, part 108 would require that certificated package delivery operators authorized to accept, handle, and transport hazardous materials packages have an accepted hazardous materials manual, approved hazardous materials training program, and safety risk assessment (SRA) acceptable to the FAA Administrator. In addition to UAS package delivery operations, Advanced Air Mobility (AAM) provides another class of aircraft that will potentially be a highly automated transportation system that may transport hazardous materials in commerce. AAM is a transportation system that is comprised of urban air mobility and regional air mobility using manned or unmanned aircraft.[25] This umbrella term covers aircraft that are typically highly automated and electrically powered, with some aircraft such as powered lift aircraft having vertical takeoff and landing capability. Many of these aircraft fall into the powered-lift category and are often referred to as air taxis.[26] Unlike some UAS operations, AAM package delivery operations are anticipated to transport packages inside of the airframe. Additionally, AAM package delivery could include the transportation of hazardous materials on the same aircraft as passengers or in passenger baggage.

Lastly, PHMSA anticipates the industry may develop additional variations of highly automated transportation systems designed to carry payloads inside the airframe over long-ranges for use in off-airport operations. In addition, there are other aspects of pre-transportation and transportation functions specific to air transportation in part 175 that could become automated, such as packaging inspection and aircraft loading functions (including traditional manned aircraft).

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[25] As defined in Section 951, Paragraph (1) of the FAA Act.

[26] https://www.faa.gov/air-taxis.

Ultimately, the air-specific requirements in part 175 of the HMR may pose a challenge for compliance when using highly automated air transportation systems as highlighted above. PHMSA—in collaboration with FAA—is seeking stakeholder input on how UAS, AAM, and other highly automated transportation systems can meet the intent of the HMR and the air-specific regulations.

C. Vessel Transportation

The HMR prescribes regulations for the safe transportation of hazardous materials by vessel in part 176 of the HMR. While PHMSA is not aware of any highly automated vessel transportation systems that currently are transporting hazardous materials in waters subject to the jurisdiction of the United States, the International Maritime Organization (IMO) has begun to scope policies on the use of Maritime Autonomous Surface Ships (MASS).[27] The IMO published a Marine Safety Circular (MSC), titled "Outcome of the Regulatory Scoping Exercise for the Use of Maritime Autonomous Surface Ships (MASS)."[28] This MSC discusses outcomes of a regulatory scoping exercise for the use of MASS, conducted by the IMO's Maritime Safety Committee. In addition, the IMO established a dedicated MASS Working Group to further develop the MASS Code and address issues under the Legal and Facilitation Committee's purview. These matters will be reviewed by the Joint MSC/LEG/FAL Working Group on MASS. The objective is to adopt a non-mandatory goal-based MASS Code by 2025, which will serve as the foundation for a mandatory goal-based MASS Code, anticipated to enter into force on January 1, 2028.

PHMSA, in collaboration with USCG, is exploring the potential use of highly automated vessel transportation systems for hazardous materials. To better understand the impact on the HMR, we are seeking stakeholder input on how these operations might affect hazardous materials transportation and the vessel-specific regulations in 49 CFR part 176.

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[27] https://www.imo.org/en/MediaCentre/HotTopics/Pages/Autonomous-shipping.aspx.

[28] MSC.1/Circ.1638 (Jun. 3, 2021).

D. Highway Transportation

The HMR prescribes regulations for the safe transportation of hazardous materials by highway in part 177 of the HMR. These regulations address critical safety aspects, such as packaging and vehicle requirements, to ensure that hazardous materials are transported safely by highway. Historically, these regulations have been tailored to human-driven vehicles, where the qualifications, actions, and decisions of the driver play a central role in ensuring safe operations.

As the transportation industry advances, emerging technologies—such as Automated Driving Systems (ADS)—are poised to transform the landscape of highway transportation. ADS operation raises unique considerations for the safe and efficient transportation of hazardous materials. ADS can offer enhanced safety features, such as the potential for more precise vehicle control, fewer human errors, and optimized route planning, but can also introduce new challenges in terms of regulatory oversight, emergency response, and system interoperability. ADS may operate in ways that differ significantly from traditional, human-driven vehicles, potentially altering the dynamics of risk assessment, hazard mitigation, and emergency management.

Given these advancements, FMCSA and PHMSA recognize the need to evaluate and, where necessary, update the HMR to account for the integration of ADS in the transportation of hazardous materials by highway, including FMCSA's consideration of whether the transportation of hazardous materials by fully automated commercial motor vehicles should be restricted or prohibited under the Federal Motor Carrier Safety Regulations (FMCSRs).[29] This ANPRM seeks to gather input from stakeholders, including industry experts, technology developers, safety organizations, and emergency responders, to ensure that regulatory updates are grounded in current and future technological realities while continuing to prioritize safety.

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29 In its Advance Notice of Proposed Rulemaking, "Safe Integration of Automated Driving Systems-Equipped Commercial Motor Vehicles," FMCSA requested comment on whether the transportation of hazardous materials by fully automated CMVs should be restricted or prohibited. 84 FR 24449, 24452 (May 28, 2019). Most commenters responding to this question supported restricting the transportation of hazardous materials in fully automated CMVs. The comments are available in Docket FMCSA-2018-0037.

PHMSA, in collaboration with FMCSA, is exploring the potential use of highly automated commercial motor vehicles for moving hazardous materials. To better understand the implications for the HMR, we are seeking stakeholder input on how these technologies might affect hazardous materials transportation and the highway-specific regulations in 49 CFR part 177.

VI. Questions

To better understand the potential impacts of future regulatory revisions on the transportation of hazardous materials in highly automated transportation systems, PHMSA is asking a series of questions to identify potential updates to the HMR. Whenever possible, please provide supporting data or specific examples.

For Section B, "Economic Questions," PHMSA is seeking per-unit, aggregate, and programmatic (both one-time implementing and recurring) data. Explanation of the bases or methodologies employed in generating cost and benefit data, including data sources and calculations, is valuable so that PHMSA can explain the support for any estimates it is able to provide that accompany a proposed rule, and other commenters may weigh in on the validity and accuracy of the data. Please also identify the baseline (*e.g.*, a particular edition of a consensus industry standard; widespread voluntary operator practice; or documentation of sample surveys and other operator-level data or information) from which those incremental costs and benefits arise. When estimates are approximate or uncertain, consider using a range or specifying the distribution in other ways.

When responding to a specific question below please note the topic letter and question number in your comment.

A. General Questions

1. How should PHMSA address the transportation of hazardous materials using highly automated transportation systems (*e.g.*, revisions to the HMR, corresponding guidance, other resources)?

2. Should PHMSA consider specific automation use cases when revising the HMR? Or should requirements be scoped to various system automation use cases and performance capabilities remain with the appropriate modal administration?
3. What specific safety concerns do you foresee with the use of highly automated transportation systems for hazardous materials? What specific safety benefits do you foresee with the use of highly automated transportation systems for hazardous materials?
4. How should PHMSA and modal administrations evaluate and mitigate risks associated with these systems?
5. Are there existing regulations that you believe adequately address the use of highly automated transportation systems for hazardous materials? If not, what new regulations or amendments would you recommend?
6. How can PHMSA support innovation while ensuring safety and compliance?
7. Are current packaging requirements in 49 CFR parts 173 and 178 adequate for highly automated transportation systems? If not, in what ways are they not adequate, and what new regulations or amendments would you recommend?
8. Are current packaging exceptions in 49 CFR part 173 adequate for highly automated transportation systems? If not, in what ways are they not adequate, and what new exceptions or amendments would you recommend?
9. Are there hazard classes, packing groups, amounts, or specific commodities that should not be authorized for transportation in highly automated transportation systems?
10. How should PHMSA and the modal administrations evaluate the hazards and risks of certain hazard classes or divisions with the varying use cases and performance capabilities of highly automated transportation systems?

11. Are there other types of highly automated transportation systems not mentioned in this ANPRM that PHMSA should consider (particularly technologies that are under development or being tested)?
12. What performance-based regulations need to be modified or clarified for highly automated transportation systems? Are there any prescriptive requirements in the HMR that should become more performance-based? Are there any requirements in the HMR that are not appropriate for highly automated transportation systems?
13. The HMR references "conditions normally incident to transportation." How should this term evolve to account for highly automated transportation systems that introduce different conditions on packages from the more traditional transportation systems?
14. What responsibilities should operators have to communicate the expected conditions of transport via a highly automated transportation system to shippers and freight forwarders?
15. What additional requirements might be necessary to protect hazardous materials packages from being exposed to the effects of highly automated transportation systems failure (*e.g.*, transport vehicle battery fire, crash)?
16. Are there any current industry standards specific to highly automated transportation systems that would help PHMSA and modal administrations evaluate potential requirements or exceptions of the HMR?
17. Are there international or country-specific regulatory frameworks that stakeholders recommend PHMSA consider harmonizing with? If so, why?
18. How can the HMR support efficient and effective hazardous materials communication (*e.g.*, marks, labels, shipping papers) for highly automated transport systems?

19. How do unmanned highly automated transportation systems (*e.g.*, absence of passengers, crewmembers, drivers) affect the current level of safety of the HMR?

B. Economic Questions

1. What are the broadly anticipated economic benefits of using highly automated transportation systems for hazardous materials?
2. What are the specific economic impacts of revising the HMR to further enable commercial UAS hazardous materials package delivery?
3. What are the specific economic implications of hazardous materials delivered by ADS systems or personal delivery devices?
4. How should PHMSA evaluate the cost-effectiveness of these systems compared to traditional methods?
5. How can PHMSA balance the need for safety regulations with the economic burden on businesses?
6. What additional costs would companies face if new inspection and safety protocols (*e.g.*, remote package inspection or monitoring systems) were required for highly automated transportation systems transporting hazardous materials?
7. What types of hazardous materials does the industry expect to transport via highly automated transportation systems in the near future, and by which mode? What commodities are expected to be transported by highly automated transportation systems in high volumes once the technology is more widely deployed?

C. Specific HMR Questions

1. What incident reporting requirements should be added or modified in §§ 171.15 and 171.16 to account for highly automated transportation systems (*e.g.*, new triggers for reporting, new data points)?
2. How should PHMSA ensure that highly automated transportation systems comply with the intent of shipping paper requirements in part 172, subpart C (*e.g.*, hazard

communication documentation that provides appropriate information to appropriate personnel, including emergency responders)?

3. How should PHMSA ensure that highly automated transportation systems comply with the intent of emergency response information requirements in part 172, subpart G?
4. How can highly automated transportation systems effectively implement the intent of hazard communication requirements, including labeling, marking, and placarding, as specified in part 172, subpart D, E, and F, respectively?
5. What specific part 172, subpart H training requirements should PHMSA establish or clarify to account for highly automated transportation systems?
6. Should PHMSA update its current hazardous materials employee training requirements to address the transportation of hazardous materials using highly automated transportation systems? If so, what types of safety assurance and certification systems should PHMSA and modal administrations consider (*i.e.*, routine safety assurance and continued monitoring equivalent to initial and recurrent hazardous materials training)?
7. Should PHMSA revise the applicability of security plan requirements to address any significant security threats in highly automated transportation systems? If so, how should PHMSA revise the security plan applicability?
8. How should PHMSA consider any cybersecurity concerns created by the use of highly automated transportation systems? Who should PHMSA consult regarding these concerns?
9. The HMR have multiple sections related to definitions, including §§ 105.5, 107.1, 109.1, and 171.8. Does PHMSA need to add new definitions in these sections that are explicitly related to highly automated transportation systems? If so, what definitions are needed? Are there definitions in other Federal laws, Federal

regulations, or international regulations the HMR should be consistent with or incorporate?

10. Should additional information be required of a Special Permit applicant for highly automated transportation systems? Or should additional information continue to be requested by PHMSA and modal administrations on an ad hoc basis?

D. Rail-Specific Questions

1. How should PHMSA ensure highly automated transportation systems comply with the general requirements for the transportation of hazardous materials by rail as outlined in § 174.1?
2. How can highly automated transportation systems meet the inspection and acceptance requirements specified in § 174.9?
3. How should PHMSA ensure highly automated transportation systems address the requirements for the removal and disposition of hazardous materials at destination as outlined in § 174.16?
4. What specific segregation procedures should be adopted by highly automated rail transportation systems to comply with § 174.81?

E. Air-Specific Questions

1. How can highly automated transportation systems comply with the general requirements for the transportation of hazardous materials by air as outlined in part 175 (*e.g.*, applicability, acceptance, rejection, loading, handling, unloading, storage incidental to movement, packaging, notifications)?
2. How should PHMSA and FAA address HMR requirements (*e.g.*, accessibility, prohibitions, quantity limits) when no crewmembers are present on cargo aircraft (*e.g.*, UAS, AAM)?
3. How should PHMSA and FAA address HMR requirements (*e.g.*, § 175.10 allowances, passenger notification, quantity limits) when no crewmembers are

present on passenger aircraft, but passengers are present (*e.g.*, AAM transportation of passengers and passenger aircraft authorized cargo)?

4. Should there be new exceptions or revisions to current exceptions from the HMR in part 175 (*e.g.*, §§ 175.8, 175.9) to account for highly automated transportation systems? Should the exceptions be contingent on approval by the FAA and operator safety risk assessments?
5. How can highly automated transportation systems meet the acceptance and inspection requirements specified in § 175.30?
6. Should PHMSA apply the same criteria for Column 9 quantity limits of the § 172.101 HMT to highly automated aircraft transportation systems? Should quantity limits be increased or decreased? If so, how should PHMSA tackle establishing new quantity limits?
7. Are there any hazardous materials currently subject to the HMR when transported by aircraft (but not regulated when transported by other modes) that should not be subject when transported by unmanned highly automated air transportation systems?
8. How can highly automated transportation systems comply with the notification and reporting requirements for hazardous materials incidents as specified in § 175.31?
9. How can highly automated transportation systems comply with current inspection requirements (*e.g.*, §§ 175.88, 175.90, for packages of hazardous materials)?

F. Vessel-Specific Questions

1. How should PHMSA ensure highly automated transportation systems comply with the general requirements for the transportation of hazardous materials by vessel as outlined in § 176.1?

2. How can highly automated transportation systems meet the documentation requirements specified in § 176.24, including the need for shipping papers, certificates, and dangerous cargo manifests?

3. What specific stowage and segregation procedures should be adopted by highly automated transportation systems to comply with § 176.83?

G. Highway-Specific Questions

1. How should PHMSA ensure highly automated transportation systems comply with the general requirements for the transportation of hazardous materials by highway as outlined in § 177.800?

2. When hazardous materials are transported using highly automated transportation systems, should PHMSA revise the requirements in § 177.817(e) that state that "[a] ***driver*** of a motor vehicle containing hazardous material, and each carrier using such a vehicle, shall ensure that the shipping paper required by this section is readily available to, and recognizable by, authorities in the event of accident or inspection?" If so, how?

3. How would the implementation of highly automated transportation systems affect compliance with 49 CFR part 177, which includes specific operational requirements for hazardous materials transported by highway (*e.g.*, loading/unloading, attendance, and incident reporting)?

4. Are there specific provisions in 49 CFR part 177 that would be particularly burdensome for small businesses using highly automated transportation systems for the transportation of hazardous materials?

5. What specific highway segregation requirements should be adopted by highly automated transportation systems to comply with § 177.848?

VII. Future Actions

Following the publication of this ANPRM, PHMSA will carefully review and consider all public comments submitted to the docket. In addition to public input, PHMSA will incorporate its own insights, research, and findings to inform the development of a potential NPRM. Furthermore, PHMSA may explore the possibility of hosting a public meeting to gather additional data and stakeholder input, ensuring a comprehensive and well-informed regulatory proposal.

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