




OFFICE OF CHEMICAL SAFETY AND POLLUTION PREVENTION
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Aluminum Phosphide, Magnesium Phosphide, and Phosphine

Interim Registration Review Decision Case Numbers 0025, 0645, and 7608

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I. INTRODUCTION

This document is the Environmental Protection Agency's (EPA or the Agency) Interim Registration Review Decision (ID) for aluminum phosphide (PC Code 066501, case 0025) and magnesium phosphide (PC Code 066504, case 0645) (hereafter referred to as "metal phosphides"¹) and phosphine (PC Code 066500, case 7608). The Federal Insecticide, Fungicide, Rodenticide Act (FIFRA)² mandates a periodic review of existing pesticide registrations every 15 years, referred to as registration review.³ During registration review, the Agency ultimately determines whether a currently registered pesticide continues to meet FIFRA's registration standard.⁴ Where appropriate, the Agency may issue an Interim Registration Review Decision (ID) before completing a final registration review decision.⁵ However, issuance of an ID is not a decision on whether a pesticide's registrations continue to satisfy the FIFRA standard for registration.⁶ Rather, the ID may include mitigation measures and changes to labeling that EPA has determined would address risks of concern, identify data or information needed to complete registration review, and include schedules for submitting such data, conducting the new risk assessment, and completing the registration review.⁷ The Agency is issuing this ID for phosphine and the metal phosphides to identify risk mitigations that EPA has determined would address risks of concern for phosphine and the metal phosphides, as presented in Section IV and Appendices A and B.

Phosphine is a colorless gas registered for use on stored products, against insect and rodent pests. It is formulated as a pressurized gas and is also the active component of the metal phosphides. Aluminum and magnesium phosphide react with moisture in the atmosphere to produce phosphine gas. Metal phosphide products are formulated as impregnated materials, pellets/tablets, and granules which release phosphine gas upon deployment. Products containing aluminum phosphide were first registered in 1958, magnesium phosphide products were first registered in 1979, and products containing phosphine were first registered in 1999. Phosphine and the metal phosphides are restricted use pesticides (RUP) and are not available for purchase or use by the general public. While the complete mode of action of phosphine is

¹ For purposes of this document, the term "metal phosphides" does not include zinc phosphide. EPA is considering zinc phosphide in a separate registration review (Case: 0026; PC Code: 88601; Docket ID: EPA-HQ-OPP-2016-0140).

² Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), 7 U.S.C. §§ 136–136w-8.

³ For more information on the registration review program, see <http://www.epa.gov/pesticide-reevaluation>.

⁴ FIFRA § 3(g), 7 U.S.C. § 136a(g); 40 C.F.R. § 155.57; *see also* FIFRA § 3(c)(5).

⁵ 40 C.F.R. §§ 155.56, 155.58. Consistent with 40 C.F.R. § 155.58, EPA must first issue and take comment on a PID before issuing an ID.

⁶ At the end of the registration review process, EPA will decide whether a pesticide registration "continues to satisfy the FIFRA standard for registration." 40 C.F.R. §§ 155.40(a), 155.57; FIFRA § 3(g), 7 U.S.C. § 136a(g); *see also* FIFRA § 3(c)(5), 7 U.S.C. § 136a(c)(5) (FIFRA registration standard); FIFRA § 2(bb), 7 U.S.C. § 136(bb) (defining "unreasonable adverse effects on the environment" as encompassing both "any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide" [FIFRA's risk-benefit standard] and "a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the [FFDCA safety standard]"). This document is not a "registration review decision" within the meaning of FIFRA Section 3(g) and 40 C.F.R. § 155.57.

⁷ 40 C.F.R. § 155.56.

unknown, the Insecticide Resistance Action Committee (IRAC) has classified phosphine as a Group 24A mitochondrial complex IV electron transport inhibitor. A reregistration eligibility decision (RED) for aluminum phosphide and magnesium phosphide was completed in 1998. The first phosphine gas product was registered in 1999. Reregistration only applied to those pesticides first registered before 1984, so phosphine was not subject to reregistration. After the RED, additional label changes were implemented for phosphine and metal phosphide products to address incidents involving these products. EPA and product registrants developed a Memorandum of Agreement (MOA) to address the incidents with changes to product labels. These included instructions for the creation of fumigation management plans (FMPs)—written descriptions of the steps involved in a fumigation intended to help ensure a safe, legal, and effective application.⁸

EPA has not yet fully evaluated the effects of phosphine and the metal phosphides on federally threatened and endangered (listed) species or designated critical habitats. However, consistent with its obligations under the Endangered Species Act (ESA),⁹ EPA expects to complete effects determinations and any necessary consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (the Services) before completing the phosphine and the metal phosphides registration review and issuing a final registration review decision. For more information on EPA's ESA obligations during registration review, see Appendix C.

EPA continues to work with the Services to improve the consultation process for pesticides in registration review. In April 2022, EPA released its ESA Workplan, which outlines strategies and actions for the Agency to meet its ESA obligations for FIFRA actions.¹⁰ Consistent with the ESA Workplan, EPA is focused on steps it will take during registration review to reduce exposure for listed species as it moves toward fulfilling its ESA obligations and making final registration review decisions. In November 2022, EPA released its first ESA Workplan Update.¹¹ As part of this update, EPA announced that, going forward, EPA may include a variety of FIFRA Interim Ecological Mitigation (IEM) measures in its registration review decisions that seek to reduce exposures for nontarget organisms based on its FIFRA ecological risk assessment(s). EPA expects that this mitigation may also reduce pesticide exposures for listed species.

As part of this ID, EPA has considered a variety of FIFRA IEM measures based on the risks and benefits of phosphine and the metal phosphides to reduce exposures to nontarget organisms, including listed species, while EPA works toward a final registration review decision. While these mitigation measures do not satisfy EPA's ESA obligations, EPA has determined that early

⁸ *Memorandum of Agreement Between the United States Environmental Protection Agency and Signatory Registrants of Phosphine Based Fumigants*. EPA announced the MOA in *Amendment to Reregistration Eligibility Decision for Aluminum Phosphide and Magnesium Phosphide*, 66 Fed. Reg. 8790 (Feb. 2, 2001).

⁹ Endangered Species Act (ESA) § 7, 16 U.S.C. § 1536.

¹⁰ *Balancing Wildlife Protections and Responsible Pesticide Use* (Apr. 2022), https://www.epa.gov/system/files/documents/2022-04/balancing-wildlife-protection-and-responsible-pesticide-use_final.pdf.

¹¹ *ESA Workplan Update: Nontarget Species Mitigation for Registration Review and Other FIFRA Actions* (Nov. 2022), <https://www.epa.gov/system/files/documents/2022-11/esa-workplan-update.pdf>

mitigation may shorten the consultation process and improve protections for listed species from currently registered pesticide products. EPA also has determined that the FIFRA IEM measures that the Agency is implementing for phosphine and the metal phosphides in this ID (Section IV.B) would fulfill EPA's obligations under Section 711 of the Consolidated Appropriations Act, PL-117-328 (Dec. 29, 2022). Among other things, Section 711 requires EPA to "include, where applicable, measures to reduce the effect of the applicable pesticide on" listed species and designated critical habitats in any ID noticed in the Federal Register between December 29, 2022 and October 1, 2026 for which EPA has not "made effects determinations or completed any necessary consultation under [ESA Section 7(a)(2)]." EPA developed the FIFRA IEM measures of this ID from the partial listed species assessments (conducted in 2010)¹² and consultations with the Services¹³, from mitigation proposed in the rodenticides proposed interim registration review decisions¹⁴, and from the 2022 ESA Workplan Update¹⁵.

Before completing registration review, EPA will also address its Federal Food, Drug, and Cosmetic Act (FFDCA) section 408(p)(6)-related commitments and obligations to ensure the protection of public health for phosphine and the metal phosphides.¹⁶ For more information on EPA's review of phosphine and the metal phosphides under this FFDCA provision, see Appendix D.

This document is organized in five sections:

- *Introduction* (summarizing updates to the 2023 Amended PID and the registration review milestones and responding to public comments);
- *Use and Usage* (discussing how phosphine and the metal phosphides may legally be used and where phosphine and the metal phosphides are actually used);

¹² USEPA. 2010. *Risks of Aluminum and Magnesium Phosphides Uses to the Federally Threatened Alameda Whipsnake (Masticophis lateralis euryxanthus) and California Tiger Salamander (Ambystoma californiense), Central California Distinct Population Segment and Federally Endangered California Tiger Salamander (Ambystoma californiense) Sonoma County Distinct Population Segment and Santa Barbara County Distinct Population Segment, San Francisco Garter Snake (Thamnophis sirtalis tetrataenia), and San Joaquin Kit Fox (Vulpes macrotis mutica).*

U.S. Environmental Protection Agency, Office of Pesticide Programs, Washington DC. Available:

<https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/2010/magnesium/assessment.pdf>.

¹³ J. Serfis, R. Tinney, R. E. McManus. July 1986. *Environmental Protection Agency's Implementation of the Endangered Species Act with Respect to Pesticide Registration.* Center for Environmental Education. Available: <https://nepis.epa.gov/Exe/ZyNET.exe/9101P1DT.TXT?ZyActionD=ZyDocument&Client=EPA&Index=1986+Thru+1990&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C86thru90%5CTxt%5C00000030%5C9101P1DT.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C->

&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=hpfr&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeeKPage=x&ZyPURL. See pp 121-132.

¹⁴ www.regulations.gov; Docket ID: EPA-HQ-OPP-2016-0140.

¹⁵ ESA Workplan Update: Nontarget Species Mitigation for Registration Review and Other FIFRA Actions (Nov. 2022), <https://www.epa.gov/system/files/documents/2022-11/esa-workplan-update.pdf>.

¹⁶ Federal Food, Drug, and Cosmetic Act (FFDCA) § 408(p), 21 U.S.C. § 346a(p).

- *Scientific Assessments* (summarizing EPA's risk and benefits assessments, updating or revising previous risk assessments, and discussing risk characterization);
- *Interim Registration Review Decision* (presenting EPA's interim decision and any mitigation measures to address risks of concern); and
- *Next Steps and Timeline* (discussing how and when EPA intends to complete registration review).

A. Updates to the 2023 Amended Proposed Interim Decision

In July 2023, EPA published the Amended PID for phosphine and the metal phosphides. The Agency has made several changes to the 2023 Amended PID in this ID. EPA made the following changes to the label language proposed in the 2023 Amended PID:

- Updates to the discussion of sulfuryl flouride as an alternative to phosphine and the metal phosphides to more accurately reflect when sulfuryl flouride may be an appropriate alternative pest control,
- Clarification to the description of in-transit fumigations in the model Fumigation Management Plan of Appendix G, and
- EPA has updated the FIFRA Interim Ecological Mitigation discussed in section IV.B, below to clarify the pre-application burrow checks and conservation areas buffer zones label language.

Furthermore, in response to public comments, EPA made other minor changes to label language for clarity and/or accuracy. For more details on how public comments influenced these changes, see Section I.B. EPA has not updated the ecological risk assessment or bystander exposure assessment for phosphine and the metal phosphides. This ID finalizes the Agency's interim decision and draft supporting documents *Phosphide (Al and Mg) and Phosphine. Human Health Non-Occupational Bystander Assessment to Support the Preliminary Interim Decision* and *Six Structural and Commodity Fumigants: Combined Draft Risk Assessment (DRA) and Drinking Water Assessment (DWA) for Registration Review*, which are available in EPA's public docket (EPA-HQ-OPP-2013-0081).

B. Summary of Phosphine and the Metal Phosphides Registration Review

On September 25, 2013, the Agency formally initiated registration review for phosphine and the metal phosphides with the opening of the registration review docket for these cases.¹⁷ The following summary highlights the docket opening and other significant milestones that have occurred thus far during the registration review of phosphine and the metal phosphides:

¹⁷ 40 C.F.R. § 155.50

- September 2013 – EPA posted the *Aluminum Phosphide, Magnesium Phosphide, and Phosphine Preliminary Work Plan (PWP)* (September 19, 2013), the *Phosphide (Al, Mg) and Phosphine: Human-Health Assessment Scoping Document Supporting Registration Review* (September 11, 2013), and the *Registration Review: Preliminary Problem Formulation for Environmental Fate, Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments for Aluminum Phosphide, Magnesium Phosphide and Phosphine* (September 12, 2013) to the public docket for a 60-day public comment period.
- April 2014 – EPA posted the *Aluminum Phosphide, Magnesium Phosphide and Phosphine Final Work Plan (FWP)* (March 20, 2014) to the public docket. The Agency received 17 comments on the PWP. These comments did not change the schedule, risk assessment needs, or anticipated data requirements in the FWP. In the FWP, EPA noted that data were needed to assess the toxicity to humans and other species from inhalation exposure to phosphine during and after application activities. The FWP also noted that data were needed to monitor phosphine concentrations in the air to assess the potential for such exposure.
- August 2014 – EPA issued generic data call-ins (GDCIs) for phosphine (GDCl-066501-1393), aluminum phosphide (GDCl-066501-1402), and magnesium phosphide (GDCl-066504-1403) to obtain data needed to conduct the registration review risk assessments. The registrants satisfied all data requirements except *Special Study – Ambient air monitoring*, which is required in all three of the GDCIs. For more information, see Section III.
- October 2020 – EPA published the PID for phosphine and the metal phosphides for a 60-day public comment period. The Agency later extended the comment period for 30 additional days. The comment period closed on January 21, 2021. EPA received 45 comments from 41 sources, including product registrants, state and federal governmental agencies, commodity producers, phosphine and metal phosphide product users, agricultural interest groups, a university-affiliated apicultural specialist, two non-governmental organizations, and other members of the public. Along with the 2020 PID, EPA posted the following documents to the public docket:
 - *Phosphide (Al and Mg) and Phosphine. Human Health Non-Occupational Bystander Assessment to Support the Preliminary Interim Decision* (September 21, 2020; Bystander Assessment)
 - *Six Structural and Commodity Fumigants: Combined Draft Risk Assessment (DRA) and Drinking Water Assessment (DWA) for Registration Review* (January 27, 2020; Eco DRA)

- *Overview of Use, Usage, and Benefits of Commodity and Structural Fumigants: Phosphine [(066500) including Aluminum Phosphide (066501) and Magnesium Phosphide (066504)], Propylene Oxide (042501), Sulfur Dioxide (077601), Sodium Metabisulfite (111409), Sulfuryl Fluoride, (078003), Ethylene Oxide (042301), and Methyl Bromide (053201) (October 5, 2020)*
- July 2023 – EPA posted the Amended PID for phosphine and the metal phosphides to the public docket for a 60-day comment period. The Agency received nine comments from nine commenters, including product registrants, commodities producers, interest groups, pest management specialists, and the U.S. Department of Agriculture. The Agency has summarized and responded to these comments in Section I.C., below. The comments changed the risk mitigation for phosphine and the metal phosphides. Along with the 2023 Amended PID, EPA posted the following documents to the public docket:
 - Phosphine, Aluminum Phosphide, and Magnesium Phosphide: Response to Comments on the Draft Human Health Risk Assessment and Proposed Interim Decision for Registration Review (March 18, 2022)
 - Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine (October 10, 2022)
- May 2024 – EPA completed the ID for phosphine and the metal phosphides and made it available in the public docket.

C. Summary of Public Comments on the Amended PID and Agency Responses

During the 60-day public-comment period (July 25 to September 25, 2023) for the phosphine and metal phosphine 2023 Amended PID, the Agency received nine public comments. Comments were submitted by the Almond Alliance of California and Almond Board of California, Arizona Pest Management Center, Arizona Farm Bureau Federation, Cytec Industries Inc., Horn Technologies and Services, National Grain and Feed Association, National Pest Management Association, Phosphine Producers Association, and United States Department of Agriculture. The Agency has summarized and responded to all substantive comments and comments of a broader regulatory nature below. The Agency thanks all commenters for participating and has considered all comments in developing this ID.

Comments Submitted by the Almond Alliance of California and Almond Board of California (Docket ID: EPA-HQ-OPP-2013-0081-0125) and United States Department of Agriculture (Docket ID: EPA-HQ-OPP-2013-0081-0122)

Comment: The Almond Alliance of California, in cooperation with the Almond Board of California, and United States Department of Agriculture (USDA) submitted comments on the benefits and importance of phosphine and the metal phosphides in maintaining global food

supply, noting the wide variety of post-harvest, quarantine, and pre-shipment uses that impact the U.S. economy. Comments from the Almond Alliance of California and Almond Board of California focused on the importance of these fumigants to almond production, storage, shipment, and processing. Commentors expressed their appreciation for EPA's consideration of new data and willingness to consult with stakeholders. They further expressed their support of the updated mitigation measures proposed in the 2023 Amended PID, particularly the updated buffer zone requirements. USDA stated that it will continue to provide relevant information to EPA regarding the proposed buffers and label mitigation based on outreach to users.

EPA's Response: EPA thanks the Almond Alliance of California and Almond Board of California and USDA for their comments and support of the revised mitigation measures. EPA acknowledges the importance of phosphine and the metal phosphides in the U.S. and across the globe. In developing the phosphine and metal phosphide product label language presented in this ID, EPA communicated with stakeholders, including registrants, users, and USDA counterparts and examined data on various fumigation activities.

Comments Submitted by the Arizona Pest Management Center (Docket ID: EPA-HQ-OPP-2013-0081-0118) and Arizona Farm Bureau Federation (Docket ID: EPA-HQ-OPP-2013-0081-0124)

Comment: The Arizona Pest Management Center and Arizona Farm Bureau Federation submitted comments on the use, usage, and benefits of aluminum phosphide products on rodent burrows. Arizona Pest Management Center provided information on special farm equipment called a "Verminator", to treat severe gopher infestations more efficiently.

Both comments expressed their support of the proposed label mitigation language restricting use to target species. Regarding the buffers to conservation areas proposed in the 2023 Amended PID, the commentors asked for further clarification on what constitutes a conservation area. They also note that users impacted by these buffers may experience economic harm as a result. Regarding the pre-application burrow check, the commentors were not opposed to the language as applicators routinely verify the presence of target species before application; however, they were concerned about ambiguities they perceived in the potential enforcement of this language.

Arizona Pest Management Center noted that growers impacted by conservation buffers may experience economic harm from these measures, and Arizona Farm Bureau Federation asked for further clarification as to what constitutes a conservation area.

EPA Response: EPA appreciates the usage and benefits information provided in these comments and acknowledges the importance of aluminum phosphide products to treat rodent burrows.

EPA acknowledges that those affected by the application buffers to conservation lands may not be able to make in-burrow applications in certain circumstances (i.e., when the target pest burrows occur within 100 feet of a conservation area). In these instances, applicators will need to resort to alternative means of pest control. EPA has clarified that any land between the conservation areas and the application area can be included in a conservation lands buffer. See section IV and Appendix B for the updated language.

Regarding the pre-burrow checks, EPA notes that such language is on existing product labels for gas cartridges, which are also registered for in-burrow rodent treatments (see registration review case 4052, docket number EPA-HQ-OPP-2007-1118). An ESA Section 7 consultation was also previously conducted for sodium nitrate which identified risks of concerns to listed species, particularly to species that may exploit the burrows of other species, from in-burrow applications.¹⁸ Statements instructing users to check for signs of non-target species are present on product labels. EPA therefore identified the need for this language on metal phosphide product labels in anticipation of future ESA Section 7 consultations for these active ingredients. EPA has added clarifying language to what was proposed in the 2023 Amended PID to emphasize the focus on non-target and listed species that may exploit the burrows of target species.

Comments Submitted by Horn Technologies and Services (Docket ID: EPA-HQ-OPP-2013-0081-0119) and Cytec Industries Inc. (Docket ID: EPA-HQ-OPP-2013-0081-0123)

Comment: Horn Technologies and Services and Cytec Industries Inc. are two fumigant service providers. Cytec Industries Inc. is also a registrant of phosphine gas products. Both companies submitted comments describing the reference to sulfuryl flouride from Section III.C. Benefits Assessment of the 2023 Amended PID as misleading and suggested that EPA remove it. In its Benefits Assessment, EPA stated that fumigators may rotate phosphine and the metal phosphides with sulfuryl flouride for insect control in grains, fruits, or structures to manage phosphine resistance in target pest populations. The commenters provided several reasons for why EPA's statements about sulfuryl flouride were misleading. They noted that sulfuryl flouride is not effective against all lifestages of target pests, that it is not registered for use on fresh fruits and vegetables, and several other factors that make sulfuryl flouride unsuitable for rotation with phosphine and the metal phosphides for resistance management. The commenters instead suggest EPA focus on fumigation best practices, such as monitoring of dosage and ensuring an appropriate duration of fumigation, rather than rotation with sulfuryl flouride. Both commentors note that the proposed labeling changes in Appendix B of the 2023 Amended PID include language about fumigation best practices for resistance management. They suggest EPA remove the reference to rotation with sulfuryl flouride in the Benefits Assessment.

¹⁸ The Section 7 consultation for sodium nitrate is summarized in the Inorganic Nitrate/Nitrite-Registration Review docket. See *RED for Sodium Nitrate: Ecotoxicity Data*, docket ID: EPA-HQ-OPP-2007-1118-0010.

EPA Response: EPA thanks Horn Technologies and Services and Cytec Industries Inc. for their comments on the appropriateness of rotating phosphine and metal phosphide products with sulfuryl fluoride products. EPA agrees that sulfuryl fluoride is not registered to be used on fresh fruit commodities (sulfuryl fluoride is registered for use on dried fruit commodities only), and thus it is not a fumigation alternative to phosphine for such uses. EPA also acknowledges that any one fumigant cannot be easily substituted for another and, therefore, each fumigant is not considered a direct alternative to another. This is because individual fumigants are often specialized for a specific pest spectrum (e.g., insects or microbes) and/or pest life stage (e.g., insect eggs or larvae). Moreover, the chemical characteristics (e.g., flammability, corrosiveness) of individual fumigants may require different approaches to be both safely deployed and still be effective on the target pest.¹⁹ However, sulfuryl fluoride can still be a viable fumigation alternative for the protection of some commodities²⁰.

For additional discussion on the key benefits of commodity and structural fumigants, including resistance management strategies, please refer to *Overview of Application Methods and Factors, Use, Usage, and Benefits of Commodity and Structural Fumigants* (October 5, 2020) within the docket.

EPA also agrees that good fumigation practices, such as effective fumigant dosage, fumigant level monitoring, proper sealing of structures, extended treatment intervals, pest resistance monitoring and adequate treatment temperatures, represent comprehensive and effective strategies for managing phosphine resistance among target pests.

EPA has amended the Benefits Assessment in Section III.D. of this document to reflect this nuance.

Comments Submitted by the National Grain and Feed Association and the North American Export Grain Association (Docket ID: EPA-HQ-OPP-2013-0081-0120)

Comment: The National Grain and Feed Association (NGFA) and the North American Export Grain Association (NAEGA) submitted joint comments on the 2023 Amended PID. NGFA is a non-profit trade association representing managers of facilities that store and process grains and oilseeds. NAEGA is a non-profit trade association that represents the grain and oilseed export industry. Their comments highlight the benefits and importance of phosphine and the

¹⁹ UKPSEP (University of Kentucky Pesticide Safety Education Program PSEP). 2016. Fumigation: Agricultural and Structural. In University of Kentucky Department of Entomology and Kentucky Department of Agriculture (Eds.) Pesticide Training Manuals. <http://www.uky.edu/Ag/Entomology/PSEP/pdfs/cat1b7cfumigation.pdf>.

²⁰ For a detailed list of commodities which can be fumigated with sulfuryl fluoride, please refer to the ProFume product label and applicator's manual (EPA Reg. No. 1015-79) available at: https://www3.epa.gov/pesticides/chem_search/ppls/001015-00079-20170801.pdf

metal phosphides to their respective industries and provide feedback on the changes to product labels proposed in the 2023 Amended PID.

NGFA and NAEGA state that phosphine and the metal phosphides allow for safe, legal, and efficacious fumigation of a variety of grains and oilseeds. Other benefits include that phosphine has a short half-life, is slow acting, and leaves no detectable residues on foods. In terms of its importance to the industry, the commentors state that phosphine is the single-most relied upon fumigant to control stored grain pests in international grain marketing. They also highlight the lack of alternatives to phosphine and the metal phosphide for pest control in grains and oilseeds.

The commentors provided feedback on the mitigation measures proposed in the 2023 Amended PID. NGFA and NAEGA believe that the proposed aeration buffers zones are not justified and that EPA lacks information about the impacts of these requirements on the NGFA's and NAEGA's constituent industries. The commentors state that because the incidents reviewed by EPA are not associated with grain fumigation, they therefore do not support the applicability of the proposed label requirements to the grain industry. The commentors further question the risk assessment and use of modeling to inform the buffer zone proposal, including modeling input parameters, and whether EPA accounted for the degradation of phosphine in its risk assessment. They also assert that phosphine and metal phosphide products are safe and note they produce a warning odor that can be smelled at levels below regulatory concern.

The commentors state that they are not aware of any commercially available emissions reductions devices, which EPA proposed as one avenue for reduction or elimination of buffer zone requirements. They note further that these devices have their own challenges, such as creating separate waste streams. Therefore, they conclude that these control devices may not be feasible for users.

Finally, the commentors state that the prohibition on persons entering aeration buffer zones could inhibit other operations at fumigation facilities. The commentors speculate that facilities would either need to equip all personnel with real time phosphine air concentration monitoring devices or halt operations during aeration if a buffer zone overlaps with areas in which other activities occur.

EPA Response: EPA thanks NGFA for the information shared about phosphine usage on US grain and oilseed exports, and acknowledges the benefits described by NGFA and NAEGA to the grain and oilseed industries. This information corroborates the conclusion that phosphine is widely used within the US on grains. Within the EPA assessment, *Overview of Application Methods and Factors, Use, Usage, and Benefits of Commodity and Structural Fumigants* (October 5, 2020), EPA stated that "Phosphine is widely used for the protection of grains and

other commodities and can be used to fumigate in-transit commodities in railcars and ship holds.”

The agency worked to minimize the impacts of the proposed labeling requirements, particularly the buffer zone requirements, on users. In developing the 2023 Amended PID, EPA communicated with the registrants of phosphine and metal phosphide products, U.S. Department of Agriculture’s (USDA) Agricultural Research Service (ARS) and Office of Pest Management Policy (OPMP), and other stakeholders to better understand how these products are used and industry practices for preventing human and environmental exposures. EPA reviewed various lines of evidence and conducted extensive modeling to develop a set of flexible, treatment-specific buffer zones to protect bystanders from phosphine exposure while also maintaining the important benefits of phosphine and metal phosphide products.

Incident data are one form of evidence that EPA uses to assess pesticide risks and develop mitigation. EPA reviewed the incident database for incidents associated with phosphine and metal phosphide products in 2019. See the *Aluminum Phosphide, Magnesium Phosphide, and Phosphine: Tier I Updated Review of Human Incidents and Epidemiology for Draft Risk Assessment* (July 31, 2019), available in the public docket (www.regulations.gov; docket ID: EPA-HQ-OPP-2013-0081-0046) for the details of that review. EPA’s review yielded several human health incidents, including fatalities, associated with phosphine and/or metal phosphide products. While several of these were caused by the misuse of these products, including deliberate acts of self-harm, many of the incident reports do not contain enough context to determine if they were associated with any particular industry. Given that not all incidents are reported to EPA and that the incidents that are reported may be inconsistent regarding the details included, incident data are just one line of evidence that EPA evaluates in determining the potential risks associated with registered uses of a pesticide.

EPA also reviewed data submitted by product registrants on a variety of applications, including fumigations of grains. These data included application rates, hold times, descriptions and images of various application types and scenarios, PERFUM (Probabilistic Exposure and Risk Model for FUMigants; a computer model used to predict the concentration of fumigants in the air around treatment sites) modeling, and other information. For more details on the various submissions, see *Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine* (October 31, 2022), available in the public docket (www.regulations.gov; docket ID: EPA-HQ-OPP-2013-0081-0114). EPA used these data to conduct over 500 additional PERFUM runs with the goal of modeling potential phosphine air concentrations around fumigation sites in numerous fumigation scenarios.

As a result of this extensive modeling, EPA dramatically modified the buffer zone requirements originally proposed in the 2020 PID with the goals of protecting bystanders from phosphine gas

exposure while providing product users with the flexibility to continue conducting fumigations under diverse circumstances. In the 2023 Amended PID, EPA provided look-up tables to determine the size of any buffer zones proposed during aeration of a given fumigation, which allows for tailored buffer zones for diverse application scenarios, rather than broadly applicable and generic buffer zones for all fumigations. Because any potential buffer zones are determined by a variety of factors, such as fumigant concentration, volume fumigated, and aeration specifications, users can manipulate these variables (e.g., increase hold time prior to aeration or change ventilation stack height) to reduce or eliminate buffer zone requirements. EPA has determined that it has produced the most accurate and accommodating buffer zones to protect bystanders.

As noted by the commenters, PERFUM does not account for further degradation of phosphine in air once aeration begins. EPA has accounted for this factor by basing buffer zones on actual measured phosphine concentrations in a fumigation structure just prior to aeration (rather than on nominal application rate concentrations). This is intended to account for any loss (including degradation) of phosphine during treatment.

If required, buffer zones (based on the buffer zone lookup tables on product labels) must be in place from the start of aeration for up to eight hours or until real-time monitoring of phosphine concentrations within the fumigation enclosure drop below the buffer zone threshold concentration for the given fumigation scenario, whichever is sooner. While the buffer zone is in place, no one may enter the buffer zone, except as described in Section VI and Appendix B, below. Fumigators unable to prevent entry into a buffer zone may have to modify their fumigation and aeration configurations (e.g., increase fumigation hold times to allow more phosphine to degrade, switch to active aeration, or change the release height) or institute administrative controls (e.g., conduct aeration outside of normal business hours or when bystanders are not present). For some fumigation scenarios, these modifications may not be feasible and large buffers could still be needed, and this would be impactful to users.

EPA appreciates the commentor's discussion of emission reduction technologies (ERTs). EPA's product labeling changes allowed users to forgo buffer zone requirements if facilities use ERT to reduce phosphine emissions by at least 95%. This provision was added to allow fumigators additional flexibility for label compliance.

While odor may sometimes alert users and bystanders to the presence of phosphine, EPA wishes to clarify that odor detection cannot be used in place of label-required safety measures, including air concentration monitoring. Phosphine gas has no odor. An impurity, diphosphane, that may be present with phosphine gas can have an odor sometimes reported as either rotting

fish or garlic that some persons, but not all, may be able to detect.^{21, 22} Phosphine can be fatal if inhaled and even non-lethal effects can be serious. Applicators should use only devices specifically designed to measure phosphine gas air concentrations to conduct exposure monitoring or other monitoring related to fumigation activities or label compliance. Follow all PPE and safety precautions required by product labels. Failure to comply with product labels is a violation of federal law.

EPA would also like to clarify NGFA and NAEGA comments about equipping all workers with personal, real-time monitoring devices to permit entry into a buffer zone. Non-handlers or other bystanders, even those equipped with personal monitoring devices, may not enter a buffer zone. The buffer zone requirements prohibit entry into the buffer zone by any person, except by certified applicators or persons under their supervision. Entry by the certified applicator or persons under their supervision into the buffer zone is prohibited for the first 10 minutes of aeration. To enter a buffer zone after the first 10 minutes such persons must be equipped with the proper personal protective equipment (PPE), as described by the product labels. Label language allows for two additional limited exceptions to buffer zone entry prohibitions. The Occupied Structure Exception allows occupants of a structure within an aeration buffer zone to remain in the structure during aeration provided continuous real-time monitoring indicates that phosphine concentrations are 0.3 ppm or less as an 8-hour time weighted average within the occupied structure. This exception only applies to structures occupied by occupational workers; it does not apply to homes, apartment buildings, schools, hospitals, nursing homes, employee housing centers, or other prohibited use sites. The Transit Exception allows limited transit through an aeration buffer zone, if brief and unavoidable. This does not apply to routine or repeated work-related tasks, which are prohibited in the aeration buffer zone. No person is allowed to transit through a buffer zone for more than 30 cumulative minutes in a 24-hour period.

Comments Submitted by the Phosphine Producers Association (PPA) (Docket ID: EPA-HQ-OPP-2013-0081-0126) and National Pest Management Association (Docket ID: EPA-HQ-OPP-2013-0081-0121)

Comment: PPA appreciated the Agency's revised buffer proposal but had some concerns regarding the remaining buffers provided in the new buffer zone lookup tables. PPA stated that these remaining buffers may cause some users to make changes to their fumigation practices or facilities to reduce or eliminate potential buffer zone requirements. Where a potential buffer

²¹ American Chemistry Society. Molecule of the Week Archive: Phosphine. October 22, 2018. <https://www.acs.org/molecule-of-the-week/archive/p/phosphine.html>. Accessed March 6, 2024.

²² Ekkehard Fluck (1976) The Odor Threshold of Phosphine, *Journal of the Air Pollution Control Association*, 26:8, 795-795, DOI: 10.1080/00022470.1976.10470319. <https://www.tandfonline.com/doi/pdf/10.1080/00022470.1976.10470319>

zone is prohibitively large, such changes may be the only way that some users or facilities are able to continue operations.

PPA is working on a submission to clarify why the ambient air monitoring data is not needed, and that the study be waived.

PPA appreciates the updated resistance management label language presented in previous decision documents. The registrants noted that the default language was not suitable for phosphine and metal phosphide products. However, PPA suggested further revisions to this language, to address the specific effect that temperature and best fumigation practices have on efficacy.

Like other commentors (see summary of comments from Horn Technologies and Services and Cytec Industries Inc. and EPA's response, above), PPA expressed concern with EPA's discussion of sulfur dioxide as an alternative to phosphine and metal phosphide products in the Benefits Assessment sections of previous decision documents. PPA noted that phosphine and the metal phosphide products are registered for more use sites than sulfur dioxide products. PPA's comments encourage EPA to focus instead on the fumigation best practices, like those described in the proposed label language of the PID and 2023 Amended PID and to remove reference to sulfur dioxide.

Finally, PPA requests that the Agency revise the definition of single aerations, and suggested updates to the Fumigation Management Plan (FMP) language to reflect the exemption for vehicles fumigated in-transit.

In their comment, the National Pest Management Association expressed full support of PPA's comments on the 2023 Amended PID.

EPA Response: EPA thanks PPA for their comments. EPA understands that the revised buffer zones proposed in the 2023 Amended PID and implemented in this ID may impact some users of phosphine and metal phosphide products. The full extent of these impacts is unknown. EPA's goals in revising the buffer zones were to protect non-occupational bystanders from exposure to phosphine gas resulting from fumigation activities and to provide flexibility to fumigators. The lookup tables provided in the 2023 Amended PID and this ID prescribe buffer zones based on various factors unique to each fumigation (such as volume fumigated, phosphine concentration, and aeration rate). The lookup tables were developed using modeling of potential bystander exposure resulting from various fumigation scenarios. This modeling was informed by weather data, the toxicity profile of phosphine, and input on industry practices from PPA, among other factors.

If a user cannot meet the buffer requirements of a given fumigation scenario under current application conditions, the Agency recognizes that the user may need to make changes to fumigation practices, processes, or design (e.g., changes to hold times or aeration rates, use of

ERTs, or other changes) to reduce or eliminate any required buffer zone. Some of these changes may be more cost effective or easier to implement than others. The cost and practicality of specific changes may vary by facility. Users are expected to implement the option that is least costly and most practical to them. EPA also notes that some users may not be required to implement buffer zones based on their current specifications and so are not expected to make changes in response to buffer zone labeling. In general terms, the buffer tables below require buffers zones for larger treatment enclosure volumes or facilities using active aeration and/or lower ventilation stack heights. Given that the need for, cost, and practicality of potential changes to application procedures or equipment investments will vary by facility, EPA cannot predict total impact of compliance on any one user.

EPA will address the request to waive the ambient air monitoring data requirements (guideline SS-1075) for phosphine (GDCI-066501-1393), aluminum phosphide (GDCI-066501-1402), and magnesium phosphide (GDCI-066504-1403) once it receives and has reviewed PPA's submission.

EPA appreciates the suggested updates to the proposed resistance management language and has incorporated the changes into the resistance management language presented in the label table in Appendix B. PPA suggested including the word "surveying" to the phrase "IPM programs for insecticides/fumigants should include scouting..." to which EPA also added the phrase "before and after a treatment." The relevant portion of the resistance management language now reads, "IPM programs for insecticides/fumigants should include surveying for pests before and after treatment..."

Regarding sulfuryl fluoride as an alternative and good fumigation practices for managing phosphine resistance, see EPA's response to Horn Technologies and Services and Cytec Industries Inc, above. For additional discussion on the key benefits of commodity and structural fumigants, including resistance management strategies, please refer to *Overview of Application Methods and Factors, Use, Usage, and Benefits of Commodity and Structural Fumigants* October 5, 2020 in the docket.

EPA has considered and accepted the suggested edits to the model FMP language in appendix G of this document. EPA has likewise accepted suggested changes to the definitions of single events in the aeration buffer zone language section of Appendix B.

II. USE AND USAGE

Phosphine is a colorless gas used on commodities in storage and shipping to prevent losses due to insect and vertebrate (mainly rodent) pests. Phosphine is formulated as a pressurized gas stored in cylinders. It is the active component of the metal phosphides, released as a gas when solid metal phosphides interact with moisture in the air. Phosphine and metal phosphide products are registered for use on fresh and dried foods (e.g., fresh and dried fruit, nuts, grains), on animal feed, and on processed foods (e.g., candy, baking mixes, crackers, meats,

dairy). Phosphine gas products are registered for use on non-food commodities, such as tobacco, clothing fibers, hair, wood, paper, tires, and beehives. Metal phosphide products are also registered for in-field (i.e., greater than 100 feet from occupied buildings), in-burrow rodent control. Phosphine and the metal phosphides are applied as structural or space fumigants (e.g., under tarps, in grain mills, in warehouses), vehicle fumigants (e.g., railcars, trucks, containers), grain fumigants (e.g., silos, farm storage, flat storage), and vessel/ship fumigants.

Data from California for the years 2013 to 2017 indicate that an average of 19,900 lbs phosphine, 160,600 lbs aluminum phosphide, and 13,200 lbs magnesium phosphide were applied annually in California. The applications for all three active ingredients (a.i.s) were made to nuts (6,900 lbs phosphine, 50,200 lbs aluminum phosphide, and 6,700 lbs magnesium phosphide), fruits (600 lbs phosphine, 16,200 lbs aluminum phosphide, 200 lbs magnesium phosphide), and rice (500 lbs phosphine, 19,600 lbs aluminum phosphide). Structural use including storage facilities and processing equipment also had reported usage (14,900 lbs aluminum phosphide, 300 lbs magnesium phosphide)²³. Additional usage data was reported from California, though a specific commodity was not identified. California is the only available usage data source for phosphine, aluminum phosphide, and magnesium phosphide.

During fumigation with phosphine gas, the gas is dispensed directly from cylinders into the space through tubing.²⁴ Duration of fumigation depends primarily on temperature but is also influenced by the dosage rate, target pests present, and the space to be fumigated. Monitoring lines and detection equipment make it possible to maintain a constant gas level of phosphine throughout the fumigation. Cylinderized phosphine gas may also be used in cold storage cooling chambers, controlled atmosphere chambers, or reefer containers specially adapted to be gas-tight for fumigations. After treatment in cold storage, aeration through large fans and/or exhaust systems capable of replacing the air in the chamber with fresh air in about one to two hours is performed. As discussed above, all phosphine and metal phosphide products are classified as RUPs.

Metal phosphide fumigants are applied directly to the commodity or space to be treated, either by manual application or auto-dispenser equipment. Describing a “typical” fumigation is difficult. Volumes of structures fumigated with metal phosphide/phosphine products vary from 1,000 ft³ to 5,000,000 ft³.

²³ California Department of Pesticide Regulation (CDPR). 2020. Annual Statewide Pesticide Use Report for the periods 2013-2017. Available at: <https://calpip.cdpr.ca.gov/main.cfm>.

²⁴ S. Nichols, J. Eickhoff, and J. Johnston. 7/13/2017. *Metal Phosphide and Phosphine Products – Use and Usage Information*. Phosphine Producers Association. MRID 50329901.

Product labels and information from registrants^{25, 26} indicate that fumigations with metal phosphides may be performed year-round. The frequency and interval of treatments vary greatly depending on the industry, commodity, site category, location, and other factors. Most fumigations with cylinderized phosphine gas occur between March and November/December and are usually conducted no more than once or twice a year. Some types of storage facilities may be fumigated more frequently, including silos/bins, chambers, railcars, and trailers. Silos/bins are generally used for long-term storage and ordinarily are fumigated monthly during warm weather but may be fumigated weekly by users who have high commodity turnover rates. Chambers that are designed expressly for fumigations may be fumigated daily or weekly during the fumigation season when commodities are moved in for fumigations, aerated, and moved out for shipping or further storage. Similarly, transport containers such as railcars and trailers serve as temporary storage for commodities while being transported from one place to another and may be fumigated as often as weekly. Ship holds containing grain for export are typically fumigated at the last load-port, remain closed during the voyage, and are aerated when the vessel reaches its destination. Aluminum phosphide may also be applied in burrows in agricultural settings and some recreational or residential areas to control burrowing rodents.

III. SCIENTIFIC ASSESSMENTS

A. Human Health Risks

The Agency has summarized the 2020 Bystander Assessment and later updates to it below. The Agency used the most current science policies and risk assessment methodologies to prepare this risk assessment in support of the registration review of phosphine and the metal phosphides. For additional details on the 2020 Bystander Assessment, see *Phosphide (Al and Mg) and Phosphine. Human Health Non-Occupational Bystander Assessment to Support the Preliminary Interim Decision* (September 21, 2020) and the 2023 Amended PID in EPA's public docket (EPA-HQ-OPP-2013-0081).

In the 2020 Bystander Assessment, EPA assessed risks to bystanders from phosphine and metal phosphide fumigations. The Agency assessed other potential human health risks, including dietary, residential, aggregate, cumulative, and occupational risks in the 2020 PID. The following section summarizes EPA's risk conclusions and addresses changes to the human health risk assessment for phosphine and the metal phosphides since the 2020 Bystander Assessment and 2020 PID. These updates were also presented in EPA's 2023 Amended PID and the risk conclusions presented there did not change in development of this ID. For information on the updated human health risk conclusions reached since the publication of the 2020 PID, see the following documents, available in the public docket:

²⁵ S. Nichols, J. Eickhoff, and J. Johnston. 7/13/2017. *Metal Phosphide and Phosphine Products – Use and Usage Information*. Phosphine Producers Association. MRID 50329901.

²⁶ MRIDs 52020901, 52020902, 52020903, 52020904, and 52020905

- *Aluminum Phosphide, Magnesium Phosphide, and Phosphine: Response to Comments on the Draft Human Health Risk Assessment and Proposed Interim Decision for Registration Review* (March 18, 2022) and
- *Phosphine, Aluminum Phosphide, Magnesium Phosphide: Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine* (October 31, 2022).

1. Risk Summary and Characterization

Phosphine is a highly reactive gas that is rapidly taken up via the lungs. All toxicity data submitted to support the aluminum/magnesium phosphide and phosphine registrations were generated for phosphine gas and are by the inhalation route of exposure only. The available data indicate phosphine is rapid acting and highly toxic but does not show progression of effects with time. Mortality is a common endpoint in the toxicity database following repeated inhalation exposure and is observed at air concentrations as low as 7.5 ppm in laboratory animals.^{27, 28} Phosphine is also classified as Toxicity Category I for acute inhalation toxicity.

A new study, submitted following completion of the 2020 Bystander Assessment, supports the use of a reference concentration (RfC) of 0.3 ppm in the 2020 Bystander Assessment.²⁹ This value was originally derived from an occupational exposure limit in the 2020 Bystander Assessment, but these new data support the Agency's use of 0.3 ppm for bystander risk assessment. In the study, rats dosed up to 8 hours did not experience mortality and showed portal-of-entry (POE) effects at ≥ 8 ppm. POE effects included degeneration of the olfactory epithelium and degeneration of the respiratory epithelium. No effects were observed at 3 ppm. With application of the appropriate uncertainty factors (UFs), this study supports an RfC of 0.3 ppm. The toxicokinetics components of both the intraspecies and interspecies UFs were reduced from 3X to 1X because phosphine causes acute irritation without progression of effects or systemic circulation or potential for bioaccumulation. Therefore, the resulting UF is 10X, corresponding to a RfC of 0.3 ppm, derived from a no effects dose of 3 ppm. Additional systemic effects observed in the toxicological database included neurotoxicity and kidney effects at higher concentrations.^{30, 31} The open literature also suggests the cardiovascular system is a primary target of phosphine.³²

²⁷ P.E. Newman. 9/5/1989. *An Acute Inhalation Toxicity Study of Phosphine in the Rat*. MRID 41377001.

²⁸ P.E. Newton, 3/2/1990. *A Thirteen Week Inhalation Toxicity Study of Phosphine (PH₃) in the Rat*. MRID 41413101.

²⁹ M. Cockburn. 7/22/2020. *A GLP Single Exposure Whole-Body Inhalation Toxicity Study of Phosphine in Sprague Dawley Rats with a 3-Week Recovery*. MRID 51220701.

³⁰ G. Schaefer. 9/23/1996. *Acute Neurotoxicity Study in Rats*. MRID 44139001.

³¹ P.E. Newman. 9/5/1989. *An Acute Inhalation Toxicity Study of Phosphine in the Rat*. MRID 41377001

³² <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3135219/>

a. Dietary (Food + Water) Risks

Magnesium phosphide and aluminum phosphide both produce phosphine gas; therefore, for all three compounds, the only potential residue of concern for tolerance enforcement and risk assessment is phosphine. Dietary exposure in food and drinking water is, however, not anticipated for registered uses of phosphine, aluminum phosphide, and magnesium phosphide.

On July 20, 2017, the IR-4 Project requested a determination by EPA's Chemistry Science Advisory Council (ChemSAC) on whether the use of phosphine for quarantine fumigation of fresh fruit and vegetable imports and exports should be considered a non-food use. Existing residue studies have demonstrated that after the aeration and holding period requirements of product labels, detectable residues of phosphine are not present. An excerpt from the June 9, 1999, tolerance revision for phosphine (64 FR 30939) indicated that "A large number of studies involving numerous types of raw agricultural commodities and processed commodities submitted to the Agency for establishment of food tolerances indicate that residues of phosphine gas will be non-detectable with adequate aeration."³³ In addition, the depuration study³⁴ demonstrated that sorption of phosphine in treated commodities and shipping material is low and depuration is rapid. Non-food uses are defined as uses that are not likely to yield residues in food (OCSPP guideline 860.1000). Given that no residues in or on any commodity were detected after aeration (limit of quantitation or LOQ = 2.4 ppb or less) following a holding period of just 24 hours and that any phosphine gas below the limits of detection (LOD) would likely dissipate as foods are cooked or prepared, the ChemSAC concluded the registered uses of phosphine as a quarantine fumigant of imported/exported fresh fruits and vegetables should be considered non-food.

The Agency waived the requirements for metabolism, residue, and storage stability data for the oxidation products of phosphine for registration review. Available data on the nature of the residue show phosphine residues along with bound residues of oxy-acids of phosphorus. The original Registration Standards for aluminum³⁵ and magnesium³⁶ phosphide reserved the requirements for human health studies until certain uncharacterized residues resulting from the treatment of food were characterized and evaluated. Since the issuance of the Reregistration Standards, the Agency received additional information which identified these formerly unknown residues as oxidation products of phosphine. Having reviewed these data, the Agency concluded that these decomposition products of phosphine are toxicologically insignificant at the levels found in the treated commodities.³⁷ Therefore, metabolism, residue, and storage stability data for the oxidation products of phosphine were not required.

³³ <https://www.federalregister.gov/documents/1999/06/09/99-14069/phosphine-pesticide-tolerances>

³⁴ J. Muhareb, et al. 12/23/2012. *Fate of Hydrogen Phosphide in Several Fruits and Vegetables Following Fumigations with ECO₂FUME Fumigant Gas at Cold Storage Temperatures*. MRID 48512301.

³⁵ <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=91012VF8.TXT>

³⁶ <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101PS90.TXT>

³⁷ <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=9101SUS4.txt>

Residue data reflecting registered postharvest treatments of stored raw agricultural and processed commodities indicate that, with adequate aeration or further processing after treatment, residues of phosphine dissipate to nondetectable levels. Consequently, exposure in food is not anticipated. Tolerances have been established for trade purposes only based on the LOQs of the analytical method for phosphine gas as well as non-detectable residues in multiple residue studies (with low LODs).

Exposures via drinking water are also not anticipated because the three compounds are used primarily indoors, and because of the physical/chemical properties of phosphine. With a vapor pressure of >760 mm Hg at 20°C, phosphine is a gas under expected use conditions and unlikely to enter ground or surface water.³⁸ Given that there were no dietary exposures anticipated, a dietary risk assessment was not conducted for phosphine and the metal phosphide fumigants.

b. Residential Handler and Residential Post-Application Risks

All phosphine products are Restricted Use Pesticides (RUP) and may be applied only by certified applicators or by workers under the direct supervision of a certified applicator, so residential handler exposures are not expected. Application is prohibited within 100 feet of occupied structures, including homes, medical facilities, schools, and daycares. However, residential post-application inhalation exposures may occur from metal phosphide use as underground treatments for burrowing rodents in residential settings (phosphine is registered for use in limited residential settings, including recreational areas and athletic fields; it is not registered for use within 100 feet of residences or occupied structures). A phosphine monitoring study for potential occupational and bystander exposures following aluminum phosphide applications to underground burrows was submitted and is detailed in the occupational sections below.³⁹ Air monitoring samples taken directly over the most heavily treated areas, as well as downwind measurements, resulted in concentrations below the regulatory exposure limits. Based on the limited use pattern, label directions, underground placement, and the air monitoring data, residential post-application exposures from outdoor underground applications are not expected to exceed the RfC defined above and are therefore not of concern.

c. Bystander Risks

EPA identified a limited set of exposure scenarios with potential bystander risks of concern. Those living, working, or otherwise near commodity fumigation facilities or treatment sites may be exposed to phosphine emissions (which originate from either gaseous or metal phosphide formulations) that travel offsite. Exposure may occur during fumigation, in the form of leakage from the fumigation structure, or post-application, during aeration. The Agency assessed bystander exposure to phosphine according to information on product labels and from

³⁸ *Registration Review: Preliminary Problem Formulation for Environmental Fate, Ecological Risk, Endangered Species, and Drinking Water Exposure Assessments for Aluminum Phosphide, Magnesium Phosphide, and Phosphine*, dated September 12, 2013. EPA-HQ-OPP-2013-0081-0002.

³⁹ R. Baker, 5/15/2002. *Potential Applicator and Bystander Phosphine Exposures from Aluminum Phosphide Use in Rodent Burrow Integrate Pest Management*. MRID 45898301 Appendix VI.

stakeholder input and using the Probabilistic Exposure and Risk Model for Fumigants (PERFUM) 3.0. EPA used PERFUM to model air concentrations from emissions at varied distances around fumigation facilities that could then be compared to the RfC of 0.3 ppm.

PERFUM input data include local meteorological records, treatment facility size, emission release heights, ventilation rates, frequency of treatments, treatment concentrations, and leakage rates. The modeled phosphine air concentrations used weather data from port facilities in Florida and California—areas known for commodity fumigation activities. The registrants also submitted information about treatment facilities and use and usage.^{40, 41, 42} Much of this latter information was submitted after completion of the 2020 PID and was used to refine EPA's bystander exposure conclusions. For details of these refinements see the *Phosphine, Aluminum Phosphide, Magnesium Phosphide: Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine* (October 31, 2022), available in the public docket. The conclusions discussed here reflect EPA's latest bystander exposure modeling.

PERFUM input data were also generated based on labeled uses. Phosphine and the metal phosphides may be used in large, indoor facilities with sophisticated ventilation and emissions recapture technology, or in sites with passive ventilation, like shipping containers or flour mills. Treatments may occur sporadically or continuously at a facility, based on demand. Additionally, treatments may be made at varying concentrations of phosphine and inert gases and at various application rates (i.e., pounds phosphine/1,000 ft³). Moreover, facilities may experience loss or leakage during fumigation. To account for these factors, a variety of theoretical treatment conditions were modeled.

Based on the inputs, PERFUM models air concentrations of phosphine as a function of distance from the emissions source. The Agency compares this to a bystander exposure value (such as an RfC or other dose) and calculates the distance beyond which modeled bystander exposure would be below the comparison value. For the 2020 PID, EPA compared modeled bystander exposure to a value of 0.3 ppm. This was derived from occupation exposure limits of 0.3 ppm set by several federal and state agencies, including the Occupational Safety and Health Administration (OSHA). Occupational exposure limits are intended to create enforceable occupational safety standards and not to assess bystander exposure. The occupational exposure limit was the most appropriate data available to inform bystander exposure assessment at the time.

⁴⁰ S. Nichols, J. Eickhoff, and J. Johnston. 7/13/2017. *Metal Phosphide and Phosphine Products – Use and Usage Information*. Phosphine Producers Association. MRID 50329901.

⁴¹ See docket ID EPA-HQ-OPP-2013-0081-0063 available in the Phosphine, Aluminum Phosphide, and Magnesium Phosphide Registration Review docket at <https://www.regulations.gov/docket/EPA-HQ-OPP-2013-0081/comments?sortBy=postedDate&sortDirection=desc>.

⁴² MRIDs 52020901, 52020902, 52020903, 52020904, and 52020905. These are discussed in the *Phosphine, Aluminum Phosphide, Magnesium Phosphide: Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine*, available in the public docket.

Since completion of the 2020 PID, PPA submitted data⁴³ to fulfill the non-guideline acute inhalation toxicity study requirement of the GDCl. From these data EPA established an RfC of 0.3 ppm for bystander exposure (i.e., equal to the occupational exposure limit used for bystander assessment for the 2020 PID). In addition, the RfC is derived from an exposure of 8 hours, which is the time-weighted average exposure period on which the OSHA occupational exposure limit is based. Thus, the new data support the use of 0.3 ppm in the 2020 Bystander Assessment.

PERFUM produced a wide range of outputs describing potential bystander exposure to phosphine. These are discussed in detail in the *Phosphide (Al and Mg) and Phosphine. Human Health Non-Occupational Bystander Assessment to Support the Preliminary Interim Decision* (September 21, 2020) and the 2023 Amended PID in EPA's public docket (EPA-HQ-OPP-2013-0081), and only an overview is presented here.

In many of the modeling scenarios, the resulting maximum concentration of phosphine was below 0.3 ppm (i.e., no buffer zone is needed to protect bystanders) for the 90th percentile of the output distributions. This is true of all scenarios modeling leakage during treatment (even those that model the maximum permitted application rate). This is also true of many scenarios modeling aeration after treatment. However, there were some aeration scenarios that produced modeled concentrations of phosphine in the atmosphere around a fumigation site above 0.3 ppm. The Agency considers these exposures to be potential risks of concern. Generally, these results were limited to scenarios with very large fumigation structures, structures aerated without a ventilation stack, and/or situations in which multiple fumigation structures were aerated concurrently at the same fumigation site.

The Agency also reviewed air monitoring data^{44, 45} submitted by the PPA, air monitoring data tied to a specific fumigation event⁴⁶ from the CA Air Resources Board (CARB), and EPA's National Air Toxics Assessment (NATA)⁴⁷. These three lines of evidence are discussed at length in the 2020 Bystander Assessment. The PPA data measured air concentrations of phosphine in and around phosphine fumigation sites. The CARB data were collected around a fumigation site before, during, and after a single fumigation. Finally, EPA's NATA is a screening tool that uses computer modeling to help federal, state, and local agencies identify possible risks to public health from air toxics for further investigation. These data and modeling indicate that the non-occupational population is not likely to be exposed to ambient levels of phosphine greater than the RfC of 0.3 ppm. However, these datasets are too limited to fulfill the non-guideline ambient

⁴³ M. Cockburn. 7/22/2020. A GLP Single Exposure Whole-Body Inhalation Toxicity Study of Phosphine in Sprague Dawley Rats with a 3-Week Recovery. MRID 51220701.

⁴⁴ J. Johnston. 10/28/2016. *Phosphine Concentrations Measured in Air at Fumigation Sites*. MRID 50095601.

⁴⁵ J.R. Smiley, et al. 1/27/2003. *Phosphine Monitoring Data Collected From Various Types of Fumigation Sites*. MRID 45898301.

⁴⁶ Adler, N. 6/7/2010. Report on Air Monitoring of the Application of Phosphine in Merced County in December 2008. California Environmental Protection Agency, Air Resources Board. California.

⁴⁷ <https://www.epa.gov/national-air-toxics-assessment>

air monitoring data requirements of the GDCIs.⁴⁸ The outstanding monitoring data would measure actual ambient air concentrations and so confirm or refute the conclusion that ambient exposure above the RfC is unlikely. The ambient air monitoring data requirements of the GDCI continue to be required.

d. Aggregate Risks

In an aggregate assessment, EPA considers the combined pesticide exposures and risks from three major sources: food, drinking water, and residential exposures. The Agency sums the exposures from these sources and compares the aggregate risk to quantitative estimates of hazard. EPA considers the route and duration of exposure when assessing aggregate risks. For phosphine and the metal phosphides, aggregate exposures are equivalent to dietary exposure estimates because there are no residential exposures except after application to rodent burrows, which may occur after application to athletic fields or other recreational areas.

Although there is the potential for residential post-application inhalation exposure from the rodent burrow use, dietary and residential handler exposures are not anticipated for currently registered uses of phosphine and the metal phosphides. Consequently, there are no exposure scenarios to aggregate with the residential post-application exposure scenario, and an aggregate risk assessment is not needed.

e. Cumulative Risks

In 2016, EPA's Office of Pesticide Programs released a guidance document entitled, *Pesticide Cumulative Risk Assessment: Framework for Screening Analysis* (<https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/pesticide-cumulative-risk-assessment-framework>). This document provides guidance on how to screen groups of pesticides for cumulative evaluation using a two-step approach beginning with the evaluation of available toxicological information and if necessary, followed by a risk-based screening approach. This framework supplements the existing guidance documents for establishing common mechanism groups (CMGs)⁴⁹ and conducting cumulative risk assessments (CRA)⁵⁰. The Agency has utilized this framework for the fumigants phosphine, aluminum and magnesium phosphides, and the rodenticide zinc phosphide, which all share phosphine as the primary toxic degradate and toxic moiety. Since the metal phosphides are considered different forms of phosphine, the Agency has determined that phosphine and the metal phosphides do not form a candidate CMG and no further cumulative evaluation is necessary.

⁴⁸ GDCI-066501-1393, GDCI-066501-1402, and GDCI-066504-1403. EPA-HQ-OPP-2013-0081.

⁴⁹ *Guidance for Identifying Pesticide Chemicals and Other Substances that have a Common Mechanism of Toxicity* (USEPA, 1999)

⁵⁰ *Guidance on Cumulative Risk Assessment of Pesticide Chemicals That Have a Common Mechanism of Toxicity* (USEPA, 2002)

f. Occupational Handler Risks

A quantitative occupational handler risk assessment is unnecessary. Occupational handlers are not expected to be exposed to levels of phosphine greater than regulatory or OSHA-recommended exposure level values, which are the same as the RfC of 0.3 ppm, derived from the newly submitted inhalation toxicity study discussed above.⁵¹ While the RfC itself is not applicable to occupational exposures, the uncertainty factors used to derive the RfC still apply to the study no observed adverse effect concentration (NOAEC) of 3 ppm, resulting in an occupational level of concern (LOC) of 10X. Therefore, the exposure levels set by OSHA are considered protective of adverse health effects to workers. This conclusion is supported by the available air monitoring data and label requirements for PPE, which include gloves and respirators (respirator requirements depend on monitored air concentrations of phosphine).

For the commodity fumigant uses of phosphine and the metal phosphides, occupational handlers include those individuals who handle the pesticide or commodities prior to application and immediately after application and clearance (e.g., forklift drivers). Activities performed immediately after application are still considered occupational handler activities because for commodity fumigation, the fumigation job site is under the purview of the fumigator until the fumigation and aeration has been completed and the commodity released.

There is potential for occupational acute-, short-, and intermediate-term inhalation handler exposures from the commodity fumigant uses of metal phosphides/phosphine. Occupational dermal exposures are not expected given the high vapor pressure of phosphine and based on the delivery systems used (which include pressurized cylinders or solid metal phosphide products).

Product labels state that persons without respiratory protection may be exposed to no more than 0.3 ppm phosphine as an 8-hour TWA, or 1.0 ppm phosphine as a 15-minute short-term exposure limit (STEL). Per label instructions, monitoring is performed to establish concentration levels. Per registered labels, aeration is complete when airborne concentrations of phosphine in the treated chamber are less than the threshold limit value (TLV) of 0.3 ppm.

Product labels require the development and implementation of fumigation management plans (FMPs)⁵² that contain measures to protect both occupational handlers and bystanders. Monitoring and protection of the fumigator, fumigation workers, bystanders, and nearby animals are addressed in the FMPs. Additionally, registered metal phosphide/phosphine product labels require monitoring to determine fumigator exposure concentrations and require

⁵¹ P.E. Newman. 9/5/1989. *An Acute Inhalation Toxicity Study of Phosphine in the Rat*. MRID 41377001.

⁵² In 2001 the *Memorandum of Agreement Between the United States Environmental Protection Agency and Signatory Registrants of Phosphine Based Fumigants*, announced in the Federal Register (66 FR 8790, available at <https://www.federalregister.gov/documents/2001/02/02/01-2773/amendment-to-reregistration-eligibility-decision-for-aluminum-phosphide-and-magnesium-phosphide>), established additional mitigation, including FMPs, to reduce risks to workers and bystanders.

respiratory protection if concentrations exceed allowable limits or are unknown. In the past FMPs required the establishment of a buffer zone (for cold storage applications only) where entry is prohibited without the appropriate respiratory protection.⁵³

Various regulatory and recommended exposure levels for inhalation exposure to phosphine exist to protect occupational workers. These include the OSHA permissible exposure level of 0.3 ppm (8-hr time weighted average). Both the National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit (REL) and the California OSHA permissible exposure level are 0.3 ppm (8-hr time weighted average) with a short-term exposure limit of 1 ppm (Ceiling limit). The American Conference of Governmental Industrial Hygienists (ACGIH) recommends a threshold limit values (8-hour time weighted average) of 0.05 ppm with a short-term exposure limit of 0.15 ppm. Exposure guidelines issued by ACGIH are recommendations only. As described above, the registrant submitted data to support an acute toxicity RfC of 0.3 ppm for risk assessment purposes.⁵⁴

Current metal phosphide/phosphine end-use product labels require various levels of PPE for occupational handlers during application and while opening cylinders. Handlers must wear gloves when connecting to or disconnecting fumigant cylinders from the blending equipment. Safety glasses are also required when working with pressurized equipment. When concentrations are unknown or known to exceed the STELs for phosphine (1 ppm for 15 minutes), a NIOSH approved self-contained breathing apparatus (SCBA) with full facepiece and operated in pressure-demand mode must be worn. A full-face gas mask with phosphine canister may be used at levels up to 15 ppm. A SCBA can be worn at levels up to 50 ppm, and when levels exceed 50 ppm, workers may not enter spaces until the phosphine level has decreased to below 50 ppm.

The registration review GDCIs⁵⁵ for phosphine and the metal phosphides required exposure data for applicators involved in fumigating commodities/materials and/or structural facilities (guideline 875.1400). A submission by the PPA⁵⁶ included extensive air monitoring data and results with measured air concentrations from various fumigation treatments, including six broad categories of containers, chambers, bins, ships, structures, and tarps. The monitoring data included more than 6,000 samples with 106 worker breathing zone samples from bin, container, structure, tarp, and ship fumigations for the phosphine gas product as well as metal phosphide treatments. Phosphine concentrations for the occupational handler breathing zone samples ranged from <LOD to 8 ppm. Although multiple monitoring sample concentrations resulted in exposure levels greater than the RfC or OSHA PEL or the STEL limits, under those air

⁵³ Under the labeling changes described in Appendix B of this document, EPA is removing the cold storage-specific buffer zones and replacing them with buffer zone requirements specific to any fumigation, as determined by several factors (e.g., fumigation volume, application rate, and aeration specifications).

⁵⁴ P.E. Newman. 9/5/1989. *An Acute Inhalation Toxicity Study of Phosphine in the Rat*. MRID 41377001.

⁵⁵ GDCI-066501-1393, GDCI-066501-1402, and GDCI-066504-1403. EPA-HQ-OPP-2013-0081.

⁵⁶ J. Johnston. 10/28/2016. Phosphine Concentrations Measured in Air at Fumigation Sites. MRID 50095601.

concentrations, handlers would be required to wear respiratory protection according to label requirements to reduce actual exposures below the regulatory limits.

An earlier submission of air monitoring data (MRID 45898301) was also made by PPA⁵⁷ for different fumigation sites including warehouses, transportation containers (trucks, vans, seagoing containers, grain storage facilities), bulk vertical (silos, small farm bins, etc.), and tarps or gas tight sheeting. The air monitoring data collected in this study were area samples mostly related to concentrations adjacent to fumigation structures or downwind at fence lines and would not represent occupational handler exposures. As part of this PPA submission, a study was also included with exposure concentrations for handlers and bystanders for the burrowing rodent uses of aluminum phosphide.⁵⁸ More than 10,000 applications of aluminum phosphide to rodent burrows were monitored with no levels exceeding the occupational PELs or NIOSH RELs as either an 8-hour TWA or a STEL exposure duration. The average mean 8-hour TWA presented in the study report for occupational handlers was identified as 0.035 ppm. The air monitoring data provided by the PPA is robust and sufficient to fulfill the guideline 875.1400 requirement detailed above.

Based on the available hazard and exposure data, as well as current requirements for the development of FMPs, air monitoring data, and PPE requirements, the Agency concludes that workers (both those that apply phosphine products and those that work in the treatment facilities) are not expected to be exposed to levels of phosphine greater than the regulatory or recommended exposure level values. Therefore, a quantitative risk assessment was not conducted and is not necessary.

g. Occupational Post-Application Risks

The Agency has not identified post-application risks of concern to workers. Workers are not expected to be exposed to levels of phosphine greater than the regulatory exposure level values when label directions are followed.

Structures that have been fumigated must be aerated until the level of phosphine gas is at or below 0.3 ppm before the space may be re-entered, unless approved respiratory protection is worn. The application area must be monitored to ensure that liberation of gas from the treated commodity does not result in unacceptable concentrations. As stated above in the occupational handler risks section, monitoring is performed to establish phosphine concentration levels and determine when workers can re-enter spaces and when workers are required to wear respiratory protection.

Occupational dermal post-application exposures are expected to be negligible given the high

⁵⁷ J.R. Smiley, et al. 1/27/2003. *Phosphine Monitoring Data Collected From Various Types of Fumigation Sites*. MRID 45898301.

⁵⁸ R. Baker, 5/15/2002. *Potential Applicator and Bystander Phosphine Exposures from Aluminum Phosphide Use in Rodent Burrow Integrate Pest Management*. MRID 45898301 Appendix VI.

vapor pressure of phosphine and have not been quantitatively assessed. There is potential for occupational post-application inhalation exposure to phosphine while handling treated commodities. These exposures can possibly occur because phosphine may continue to volatilize, or off-gas, from treated commodities or packaging. These exposures may be acute, short-, and intermediate-term in duration for workers. The 2013 scoping document for registration review⁵⁹ outlined the need for exposure data for post-application workers or bystanders near fumigation facilities/operations or those who work directly with previously treated commodities/materials, according to guideline 875.2500. These data were required in Registration Review GDCIs⁶⁰ for phosphine and the metal phosphides. Emission rates for phosphine from treated commodities/materials and the potential for occupational exposure due to those emissions further down the distribution chains after fumigation were also required. The types of workers that these data describe may include cold storage workers or transport workers who unload trucks, containers, etc., following transport fumigation treatments.

The guideline 875.2500 data were not submitted. Instead, as described above, the PPA submitted data from monitoring of air concentrations from various fumigation treatments (MRID 50095601) along with an earlier submission of phosphine monitoring data collected from various types of fumigation sites (MRID 45898301) that the Agency used to assess occupational post-application risk. Data required in the GDCI to assess occupational post-application exposures to phosphine residues as treated commodities travel through the distribution chain were not submitted. Registrants submitted other data in lieu of these data that the Agency was able to use to assess these exposures and conclude they are not of concern. A study was submitted (MRID 49066801)⁶¹ and reviewed by the Agency⁶² on the sorption and depuration of phosphine relative to methyl bromide following fumigation of grapes and citrus. The Agency concluded that, relative to methyl bromide (another fumigant), phosphine is sorbed by palletized loads of fruit during fumigation at one-tenth the magnitude and that phosphine off-gasses approximately 20-fold and 5-fold faster than methyl bromide from loads of grapes and oranges in cold storage, respectively. Therefore, worker inhalation exposures further down the distribution chains after fumigation are expected to be less than those experienced with methyl bromide fresh fruit applications. While EPA was able to use these data to conduct its assessment, specific, task-related data could further characterize occupational post-application exposure potential.

⁵⁹ M. King, et. al., D410399, 09/11/2013. Phosphide (Al, Mg) and Phosphine. Human Health Assessment Scoping Document Supporting Registration Review.

⁶⁰ GDCI-066501-1393, GDCI-066501-1402, and GDCI-066504-1403. EPA-HQ-OPP-2013-0081.

⁶¹ S. Walse. 2/26/2013. *Sorption and Depuration of Phosphine Relative to Methyl Bromide Following Post Harvest Fumigation of Grapes and Citrus*. MRID 49066801.

⁶² J. Miller, D410561, 8/20/2013. Data Evaluation Record. Phosphine: Sorption and Depuration of Phosphine Relative to Methyl Bromide Following Post-Harvest Fumigation of Grapes and Citrus.

The aluminum phosphide rodent burrow study⁶³ mentioned above in the occupational handler section also monitored sites above the most heavily treated areas and downwind of treatments, as well as residences or other structures adjacent to treated areas. The post-application area monitoring exposures representing persons entering treated fields or nearby treated fields resulted in a maximum measured TWA of 0.06 ppm and a maximum direct read short-term reading of 0.32 ppm phosphine. Of the 30 residences or structures monitored, only two had detectable levels of phosphine, with a maximum 8-hour TWA concentration of 0.03 ppm, ten times lower than the exposure limits set by OSHA and other regulatory agencies described above.

Based on the current label requirements for re-entry phosphine air concentration levels and required respiratory protection and considering the results of the submitted sorption and deuration data for cold storage air concentrations, the Agency does not expect that occupational post-application worker exposure will exceed regulatory exposure level values.

2. Human Incidents and Epidemiology

EPA conducted two incident reviews for the aluminum phosphide, magnesium phosphide, and phosphine registration review. The initial review of human incidents – conducted in 2013 – concluded that there was a relatively low frequency and severity of incidents reported for magnesium phosphide and phosphine, whereas there was a moderately high frequency of aluminum phosphide incidents in the Sentinel Event Notification System for Occupational Risk (SENSOR-Pesticides) database as well as two deaths related to aluminum phosphide use in the Incident Data System (IDS).

In 2019, the Agency conducted an updated review of human incidents as well as reviewed epidemiology studies on phosphine/metal phosphides included in the Agricultural Health Study (AHS). The updated review confirmed that aluminum phosphide was involved in more incidents (13 in Main IDS, 8 in Aggregate IDS, and 44 in SENSOR-Pesticides) than phosphine and magnesium phosphide. For phosphine and magnesium phosphide combined, there were 2 incidents in IDS and 8 incidents in SENSOR-Pesticides. Aluminum phosphide incidents reported in IDS ranged from major to minor severity, with five incidents resulting in fatalities. Two of the fatalities were due to illegal use of the product in a residential home, two were due to ingestion of the product to self-harm, and one had no exposure details. The two incidents reported for phosphine and magnesium phosphide in the IDS were of moderate severity. Most phosphine/fumigant metal phosphide incidents reported in the SENSOR-Pesticide database were occupational in nature and nearly half of the incidents were of moderate (20 incidents) or high (4 incidents) severity. The remaining 28 incidents reported in SENSOR-Pesticides were of minor severity.

⁶³ R. Baker, 5/15/2002. *Potential Applicator and Bystander Phosphine Exposures from Aluminum Phosphide Use in Rodent Burrow Integrate Pest Management*. MRID 45898301.

Aluminum phosphide was the only chemical from the phosphine/metal phosphide group included in the AHS, and overall, there is insufficient evidence to conclude that a clear associative or causal relationship exists between aluminum phosphide exposure and the carcinogenic and non-carcinogenic health outcomes assessed in the twenty-one AHS studies that discussed aluminum phosphide. The Agency will continue to monitor the epidemiology data, and—if a concern is triggered—additional analysis will be conducted. More detail on the incident reports and epidemiology review can be found in the Tier I review memo⁶⁴ and Tier I updated review memo.⁶⁵

Since the 2019 review, EPA has been notified of four further human incidents involving metal phosphide products. One occurred in 2017 and was reported to EPA in 2020. An individual died after the apparent deliberate ingestion of metal phosphide tablets. Another incident also involved the apparent deliberate ingestion of metal phosphide tablets. It is not clear from the information available if the individual survived. This incident is classified as moderate in severity. Of the remaining two incidents, one is classified as minor and the other moderate in severity. The information available indicates that the individuals in these two remaining incidents recovered after receiving medical treatment.

The Agency intends to continue to monitor human incidents for phosphine and the metal phosphides and will conduct additional analyses if necessary.

3. Tolerances

Phosphine and the metal phosphides are registered for uses that result in residues in or on food. Data indicate that aeration or further processing after treatment cause residues of phosphine to dissipate to nondetectable levels. Therefore, tolerances have been established for trade purposes only based on the LOQs of the analytical method for phosphine gas as well as non-detectable residues in multiple residue studies (with low LODs). Generally, a tolerance or tolerance exemption must cover the residues or the affected food is considered adulterated.⁶⁶ EPA has identified that the Agency established all the necessary tolerances for residues resulting from phosphine and the metal phosphides' legal use. Tolerances are established for residues of aluminum phosphide, magnesium phosphide and, phosphine gas on various commodities in 40 CFR §180.225. Tolerances range from 0.01 ppm to 0.1 ppm.

However, during the risk assessment process EPA identified that revisions to the tolerance expressions and commodity definitions for several crops are necessary to comply with current practices. For more information, see Section IV.D. and Appendices E and F, below.

⁶⁴ S. Recore and E. Evans, D411384, 5/8/2013. Aluminum Phosphide, Magnesium Phosphide and Phosphine: Review of Human Incidents.

⁶⁵ S. Recore, E. Evans, and E. Jones, D453165, 7/31/2019. Aluminum Phosphide, Magnesium Phosphide and Phosphine: Tier I Updated Review of Human Incidents and Epidemiology for Draft Risk Assessment.

⁶⁶ 21 U.S.C. §§ 342, 346(a).

There are numerous Codex and Canadian maximum residue limits (MRLs) for phosphine and/or hydrogen phosphide. MRLs were harmonized where possible. However, there are instances where Codex/Canada has MRLs on commodities and the U.S. does not and vice versa. In these instances, harmonization is not necessary.

For food commodities, the existing tolerances are based upon non-detectable residues in magnitude of the residue studies. Anticipated residues presented in the Human Health Assessment section of the *Reregistration Eligibility Decision (RED): Al and MG Phosphide*⁶⁷ were set at four different levels (<0.003 ppm, <0.004 ppm, <0.005 ppm, or <0.006 ppm). These levels correspond to the analytical LOD reported in the original tolerance petitions. A residue study submitted in 2010 (MRID 48512301) and 2011 (companion volume, MRID 48681201) was conducted on six different fresh fruits and vegetables (apples, strawberries, grapes, peaches, squash and broccoli) fumigated under cold conditions for 24-48 hours at the maximum label rate of 2,500 ppm phosphine on fresh fruits and vegetables. No residues in or on any commodity were detected after aeration (LOQ = 2.4 ppb or less) following a holding period of just 24 hours (note the label requirement for aeration is 48 hours or a shorter time period for cold storage if measured airborne phosphine is < 0.3 ppm).

4. Human Health Data Needs

The human health database for phosphine and the metal phosphides is not considered complete. Although not all human health data requirements have been met, EPA has considered the available data and they were sufficient to conduct the 2020 Bystander Assessment and are sufficient to support this ID. EPA was able to assess bystander exposure to phosphine with PERFUM modeling. Furthermore, EPA assessed ambient exposure with the available data from the PPA, CARB, and NATA, as discussed previously. Ambient air monitoring data are still necessary to confirm EPA's conclusions about bystander ambient exposures. The Agency intends to continue working with the registrant to satisfy these data requirements under existing GDCI notices (GDCI-066501-1393, GDCI-066501-1402, and GDCI-066504-1403).

The following data/guidelines remain outstanding:

- *Non-guideline Study – Ambient air monitoring.* This study is required to assess ambient air concentrations for communities in proximity to treated facilities.

B. Ecological Risks

The Agency has summarized the 2020 draft ecological risk assessment (2020 Eco DRA) below. The Agency used the most current science policies and risk assessment methodologies to prepare a qualitative risk assessment in support of the registration review of phosphine and the

⁶⁷ EPA 738-R-98-017, December 1998, *Reregistration Eligibility Decision (RED): AL and MG Phosphide*.

metal phosphides.⁶⁸ For additional details on the 2020 Eco DRA, see the *Six Structural and Commodity Fumigants: Combined Draft Risk Assessment (DRA) and Drinking Water Assessment (DWA) for Registration Review* (January 27, 2020) in EPA's public docket (EPA-HQ-OPP-2013-0081-0043).

EPA is currently working with its federal partners and other stakeholders to improve the consultation process for listed species and their designated critical habitats. The Agency has not yet fully evaluated phosphine and the metal phosphides' risks to listed species. However, EPA will complete its listed-species assessment and any necessary consultation with the Services before completing the phosphine and the metal phosphides registration review. See Appendix C for more details. As such, only potential risks for nontarget species under FIFRA are described below.

1. Risk Summary and Characterization

a. Aquatic Risks

The conclusions of the 2020 Eco DRA were similar to those of the 1998 RED. Acute and chronic risk to nontarget aquatic taxa from exposure to phosphine is expected to be low. As described above, the metal phosphides rapidly degrade into phosphine gas. Phosphine then readily disperses in the environment and breaks down by photodegradation. It is unlikely to contaminate water due to its volatility and any residual trapped phosphine gas in burrows is expected to bind to soil and further degrade to phosphates, a naturally occurring substance. Deposition in receiving waterbodies could occur, but rates of these processes would likely be limited by atmospheric conditions and delivery to the water interface. Lastly, phosphine is unlikely to be bioconcentrated in tissues of aquatic organisms due to its physical properties [i.e., log octanol-water partition coefficient (K_{ow}) < 0 and limited persistence in the environment]. As a result, acute and chronic risk from aquatic exposure of phosphine is expected to be below levels of concern.

b. Terrestrial Risks

Terrestrial Vertebrates

There is a minimal potential for risk to nontarget terrestrial organisms from registered indoor uses of phosphine and the metal phosphides. Inhalation and direct contact from outdoor (i.e., rodent burrow) uses and inhalation downwind from aerated structural treatment sites are expected to be the main exposure routes to terrestrial plants and animals. Nontarget terrestrial vertebrates and invertebrates that are in burrow application sites or downwind from structural treatment sites during and shortly after treatment may be exposed to phosphine. Additionally, terrestrial plants and animals within the currently required buffer zones specified on the label

⁶⁸ The 2020 Eco DRA does not specifically consider potential impacts to species listed under the Endangered Species Act.

are expected to be exposed to reduced concentrations, but not necessarily concentrations below the level of concern.

Since the problem formulation, an avian inhalation study was submitted to the Agency. The avian inhalation study conducted with Northern bobwhite quail (*Colinus virginianus*) estimated an LC₅₀ (i.e., the concentration lethal to 50% of the population) for phosphine vapor exposure of 36 milligrams active ingredient per liter (mg a.i./L).

Exposure is considered limited to site-specific scenarios where phosphine from treated containers and contents are aerated and may be released into the environment, at or downwind from structural treatment sites during and shortly after treatment, or directly in burrows. Volatilization is significant for these chemicals and occurs rapidly. Thus, inhalation and direct contact, rather than consumption of residues deposited on dietary items (such as plants, insects, seeds and, in the case of bees, pollen and nectar), are expected to be the main routes of exposure for terrestrial plants and animals.

In 2010, EPA conducted partial listed species assessment for selected listed species in the San Francisco Bay area from registered uses of the metal phosphides. The Agency reached “no effect” determinations for the assessed species for indoor (i.e., commodities fumigation) uses of the metal phosphides due to an incomplete exposure pathway. For the outdoor (i.e., burrow treatment) uses, EPA made “may affect” and “likely to adversely affect” determinations for all evaluated species: Alameda whipsnake (*Masticophis lateralis euryxanthus*), California Tiger Salamander (*Ambystoma californiense*)—Central California, Sonoma County, and Santa Barbara County distinct population segments—San Francisco garter snake (*Thamnophis sirtalis*), and San Joaquin Kit Fox (*Vulpes macrotis mutica*).

Terrestrial Invertebrates

EPA relies on data about honey bees as a surrogate for terrestrial invertebrate species. Since the problem formulation, two honey bee (*Apis cerana indica*) acute vapor exposure toxicity studies on magnesium phosphide were submitted to the Agency. The first one estimated an LC₅₀ of 277 mg product/L and the second estimated an LC₅₀ of 181 mg product/L. Both studies were classified as supplemental and can only be used for characterization purposes due to uncertainties about exposure concentrations of the active ingredient phosphine gas in the laboratory studies.

EPA has determined that uses of phosphine and the metal phosphides do not present risks of concern to honey bees, because limited exposure is expected from registered uses because volatilization is expected to occur rapidly. Thus, inhalation and direct contact, rather than consumption of residues deposited on dietary items (pollen and nectar), is expected to be the main route of exposure. Ultimately, while these chemicals may indicate toxicity, due to the limited potential exposure pathway, there is minimal potential exposure for risk to nontarget terrestrial invertebrates. Moreover, the available incident data do not demonstrate risks to

honey bees. Therefore, the Agency is not proposing to require additional honey bee studies for phosphine or the metal phosphides.

2. Ecological Incidents

EPA conducted a search of the Incident Database System (IDS), which is maintained by the Agency's Office of Pesticide Programs, in August 2019. The search yielded a single ecological incident associated with the use of phosphine, and 6 ecological incidents associated with the use of aluminum phosphide before the Problem Formulation was published. No incidents have been attributed to magnesium phosphide. This search excludes incidents classified as "unlikely" or "unrelated" and only includes incidents with the certainty categories of "possible," "probable," and "highly probable." The single phosphine incident (I028682-00009), which was classified as possible, involved mortality to 25 wild turkeys (*Meleagris gallopavo*) in Yolo County, California in 2016. It was suspected that the turkeys were exposed to phosphine while foraging in a vineyard or olive orchard, but no additional information is available about the incident and the legality was undetermined.

Since the August 2019 search of IDS, EPA learned of a 2021 incident involving six wolves that died of suspected pesticide poisoning. The species of wolf was not specified. The stomach contents of five of the wolves tested positive for phosphine, suggesting exposure to aluminum or zinc phosphide. The stomach contents of four of the wolves tested positive for the pesticide aldicarb (oxamide and nitrile). One wolf's stomach contents tested negative for both phosphine and aldicarb. Organophosphate or carbamate exposure was also indicated in the incident, based on sampling of brain tissue.

In addition to the incidents recorded in IDS, additional incidents are reported to the Agency in aggregated form. No aggregate incidents were reported for phosphine or magnesium phosphide. One aggregate incident involving plant damage was reported for aluminum phosphide. The number of actual incidents associated with these fumigants may be higher than what is reported to the Agency. Incidents may go unreported since side effects may not be immediately apparent or readily attributed to the use of a chemical. Although incident reporting is required under FIFRA Section 6(a)(2), the absence of reports in IDS does not indicate that the chemical has no effects on wildlife; rather, it is possible that incidents are unnoticed and unreported.

3. Ecological and Environmental Fate Data Needs

The ecological and environmental fate database for phosphine and the metal phosphides is complete. The Agency does not anticipate any further data needs for phosphine and the metal phosphides.

C. Benefits Assessment

Broadly, the advantages of fumigants, including phosphine and the metal phosphides, are that they provide applicators with pest control options that are fast acting, and/or broad-spectrum that may result in pest eradication. They provide a pest control mechanism that can penetrate and treat commodities and structures that cannot be easily or feasibly reached by other pesticide types and leave minimal or no surface residues. Due to the variety of ways phosphine and the metal phosphides fumigations may be deployed or utilized (e.g., structures or spaces, grain silos, vehicles or in-transit railcars or ship holds, tarpaulin, spot, burrows), they provide flexibility to applicators managing insect and vertebrate pests in a variety of scenarios.⁶⁹

Phosphine and the metal phosphides play a vital role in controlling pests that infest structures or spaces that store commodities. Pests controlled by phosphine have public health and economic importance and include both stored-product insect and vertebrate (rodent) pests. These pests can spread diseases in humans (e.g., rodents and Sylvatic plague) and/or result in the adulteration or spoiling of food and non-food commodities (e.g., tobacco) that are in storage or transit. In cases where the purpose of treatment is to control for a vector-borne disease, the use would be considered a public health use. While the exposure times for structures or spaces with goods fumigated with phosphine are generally prolonged relative to other fumigants, a key advantage is that phosphine is effective against all insect life stages and provides flexibility to fumigators who may utilize in-transit commodity (e.g., grains) fumigations that may take place over several days on railcars or in ship holds. Moreover, their varied formulations which include pellets, tablets, or other prepackaged options make metal phosphide products easy to use inside spaces with known volumes or as spot treatments to disinfest machinery or food processing equipment.

Few alternative technologies are available for pest control in commodities and structures. When applicable, prevention and sanitation practices and surface treatments with insecticides (e.g., pyrethroids, organophosphates, insect growth regulators) are made to prevent or control pests that infest commodities and structures. Generally, fumigation is only needed for pest control in structures and spaces when these methods have failed or are not practical. Fumigants are sometimes the last option for pest infestations. Phosphine may serve as an alternative to methyl bromide for certain uses. Non-chemical alternatives for phosphine and the metal phosphides uses include heat/steam and irradiation. However, facilities may not be equipped with practical methods to deliver heat/steam to all stored commodities, and the exposure to heat and moisture may negatively impact the quality of the commodity. Further, irradiation sterilization methods do not have market acceptance in the U.S.

Metallic phosphide fumigation for rodent control can be beneficial as the control measure is not dependent upon rodents' acceptance of baits to be effective. Additionally, fumigation for

⁶⁹ Hansel, J., Kells, B., Otte, B. and Fovargue, R. 2022. EPA Memorandum: Use and Benefits Assessment for 11 Rodenticides and Impacts of Potential Risk Mitigation. Available: <https://www.regulations.gov/document/EPA-HQ-OPP-2015-0778-0095>

rodent control may be warranted when use of other rodenticides is ineffective, or impractical e.g., in cases of extreme harborage.⁷⁰

For more information on the benefits of fumigations and individual fumigants see *Overview of Use, Usage, and Benefits of Commodity and Structural Fumigants: Phosphine [(066500) including Aluminum Phosphide (066501) and Magnesium Phosphide (066504)], Propylene Oxide (042501), Sulfur Dioxide (077601), Sodium Metabisulfite (111409), Sulfuryl Fluoride, (078003), Ethylene Oxide (042301), and Methyl Bromide (053201)* (October 5, 2020) available in the public docket.

IV. INTERIM REGISTRATION REVIEW DECISION

The Agency is issuing this ID in accordance with 40 C.F.R. §§ 155.56 and 155.58. Based on the Agency's review of phosphine and the metal phosphides at this time in the registration review process, EPA is implementing certain changes to the affected registrations and their labeling. EPA determined that the mitigations identified in Sections IV.A.–B. and Appendices A and B will address specific risks of concern identified at this point in the ongoing registration review process.

At the end of the registration review process, EPA will decide whether each phosphine and metal phosphide pesticide registration “continues to satisfy the FIFRA standard for registration.”⁷¹ However, the mitigation specified in this ID may not be sufficient for EPA to determine that phosphine and metal phosphide registrations continue to satisfy the FIFRA standard for registration. EPA may determine that additional mitigations or other measures are necessary in subsequent interim determinations or its final registration review decision.

The Agency has not completed ESA effects determinations for phosphine and metal phosphide registrations. In 2010, the Agency transmitted its final biological evaluation and initiated formal consultation with FWS on the effects of the metal phosphides on 11 listed species in the greater San Francisco Bay area.⁷² The Agency will complete a nationwide listed-species assessment and any necessary consultation with the Services before completing the metal phosphides registration reviews. However, EPA has determined that the mitigation in this ID will reduce environmental exposure to phosphine and may reduce effects on listed species whose range or critical habitat co-occur with the use of phosphine and the metal phosphides. Additionally, EPA

⁷⁰ Hansel, J., Kells, B., Otte, B. and Fovargue, R. 2022. EPA Memorandum: Use and Benefits Assessment for 11 Rodenticides and Impacts of Potential Risk Mitigation. Available: <https://www.regulations.gov/document/EPA-HQ-OPP-2015-0778-0095>

⁷¹ 40 C.F.R. §§ 155.40(a), 155.57; 7 U.S.C. § 136a(g); see also 7 U.S.C. §§ 136a(c)(5) (FIFRA registration standard), 136(bb) (defining “unreasonable adverse effects on the environment” as encompassing both “any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide” [FIFRA’s risk-benefit standard] and “a human dietary risk from residues that result from a use of a pesticide in or on any food inconsistent with the [FFDCA safety standard]”). This document is not a “registration review decision” within the meaning of FIFRA Section 3(g) and 40 C.F.R. § 155.57.

⁷² <https://www.epa.gov/endangered-species/endangered-species-litigation-and-associated-pesticide-limitations>

has added FIFRA IEM measures in Section IV.B. of this ID, which are intended to reduce effects to nontarget organisms, including listed species. EPA also has determined that the FIFRA IEM measures discussed in Section IV.B would fulfill EPA's obligations under Section 711 of the Consolidated Appropriations Act, PL-117-328 (Dec. 29, 2022). Section 711 requires EPA to "include, where applicable, measures to reduce the effect of the applicable pesticide on" listed species and designated critical habitats in any ID noticed in the Federal Register between December 29, 2022 and October 1, 2026 for which EPA has not "made effects determinations or completed any necessary consultation under [ESA Section 7(a)(2)]." Section 711 also requires EPA to "take into account the input" of the Secretary of Agriculture and other members of the Interagency Working Group (IWG), established under FIFRA Section 3(c)(11), in developing such measures. EPA has taken into account input from USDA and other members of the IWG in developing the FIFRA IEM measures. EPA has previously requested public input on the FIFRA IEM measures described in this ID. The Agency will complete effects determinations and any necessary Endangered Species Act (ESA) Section 7 consultation with the Services before issuing a final registration review decision for phosphine and the metal phosphides. For more information, see Appendix C.

A. Risk Mitigation and Regulatory Rationale

EPA identified potential human health risks of concern to non-occupational bystanders associated with registered uses of phosphine and the metal phosphides. The Agency also identified potential risks to nontarget terrestrial organisms from burrow applications and from downwind exposure near structural fumigation sites. Nontarget organisms present in rodent burrows may be exposed to phosphine gas above the level of concern following application of metal phosphide products. Furthermore, nontarget organisms near commodities fumigation activities may be exposed to emissions from these actives that may be above the level of concern. Finally, the Agency identified benefits to commodity producers and consumers from registered uses. Phosphine and metal phosphides play a vital role in controlling public health pests and other economically important pests in structures and spaces that store commodities.

Based on its evaluation of the risks and benefits, EPA has identified label changes that would address the identified risks of concern. Language describing the implementation of aeration buffer zones around phosphine application sites is necessary to mitigate potential exposure to non-occupational bystanders. Aeration buffer zones are areas around fumigation sites that bystanders may not enter during the aeration phase of a fumigation. Label changes to address generic labeling requirements for all phosphine and the metal phosphides products and uses are also necessary. Personal Protective Equipment (PPE) language prescribing loose-fitting clothing is necessary to mitigate dermal exposure to occupational handlers. Tight clothing may trap phosphine gas against the skin, exacerbating potential dermal irritation.

1. Aeration Buffer Zones

The Agency identified potential risks of concern to bystanders resulting from the phosphine emission released during the aeration phase of indoor uses (i.e., fumigations of commodities,

machinery, etc.) of phosphine and metal phosphide products. EPA is adding aeration buffer zones language to product labels to address situations where the Agency identified potential bystander risks of concern. Aeration buffer zones protect bystanders by physically distancing them from phosphine emissions. EPA has changed the scope of the buffer zones proposed in the 2020 PID. These changes are described below. The discussion below and the resulting buffer zones presented in Appendix B have not substantively changed from what was proposed in the 2023 Amended PID.

Aeration buffer zones are areas around fumigation enclosures from which non-handlers must be excluded. They extend outward from the point of phosphine emission equally in all directions. Fumigations include two distinct phases: 1) treatment—during which the product is applied and the treatment enclosure is sealed—and 2) aeration—during which the treatment enclosure is unsealed and aerated to allow the phosphine to disperse. Aeration buffer zones are in place from the start of aeration for up to eight hours or until the completion of aeration (whichever is shorter). During this time, non-handlers may not enter the aeration buffer zone. Handlers are personnel involved directly with fumigation and aeration processes and under the supervision of the certified applicator.

All other persons are non-handlers, including those on-site but not involved in fumigation or aeration processes or not under supervision of the certified applicator. Non-handlers also include off-site bystanders who might come within the buffer zone (i.e., in cases where the buffer zone extends off-site). Non-handlers must be excluded from the aeration buffer zone while it is in place. If handlers choose to remain in the aeration buffer zone, they must wear the minimum respiratory protection specified on labels. If non-handlers cannot be restricted from the buffer zone during a planned aeration (e.g., during regular business hours), the aeration must be rescheduled to a time when non-handlers can be restricted (e.g., outside of regular business hours). Appendix B details aeration buffer zone product label language, including instructions for determining if and how large an aeration buffer zone is needed for a given fumigation.

EPA identified two limited exceptions to allow entry into aeration buffer zones by non-handlers. The Occupied Structure Exception allows occupants of a structure within an aeration buffer zone to remain in the structure during aeration provided continuous real-time monitoring indicates that phosphine concentrations are 0.3 ppm or less as an 8-hour time weighted average within the occupied structure. This exception only applies to structures occupied by occupational workers; it does not apply to homes, apartment buildings, schools, hospitals, nursing homes, employee housing centers, or other prohibited use sites. The Transit Exception allows limited transit through an aeration buffer zone, if brief and unavoidable. This does not apply to routine or repeated work-related tasks, which are prohibited in the aeration buffer zone. No person is allowed to transit through a buffer zone for more than 30 cumulative minutes in a 24-hour period. For more details on these exemptions, see Appendix B, below.

In the 2020 PID, EPA proposed generic buffer zones for both the treatment and aeration phases of all fumigations. The minimum proposed buffer zones were 10 feet. The largest proposed buffer zones were 500 feet. The Agency proposed using fumigation structure volume, application rate, and aeration specifications, including stack height, use of scrubbers, and aeration rate to determine the appropriate buffer zone for a given fumigation and aeration. However, the Agency did not provide specific buffer zones or buffer zone look-up tables in the 2020 PID. Instead, the Agency provided a general description of the buffer zones and solicited comments on how to best determine the necessary buffer zone for a given fumigation scenario.

EPA received numerous public comments on its buffer zone proposal, particularly from phosphine and metal phosphide product registrants. Using information in these comments, EPA refined the emissions modeling that informs the buffer zone requirements, the factors determining the size of the buffer zones, and the buffer zone language for product labels and proposed these changes in the 2023 Amended PID. These updates protect bystanders from phosphine exposure while providing flexibility to users of phosphine and metal phosphide products. For a description of the updates to the emissions modeling conducted since the publication of the 2020 PID, see the *Phosphine, Aluminum Phosphide, Magnesium Phosphide: Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine* (October 31, 2022), available in the public docket. Based on refined modeling, the Agency developed specific buffer zone requirements for the aeration phase of fumigations. EPA removed the generic, 10-foot minimum treatment and aeration buffer zones from all fumigations. Moreover, no buffer zones of any size or duration were proposed during the treatment phase of any fumigation.

The PERFUM model produces a distribution of possible phosphine emissions concentrations around a treatment enclosure, based on various inputs. EPA assessed exposure to bystanders at the 90th percentile of PERFUM output distributions. In choosing the 90th percentile, EPA considered the hazard profile of phosphine gas, information from incident reports, other monitoring data, and stakeholder input, along with comprehensive analysis of results from PERFUM modeling. At the 90th percentile, 90% of the model outputs for a given scenario are below the RfC of 0.3 ppm. For many scenarios, aeration buffer zones are no longer necessary. For other scenarios, aeration buffer zones may still be necessary. The need for and size of buffer zones is dependent of several variables: fumigation enclosure volume, aeration rate, and emission release height. As a result of input from users, registrants, and USDA, EPA has added another factor in determining the need for and size of aeration buffers: the measured concentration of phosphine gas in the fumigation enclosure immediately prior to aeration.

Previously, EPA had based the buffer zones on the assumption that the concentration of phosphine gas in the fumigation enclosure did not change significantly throughout the treatment phase. Buffer zones were prescribed based on the initial treatment concentration (in the case of gaseous products) or the equivalent gas concentration (in the case of metal phosphide products). PPA sponsored data (MRID 52020904) demonstrating that the concentration of phosphine gas in fumigation enclosure decreases from the initial treatment

concentration during the treatment phase. Upon review of the data, EPA determined that buffer zones can be prescribed based on the measured concentration of phosphine gas in the fumigation enclosure at the start of aeration. With this approach, measurements must be taken from within the fumigation enclosure (using monitors, detectors, sampling lines, portals, etc.) prior to the start of aeration. If phosphine readings cannot be taken from within the fumigation enclosure, then buffer zones are determined using the equivalent concentration of phosphine gas applied at the beginning of treatment.

Assuming all other variables are equal, buffer zones determined based on the phosphine concentration at the start of aeration are typically smaller than those determined on the treatment concentration, because less overall phosphine gas is available for bystander exposure at aeration due to loss and degradation during treatment. Therefore, the buffer zones being implemented through this ID are typically smaller than the 500-foot maximum proposed in the 2020 PID. However, some of the aeration buffer zones are larger than the 500-foot maximum proposed in the 2020 PID, due to updates to the underlying PERFUM modeling of bystander exposure [see the *Phosphine, Aluminum Phosphide, Magnesium Phosphide: Summary of Submissions Received to Inform Updated Modeling and Bystander Exposure Assessment for Phosphine* (October 31, 2022) for modeling updates]. In general, larger treatment enclosure volumes, active aeration and/or lower ventilation stack heights require larger buffers, though various combinations of these factors can produce other results. Moreover, altering these specifications (e.g., adding a ventilation stack) may reduce or eliminate the need for an aeration buffer zone. EPA has developed look-up tables for product labels that summarize the aeration buffer zone requirements for a given fumigation and aeration scenario.

EPA acknowledges that the buffer zone requirements may cause some users to change fumigation practices or equipment, particularly in instances where no buffer zone was required previously. For example, users may have to change the timing of aeration to ensure that bystanders can be excluded from buffer zones. In instances where the required buffer zone extends offsite or cannot otherwise be ensured, facilities may have to increase holding times, change the release height, or adjust practices or equipment in some way to reduce the size of the required buffer zone. While the buffer requirements will be impactful to some current users of phosphine and metal phosphide products, these users have the flexibility to modify how they currently use phosphine in a way that will be least impactful to their operations. Alternatively, these users may choose another chemical or pest control method to the extent that one is available for their purposes. Nevertheless, if these users cannot utilize phosphine and the metal phosphides for fumigation or control target pests through other means, then this lack of pest control could potentially result in direct losses to these users (e.g., commodities like grains, dried fruit, or tobacco).

2. Resistance Management

The Agency is adding resistance-management language to phosphine and metal phosphide labels⁷³ to address pesticide resistance.⁷⁴ Consistent with EPA's Pesticide Registration Notice (PRN) on general pesticide resistance management,⁷⁵ EPA issues pesticide resistance measures for existing chemicals during registration review and for new chemicals and new uses at the time of registration. To combat pesticide resistance, resistance management experts recommend using pesticides with different chemical modes (or mechanisms) of action against the same target pest population as part of integrated pest management (IPM) programs. This approach may prevent or delay target pest populations from developing resistance to a particular mode (or mechanism) of action without resorting to increased rates and frequency of application, possibly prolonging the useful life of pesticides.

Adding this language will provide pesticide users with easy access to important information on maintaining the effectiveness of pesticides—including phosphine and metal phosphide—thereby preserving the benefits of phosphine and the metal phosphides and other useful pesticides.⁷⁶ The Agency recognizes that not all statements may be appropriate for phosphine and metal phosphide fumigations and that the registrants should determine which statements are appropriate for these specialized uses. In particular, the mode of action box, fumigant, or other pesticide rotation (when possible), consideration of non-chemical practices (e.g., sanitation), and sampling for pests before and after use of the fumigant may be applicable for phosphine and metal phosphide products.

Given the unique nature of phosphine and the metal phosphides, EPA has tailored the resistance language for products with these active ingredients. The resistance language includes descriptions of best practices for fumigation, such as ensuring proper sealing of the fumigation structure and maintaining consistent temperature and humidity. Since the 2023 Amended PID, EPA has made minor updates to the resistance language in response to public comments. At the suggestion of comments from PPA, EPA changed the word "retention" to "maintenance" and "interval" to "duration and/or warming" in the first paragraph. EPA also changed "scouting" to "surveying" in the second paragraph and added the phrase "before and after treatment."

⁷³ For specific label language, see Appendix B.

⁷⁴ Pesticide resistance is the ability of portions of a pest population to tolerate or survive otherwise lethal doses of a pesticide through genetic or behavioral changes. EPA considers increased pesticide resistance an adverse effect that can drive increased use of pesticides. For more details, see PRN 2017-1 and PRN 2017-2, available at <https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year>.

⁷⁵ PRN 2017-1, "Guidance for Pesticide Registrants on Pesticide Management Labeling" (Aug. 24, 2017), available at <https://www.epa.gov/pesticide-registration/pesticide-registration-notices-year>.

⁷⁶ For a detailed discussion of the benefits of phosphine and the metal phosphides, see Section III.C, above.

3. Fumigant Management Plans

As described in the Introduction, a Memorandum of Agreement—announced in the Federal Register on February 2, 2001—between EPA and phosphine and metal phosphide product registrants requires that labels for registered products must carry language describing how to design and implement a fumigation management plan (FMP).⁷⁷ An FMP is an organized, written description of the steps required for a fumigation. FMPs are intended to ensure safe, effective fumigations that comply with product label and other legal requirements. An FMP must be developed prior to every fumigation.

All phosphine gas and aluminum and magnesium phosphide products registered before the completion of this interim registration review decision already carry the requisite label language for FMPs; however, specific language differs between labels based on a product's specific registered uses and active ingredient. Because of this, EPA is providing the needed elements of a complete FMP label language in Appendix B. Additionally, EPA is providing examples of the minimum generic FMP label language for phosphine gas and aluminum and magnesium phosphide in Appendix G of this document. Product registrants should use these examples as the minimum baseline language to write the FMP language for their product labels.

EPA has also made two changes to the post-application procedures section of existing product label FMP language. These changes implement the aeration buffer zones discussed above. First, EPA has added instructions to the FMP language for the monitoring of phosphine gas concentrations in the fumigation enclosure prior to aeration. This monitoring is needed to determine if and how large a buffer zone is needed to protect bystanders during aeration. If phosphine gas levels inside the fumigation enclosure cannot be measured, then the equivalent concentration of phosphine gas applied at the beginning of fumigation must be used to determine any aeration buffer zone requirements. Second, EPA has removing existing post-application procedures for fumigation in cold-storage fumigations, which are no longer necessary given the updated aeration buffer zone language.

EPA does not expect additional impacts to users from the use of FMPs. All existing labels for registered products include FMP requirements and instructions.

4. Update Description of Personal Protective Equipment Fit and Prohibit Jewelry and Watches when Handling Phosphine Gas Products

Tight clothing and jewelry may trap phosphine gas against the skin, worsening potential dermal irritation in the event of dermal contact. EPA has added language to labels that stipulates that

⁷⁷ *Memorandum of Agreement Between the United States Environmental Protection Agency and Signatory Registrants of Phosphine Based Fumigants*, announced in the February 2, 2001 Federal Register titled *Amendment to Reregistration Eligibility Decision for Aluminum Phosphide and Magnesium Phosphide* (66 FR 8790; <https://www.federalregister.gov/documents/2001/02/02/01-2773/amendment-to-reregistration-eligibility-decision-for-aluminum-phosphide-and-magnesium-phosphide>).

handlers' PPE be loose-fitting to mitigate this risk. EPA also has added language prohibiting the wearing of jewelry and watches when handling phosphine gas products.

B. FIFRA Interim Ecological Mitigation Measures

The ESA Workplan Update Appendix includes a menu of FIFRA IEM measures, some of which are included in this ID. Because of the unique properties and registered uses of phosphine and the metal phosphides, EPA also developed FIFRA IEM measures specific to phosphine and the metal phosphides. EPA previously sought public comment on the full suite of FIFRA IEM measures, which is available in the ESA Workplan Docket (EPA-HQ-OPP-2022-0908-0002), at www.regulations.gov. EPA updated some of the proposed FIFRA IEM measures for phosphine and the metal phosphides after considering public comments on the ESA Workplan Update and on the 2023 Amended PID and after additional EPA and interagency review of the mitigations. The FIFRA IEM measures described for phosphine and the metal phosphides in this ID reflect these revisions.

EPA developed the FIFRA IEM measures to reduce exposure to nontarget organisms, including listed species.⁷⁸ EPA has identified the following FIFRA IEM measures for phosphine and the metal phosphides:

- Label language to restrict use to only target species specified on the label
- Pre-application burrow check label language
- Conservation areas application buffers
- Ecological Incident reporting label language
- Bulletins Live! Two (BLT) labeling

The FIFRA IEM measures in this ID are not designed to fully address EPA's ESA obligations for phosphine and the metal phosphides during registration review. Rather, they are initial steps under FIFRA that are designed to reduce exposure to all non-target organisms, including listed species, while EPA continues to work towards meeting its ESA obligations during registration review before issuing a final registration review decision. EPA may subsequently propose additional mitigation measures for phosphine and the metal phosphides during registration review, such as mitigations developed as part of its various ESA initiatives.⁷⁹ Additional measures may also be necessary when EPA conducts effects determinations and, if necessary, consults with the Service(s) on phosphine and the metal phosphides.

⁷⁸ See the *ESA Workplan Update: Nontarget Species Mitigation for Registration Review and Other FIFRA Actions* (Nov. 2022), <https://www.epa.gov/system/files/documents/2022-11/esa-workplan-update.pdf>.

⁷⁹ <https://www.epa.gov/endangered-species/implementing-epas-workplan-protect-endangered-and-threatened-species-pesticides>

1. Restrict Use to Labeled Target Species Only

To prevent deliberate use against species for which products are not registered, EPA has identified that the following language should be included on labels of products registered for in-burrow applications to control rodents:

“For in-burrow applications: This product may only be applied to the underground burrow systems of the target pests listed below.

Woodchucks, yellowbelly marmots (rockchucks), prairie dogs (except Utah prairie dogs, *Cynomys parvidens*), Norway rats, roof rats, mice, ground squirrels, moles, voles, pocket gophers and chipmunks.

This product must not be applied in the underground burrow systems of any species not listed above.”

2. Pre-Application Burrow Check

To reduce nontarget organism exposure during metal phosphide applications made in vertebrate pest burrows, EPA has identified the following language to be included on labels of products registered for in-burrow applications to control rodents:

“Nontarget species, including endangered or threatened species, may exploit or inhabit the burrows of target species. Check all burrows to determine if any nontarget species is inhabiting the burrows. If nontarget species or their signs are present, do not treat burrows.”

EPA does not expect pre-application burrow checks to impose burdens on users, who would already be scouting for signs of target pests in and around burrows and filling in burrows as part of treatments.

3. Conservation Areas Application Buffers

Potential risks of concern to non-target organisms were identified from in-burrow uses of metal phosphide products. To reduce risks to organisms that reside in conservation areas, the Agency is adding spray drift buffers between the edge of the field and conservation areas (e.g., public lands and parks, wilderness areas, National Wildlife Refuges, reserves, and conservation easements). For products registered for in-burrow applications, the buffer language is as follows:

“Do not apply within 100 feet of any conservation areas. Conservation areas include public lands and parks, national and state wilderness areas and wildlife refuges, national and state forests, and national and state grasslands. Any land between the conservation areas and the application area can be included in the buffer (including Conservation

Reserve Program (CRP) and Agricultural Conservation Easement Program (ACEP) areas). Applications made within a conservation area are acceptable when made in accordance with an approved pesticide management plan for the conservation area and the restrictions on this label.”

Users will not be able to make in-burrow applications within 100 feet of conservation areas. Alternative pest control measures (e.g., using a rodenticide, removal via trapping) may need to be used in these instances, which could be more expensive than the current cost of using phosphine to control these pests. If alternative control measures cannot be used, then these pests may not be adequately controlled, and losses could occur from a pest infestation in the area/use site.

4. Ecological Incident Reporting Label Language

EPA has proposed and subsequently required ecological incident reporting language on some labels in the past, and ecological incident reporting has been included as a reasonable and prudent measure in Biological Opinions issued by the Services. The Agency anticipates the need to add incident reporting labeling as part of any necessary ESA consultation. EPA is adding incident reporting labeling to all product labels to provide consistent information to pesticide users on how to report ecological incidents and to expedite any necessary ESA consultation. The incident reporting language is as follows:

“**REPORTING ECOLOGICAL INCIDENTS:** For guidance on reporting ecological incidents, including death, injury, or harm to plants and animals, including bees and other non-target insects, see EPA’s Pesticide Incident Reporting website: <https://www.epa.gov/pesticide-incidents> or call (registrant phone number).”

5. Bulletins Live! Two Labeling

ESA mitigation can take the form of nationwide restrictions on the general pesticide product labeling or geographic-specific restrictions located in Endangered Species Protection Bulletins (hereafter referred to as Bulletins), which are extensions of the general labeling accessed through a website. EPA is using a web-based system, Bulletins Live! Two (BLT), to provide timely protections for listed species and to minimize pesticide product labeling changes.

EPA uses BLT when mitigation applies in a particular geographic region where listed species are present and, in some cases, during only certain times of the year. BLT simplifies compliance by offering a tool for users to identify where and when they are subject to the mitigation. When directed by product labeling, pesticide applicators are required to visit the BLT online database, and follow any mitigation specified in a Bulletin for the application area.

Phosphine and the metal phosphides do not currently have any listed species bulletins. However, the Agency has identified the following Bulletins language to be added to all phosphine and the metal phosphide product labels. This language instructs users to check the

Bulletins Live! Two website in order to understand listed species use restrictions that may apply to them, if available. Including this language on product labels will help streamline implementation of any additional risk reduction measures that may be identified during any necessary ESA consultation.

The BLT language is as follows:

“ENDANGERED AND THREATENED SPECIES PROTECTION REQUIREMENTS: Before using this product, you must obtain any applicable Endangered Species Protection Bulletins (‘Bulletins’) within six months prior to or on the day of application. To obtain Bulletins, go to Bulletins Live! Two (BLT) at <https://www.epa.gov/pesticides/bulletins>. When using this product, you must follow all directions and restrictions contained in any applicable Bulletin(s) for the area where you are applying the product, including any restrictions on application timing if applicable. It is a violation of Federal law to use this product in a manner inconsistent with its labeling, including this labeling instruction to follow all directions and restrictions contained in any applicable Bulletin(s). For general questions or technical help, call 1-844-447-3813, or email ESPP@epa.gov.”

Although the BLT system has been in place for many years, there may be applicators who are unfamiliar with this system. Using the online tool to determine if mitigation is required for a particular treatment area may be a new step that many users will need to take prior to an application. However, the Agency anticipates that over time and with wider implementation, BLT will become a familiar tool that is integrated into a user’s planning process for pesticide applications. In February 2022, EPA released an improved version of BLT⁸⁰, which allows users to more easily find the information they need for a particular pesticide product. The Agency has also developed a tutorial⁸¹ that explains how to use the online system. EPA also held a public webinar (a recording of which can be found online⁸²) and maintains a Q&A webpage about Bulletins Live Two!⁸³. In addition, the general label language referring users to BLT provides a phone number and email address for those needing technical assistance.

EPA is currently working on several ESA strategies such as the Vulnerable Species Pilot⁸⁴ and the Herbicide Strategy⁸⁵ to expedite and streamline the ESA consultation process and provide protections for listed species. Pesticide Use Limitation Areas (PULAs) and the associated geographically specific mitigation (i.e., bulletins) are not yet available under these efforts. While the BLT language above is being added on the pesticide label without being linked to PULAs or bulletins for phosphine or the metal phosphides at this time, pesticide users should be aware that as various ESA pilot efforts are finalized, EPA expects to add new PULAs and new bulletins

⁸⁰ <https://www.epa.gov/endangered-species/endangered-species-protection-bulletins>

⁸¹ <https://www.epa.gov/endangered-species/bulletins-live-two-bl-tutorial>

⁸² <https://www.epa.gov/endangered-species/materials-november-2023-bulletins-live-two-webinar>

⁸³ <https://www.epa.gov/endangered-species/bulletins-live-two-qa>

⁸⁴ <https://www.regulations.gov/docket/EPA-HQ-OPP-2023-0327>

⁸⁵ <https://www.regulations.gov/docket/EPA-HQ-OPP-2023-0365>

to BLT. Before new PULAs and bulletins are added in BLT, EPA will notify stakeholders and provide an opportunity for public comment. See Appendix C: Listed Species Assessments for more information.

C. Environmental Justice

EPA seeks to achieve environmental justice, the fair treatment and meaningful involvement of all people, regardless of race, color, national origin, or income, in the development, implementation, and enforcement of environmental laws, regulations, and policies. Throughout the registration review process, EPA has sought to include all communities and persons across the Nation, including minority, low-income, and indigenous populations who may be disproportionately overburdened by the use of phosphine and the metal phosphides. EPA continues to require the outstanding ambient air monitoring data of the of the GDCI (GDCI-066501-1393, GDCI-066501-1402, and GDCI-066504-1403) in part to address environmental justice concerns.

Workers and handlers of commodities treated with phosphine and other employees of organizations that conduct phosphine treatments and may be near the treatment area may experience disproportionate exposure to pesticides. EPA has conducted assessments of risks to workers who handle phosphine and the metal phosphides or may be exposed to phosphine and the metal phosphides when handling treated commodities and has not found occupational risks of concern for phosphine and the metal phosphides. EPA has also evaluated the risks to bystanders to fumigation sites and found potential risks of concern for phosphine and the metal phosphides from exposure to phosphine emissions in the atmosphere. Bystanders include residents of communities near to treatment sites and workers at treatment sites not involved with fumigation activities. EPA has also evaluated risk to adults/children that may be exposed to residues after pesticide application (such as in-burrow rodent control) in residential areas and has not found risks of concern. To mitigate potential risks to bystanders near application sites, EPA is establishing aeration buffer zones around fumigation sites. Aeration buffer zones are areas around a fumigation structure into which bystanders may not enter during aeration of fumigation structures.

The Agency sought information during the public comment periods throughout registration review on any other groups or segments of the population who, as a result of their proximity and exposure to pesticides, unique exposure pathway (e.g., as a result of cultural practices), location relative to physical infrastructure, exposure to multiple stressors and cumulative impacts, lower capacity to participate in decision making, or other factors, may have unusually high exposure to phosphine and the metal phosphides compared to the general population or who may otherwise be disproportionately affected by the use of phosphine and the metal phosphides as a pesticide. EPA requested but did not receive any comments concerning environmental justice.

D. Tolerance Actions

The Agency plans to exercise its FFDCA authority to update the tolerance expression to appropriately cover the metabolites and degradates of phosphine and the metal phosphides and to specify the residues to be measured for each commodity for enforcement purposes. The current tolerance expression is as follows:

Tolerances are established for residues of phosphine in or on the following raw agricultural commodities (RACs) resulting from post-harvest fumigation for the control of insects with phosphine gas or phosphide compounds that produce phosphine gas.

EPA anticipates amending the tolerance expression to read as follows:

Tolerances are established for residues of the insecticide phosphine, including its metabolites and degradates, in or on the commodities in the table below. Compliance with the tolerance levels specified below is to be determined by measuring only phosphine, in or on the commodity.

The Agency also plans to exercise its FFDCA authority to modify the commodity definitions for phosphine and metal phosphides tolerances as summarized in Appendix E, below. Appendix F presents a summary of U.S. and international tolerances and maximum residue limits (MRLs).

E. Data Requirements

Registrants must submit the outstanding non-guideline ambient air monitoring study.

V. NEXT STEPS AND TIMELINE

A Federal Register Notice will announce the availability of the phosphine and the metal phosphides ID. A final registration review decision for phosphine and the metal phosphides will only be made after EPA (1) completes complete effects determinations and (2) meets EPA's ESA section 7 obligations (*e.g.*, initiate any necessary consultation with the Services, consistent with ESA § 7(a)(2)).

Implementation of Mitigation Measures

The mitigations discussed in Part IV are implemented through label amendments and/or registration changes. Registrants: Submit a cover letter, a completed Application for Registration (EPA form 8570-1) and electronic copies of the amended product labels within 60 after the announcement of this ID in the Federal Register. Submit two copies for each label, a clean copy and an annotated copy with changes. Include the following statement on the Application for Registration (EPA form 8570-1):

“I certify that this amendment is consistent with the phosphine and the metal phosphides Interim Registration Review Decision and satisfies the requirements of EPA regulations at 40 CFR Section 152.44, and no other changes have been made to the labeling of this product. I understand that it is a violation of 18 U.S.C. Section 1001 to willfully make any false statement to EPA. I further understand that if this amendment is found not to satisfy the requirements of the statute or regulations, this product may be in violation of FIFRA and may be subject to regulatory and/or enforcement action and penalties under FIFRA.”

Submit the required documents to the Registration Review section of the EPA’s Pesticide Submission Portal (PSP), which can be accessed through the EPA’s Central Data Exchange (CDX) at <https://cdx.epa.gov/>. Registrants may instead send paper copies of their amended product labels, with an application for a fast-track, Agency-initiated non-PRIA label amendment to Jonathan Williams at the following address, so long as the labels and application are submitted within the timeframe specified above:

VIA US Mail

USEPA Office of Pesticide Programs
Pesticide Re-evaluation Division
1200 Pennsylvania Ave NW
Washington, DC 20460-0001

After all the label amendments or registration changes have been submitted, EPA will review them to ensure that they incorporate the necessary mitigation. If they meet the necessary changes, EPA intends to approve the requested changes and/or amendments. If the registrant does not submit the label amendments or registration changes, EPA reserves the right to take appropriate action under FIFRA. 40 C.F.R. § 155.58. This ID does not effect a change in the existing registration, and no registration will be canceled involuntarily unless EPA follows the procedures and substantive requirements of 7 U.S.C. section 136d or is under court order to cancel. *See* 7 U.S.C. section 136a(g)(1)(A)(v).

Appendix A: Summary of Mitigation for Phosphine and the Metal Phosphides

Registration Review Case #: 0025, 0645, and 7608 PC Code: 066500, 0665501, and 066504 Chemical Type: Biocide Chemical Family: Fumigant Mode of Action: Group 24A: Mitochondrial complex IV electron transport inhibitor						
Affected Population(s)	Source of Exposure	Route of Exposure	Duration of Exposure	Potential Risk(s) of Concern	Mitigation	Comment
Non-occupational bystanders	Phosphine emissions in the atmosphere around commodities fumigation sites released during aeration of treated commodities	Inhalation	Acute, short- and intermediate-term	Inhalation toxicity	Establish buffer zones around the commodities fumigation sites into which bystanders may not enter during aeration of commodities post-treatment	
Nontarget organisms	In-burrow applications	Inhalation	Acute	Mortality	Label language to restrict use to registered target species, pre-application burrow check language, and conservation areas application buffer	

Appendix B: Necessary Labeling Changes for Phosphine and Metal Phosphide Products

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label				
	End Use Products					
<p>Mode of Action Group Number For all end use products</p>	<p>Note to registrant:</p> <ul style="list-style-type: none"> • Include the name of the ACTIVE INGREDIENT in the first column (include the active ingredient corresponding to the correct active ingredient in the product—Phosphine, Aluminum Phosphide, or Magnesium Phosphide) • Include the word “GROUP” in the second column • Include the MODE/MECHANISM/SITE OF ACTION CODE in the third column (for herbicides this is the Mechanism of Action, for fungicides this is the FRAC Code, and for insecticides this is the Primary Site of Action); for Herbicides this is MODE OF ACTION • Include the type of pesticide (<i>i.e.</i>, HERBICIDE or FUNGICIDE or INSECTICIDE) in the fourth column. <table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 25%;">Phosphine, Aluminum Phosphide, Magnesium Phosphide</td> <td style="width: 15%;">GROUP</td> <td style="width: 25%;">24A</td> <td style="width: 35%;">INSECTICIDE/FUMIGANT</td> </tr> </table>	Phosphine, Aluminum Phosphide, Magnesium Phosphide	GROUP	24A	INSECTICIDE/FUMIGANT	<p>Front Panel, upper right quadrant.</p> <p>All text should be black, bold face and all caps on a white background, except the mode of action code, which should be white, bold face and all caps on a black background; all text and columns should be surrounded by a black rectangle.</p>
Phosphine, Aluminum Phosphide, Magnesium Phosphide	GROUP	24A	INSECTICIDE/FUMIGANT			
<p>Resistance-management labeling statements for insecticides and acaricides For all end use products</p>	<p>“For resistance-management, [name of product] releases volatilized phosphine gas, a Group (24A) insecticide/fumigant. Any pest population may contain individuals naturally resistant to [name of product] and other Group (24A) insecticides/fumigants. Over time, resistant individuals may dominate the insect population if this group of insecticides/fumigants is used repeatedly on the same pest population or if poor fumigation practices are used. Use best fumigation practices and survey for unexpected target pest survival after fumigation. Best fumigation practices include: proper sealing of the fumigation structure; application of the recommended dose with appropriate concentration monitoring to ensure adequate maintenance and distribution of phosphine for the duration of fumigation; and an understanding that phosphine toxicity is critically dependent on time, humidity, and temperature, whereby efficacy is improved by extending the treatment duration and/or warming.</p> <p>“Appropriate resistance-management strategies should be followed, such as adopting an integrated pest management (IPM) program. IPM programs for insecticides/fumigants should include surveying for pests before and after treatment as well as cultural and physical control practices, such as sanitation and pest exclusion, biological control practices, other chemical control practices, and record keeping. Contact your local extension specialist or pest control advisor for any additional</p>	<p>Directions for Use, prior to directions for specific crops</p>				

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	pesticide resistance-management and/or IPM recommendations for your area. For further information or to report suspected resistance contact [company representatives] at [toll free number] or at [Internet site] .”	
Fumigation Management Plans (FMPs) For all end use products	<p>All labels must carry instructions and requirements for creating fumigation management plans (FMPs) prior to fumigations. All phosphine gas and aluminum and magnesium phosphide products registered before the completion of this interim registration review decision carry the requisite label language for FMPs; however, specific language differs between labels based on specific uses and active ingredients. Because of this, EPA is providing the required elements of complete FMP label language in this table and examples of the minimum generic FMP label language for phosphine gas and aluminum and magnesium phosphide products in Appendix G of this document. Product registrants should use these examples as the minimum baseline language to write the FMP language for their product labels.</p> <p>The required elements of complete FMP label language are:</p> <ul style="list-style-type: none"> • Certified applicator responsibilities, including a list of factors that must be considered in putting together an FMP • The steps for the preparation of an FMP, including a description of the purpose of an FMP and the checklist guide for preparation on an FMP. The checklist needs to include the following elements: <ul style="list-style-type: none"> A. Preliminary Planning and Preparation B. Personnel C. Monitoring D. Notification E. Sealing Procedures F. Application Procedures & Fumigation Period G. Post-Application Instructions 	Directions for Use
Add Buffer Zone Language For all end use products	<p>Add the following language to the enumerated list at the start of the section of the Directions for Use titled “REQUIRED WRITTEN FUMIGATION MANAGEMENT PLANS”. Add this language below item 8., but above item 9. of the list and adjust the numbering of the list such that the existing item 9. Becomes item 10. And so forth:</p> <p>9. “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label. Use this completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.”</p>	Directions for use, in the enumerated list at the start of the section titled “REQUIRED WRITTEN FUMIGATION MANAGEMENT PLANS”
Aeration Buffer Zone Monitoring For all end use products	<p>Add the following language to the section title “CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN” under item C.: “MONITORING” after item 2. “Efficacy”:</p> <p>3. “Prior to Aeration</p> <p>a. “At the completion of fumigation, prior to aeration, measure the phosphine concentration within the</p>	Directions for use, in the section “REQUIRED WRITTEN FUMIGATION

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	<p>fumigation enclosure to determine if and what size aeration buffer zone is required during aeration (see the “Aeration Buffer Zones” section in [insert Aeration Buffer Zones section numbering and title as appropriate] of the Directions for Use).</p> <p>b. “These readings must be obtained from within the fumigation enclosure and can be measured via monitors, detectors, sampling lines, portals, etc operated by personnel outside of the enclosure. If internal readings cannot be taken, then use the equivalent concentration of phosphine gas applied at the beginning of fumigation to determine any aeration buffer zone requirements.</p> <p>c. “These readings and any required aeration buffer zone must be documented. Use this completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.”</p>	<p>MANAGEMENT PLANS”, under the heading “A Checklist Guide for a Fumigation Management Plan”, below the “Efficacy” section of the “MONITORING” requirements.</p>
<p>Add Buffer Zone Language For all end use products</p>	<p>Add the following language to the section of the titled “CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN”, under the “POST-APPLICATION OPERATIONS” heading. Add the following statement to the top of the list and adjust the numbering of the list, such that the existing item 1./a. becomes item 2./b. and so forth:</p> <p>1./a. [select appropriate list style] “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label. To use either the Occupied Structures Exemption or Transit Exemption from an aeration buffer zone, you must include the relevant information in the FMP as described in the “Buffer Zone Entry Restrictions” of the Direction for Use.”</p>	<p>Directions for use, in the section “REQUIRED WRITTEN FUMIGATION MANAGEMENT PLANS”, under the heading “CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN”, at the top of the “POST-APPLICATION OPERATIONS”</p>
<p>Ecological Incidents Statement For all products</p>	<p>“REPORTING ECOLOGICAL INCIDENTS: For guidance on reporting ecological incidents, including death, injury, or harm to plants and animals, including bees and other nontarget insects, see EPA’s Pesticide Incident Reporting website: https://www.epa.gov/pesticide-incidents or call [registrant phone number]”</p>	<p>Directions for Use, under the heading “REPORTING ECOLOGICAL INCIDENTS”</p>
<p>Endangered Species Protection Requirements For all products</p>	<p>“ENDANGERED AND THREATENED SPECIES PROTECTION REQUIREMENTS: Before using this product, you must obtain any applicable Endangered Species Protection Bulletins (‘Bulletins’) within six months prior to or on the day of application. To obtain Bulletins, go to Bulletins Live! Two (BLT) at https://www.epa.gov/pesticides/bulletins. When using this product, you must follow all directions and restrictions contained in any applicable Bulletin(s) for the area where you are applying the product, including any restrictions on application timing if applicable. It is a violation of Federal law to use this product in a</p>	<p>Directions for Use, at the beginning under the heading “ENDANGERED AND THREATENED</p>

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	manner inconsistent with its labeling, including this labeling instruction to follow all directions and restrictions contained in any applicable Bulletin(s). For general questions or technical help, call 1-844-447-3813, or email ESPP@epa.gov.”	SPECIES PROTECTION REQUIREMENTS”
	Changes for End Use Product Labels for All Products, Except those Solely Registered for Use on Rodent Burrows	
<p>Aeration Buffer Zones</p> <p>For products registered for use on commodities, equipment, or other use sites; this language does not apply to rodent burrow uses</p>	<p>Create an “AERATION BUFFER ZONES” section and include the following language:</p> <p>“Important Information: “An aeration buffer zone may be required during aeration of the fumigation enclosure following treatment. Use the information in this section to determine if an aeration buffer zone is needed and to select the appropriate aeration buffer zone distance. Everyone within the aeration buffer zone must be made aware that a release of fumigant gas is about to take place. During the first 10 minutes of aeration, no one is permitted within the aeration buffer zone and must remain outside of the aeration buffer zone until monitoring indicates that the level of phosphine gas is 0.3 ppm or below. For personal safety, gas levels should occasionally be monitored at greater distances, especially downwind to ensure that the buffer zone is adequate. If fumigation handlers choose to enter the aeration buffer zone after the first 10 minutes, they must wear the minimum respiratory protection specified in [reference respiratory protection section of label], based on monitored levels of phosphine gas. All non-handlers must evacuate and remain outside of the aeration buffer zone until the completion of the aeration buffer zone duration (see the definition of “Aeration Buffer Zone Duration” below for details). If people cannot be restricted from the aeration buffer zone during regular work hours, aeration must be done during another time. For aerations facilitated by an aeration, ventilation, or exhaust stack, review and follow the “Best Practices for Aeration Facilitated by an Aeration Stack” information below.</p> <p>“Aeration Buffer Zone Definitions:</p> <ul style="list-style-type: none"> • Aeration Buffer Zone: An area that extends from the point of phosphine emission from the treatment enclosure (e.g., aeration stack opening, tarp edge, door, hatch ventilation fan, etc.) outward in all directions to a specified distance, within which access is limited. Entry by any person except the certified applicator and authorized fumigation handlers under direct supervision of the certified applicator is prohibited, except as provided in the “Exceptions to Buffer Zone Entry Restrictions” section below. • Aeration Buffer Zone Duration: The period of time that an aeration buffer zone is in place, beginning at the start of aeration and lasting for up to eight hours or until the phosphine concentration within the fumigation enclosure is below the level for which a buffer zone will be required (whichever is shorter). • Aeration, Ventilation, or Exhaust Stack: A duct used to exhaust phosphine from the treatment enclosure. 	Directions for Use

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	<ul style="list-style-type: none"> • Active Aeration: The use of fans or any other mechanical devices to aerate or ventilate the fumigation enclosure, excluding scrubber technology (emission reduction technology or a phosphine abatement device) designed to reduce phosphine emissions by at least 95 percent, which eliminates the need for buffers. • Breathing Zone: The region within an occupied space between planes 3 and 72 inches above the floor and more than 2 feet from the walls or fixed air-conditioning equipment. See the Buffer Zone Entry Restrictions section of this label for further context. • Emissions Reduction Technology: Scrubbers or phosphine abatement devices that reduce phosphine emissions from the fumigation enclosure during aeration by at least 95 percent. • Fumigation Site: The location at which fumigation activities will be conducted, at a minimum encompassing the treatment enclosure(s) and buffer zone(s). • Fumigation Enclosure: The space in which the fumigation occurs. Examples include chambers, structures, silos, tarps, containers, bins, buildings, shipping containers or other spaces. • Fumigation Handler: A person involved in the fumigation, including the certified applicator and persons under supervision of the certified applicator. Fumigation handlers must be trained and equipped to use PPE according to label requirements. This term does not include persons who do not enter the treatment enclosure or aeration buffer zone. • Multiple Aeration: Multiple aerations occur when the aeration buffer zones of more than one fumigation enclosure are in place concurrently at any time during their duration and such that the areas of the aeration buffer zones overlap spatially. If the durations of two or more aeration buffer zones overlap for at least one minute AND their individual buffer zone footprints overlap by at least 1 foot, then a multiple aeration has occurred. • Ground Level Stack: an aeration stack with a release height below the roofline level and a minimum of 10 feet above the ground. Buffer distance tables are provided for release heights of 10 to 24 feet, 25 to 49 feet, and 50 feet or greater. For aeration stacks with release heights at or above the roofline level, refer to the definition of Roofline Level Stack and to the Roofline Level Stack buffer distance table. • Non-handler: Any person not described by the definition of "Fumigation Handler". Non-handlers are persons not involved directly with fumigation and aeration processes or not under the supervision of the certified applicator. Non-handlers may be on-site (but not involved in fumigation or aeration processes) or may be off-site. Non-handlers must be prevented from entering an aeration buffer zone, especially in cases where the buffer zone extends off-site. 	

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	<ul style="list-style-type: none"> • Passive Aeration: Non-mechanical ventilation of the fumigation enclosure (i.e., opening doors and windows or removing/cutting tarpaulin covers). • Release Height: The height at which phosphine emission from the fumigation enclosure occurs. The release height may be described relative to the roofline level of the fumigation enclosure (e.g., below, at, or above the roofline level) or in height above the ground (e.g., 10, 25, or 50 feet above the ground). • Roofline Level Stack: An aeration stack with a release height equal to or above the roofline level. This can include temporary tubing that is adjacent to the fumigation enclosure, so long as it extends to or above the roofline level. Aeration arrangements at the roofline that do not include an aeration, ventilation, or exhaust stack, such as roofline level slot vents with no associated duct are not considered roofline level stacks. • Single Aeration: When only one aeration occurs at a time, such that successive aeration buffer zones do not overlap in time AND their footprints do not overlap. Situations in which multiple fumigation enclosures are aerated concurrently through the same aeration stack or manifold are considered single aeration events. In such a case, any necessary aeration buffer zone should be determined from the total volume aerated through the stack or manifold. <p>“Buffers and Buildings: “If the fumigation enclosure is contained within a closed building (exterior windows, doors, ventilation intakes, and other openings are closed), the entire building must follow all buffer zone restrictions, even if the calculated aeration buffer zone distance would not encompass the entire building.</p> <p>“If the treatment structure is within an opened building (all exterior windows, doors, and other openings are open), then only the area within the aeration buffer zone must follow the buffer zone restrictions.</p> <p>“The aeration buffer zones extend into nearby buildings unless all openings (exterior windows, doors, ventilation intakes, and other openings) inside the buffer zone are closed or sealed.</p> <p>“Best Practices for Aeration Facilitated by an Aeration Stack:</p> <ul style="list-style-type: none"> • “Consider wind direction and position stack outlet upwind of an open area and downwind and away from people. • “Always point the stack outlet upward to aid in dispersing the exhausted gas. • “Position stack outlets away from doors, windows, vents, or other openings into buildings, structures, and enclosures. 	

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label		
	<ul style="list-style-type: none"> • “For ground level stacks, position stack outlets downwind of and as far from buildings, structures, and enclosures as feasible. The release height must be a minimum of 10 feet above the ground and should be as high as feasible to aid in dispersing the exhausted gas. Structures near the stack outlet may create downdrafts that trap exhausted gas at ground level. See the Aeration Buffer Zones section for a description of a “ground level stack”. <p>“Aeration Buffer Zone Selection: “The appropriate aeration buffer zone distance must be used for every fumigation. Aeration buffer zone distances are based on the measured concentration of phosphine gas in the fumigation structure at the end of treatment, prior to the start of aeration. These readings must be obtained from within the fumigation enclosure and can be taken via monitors, detectors, sampling lines, portals, etc operated by personnel outside of the enclosure. If internal readings cannot be taken, then use the equivalent concentration of phosphine gas applied at the beginning of fumigation to determine any aeration buffer zone requirements. The following tables describe the buffer zones required for various aeration set-ups, fumigation enclosure volumes, and phosphine gas concentrations. Select the scenario that best-describes a given fumigation to determine the required aeration buffer zone distance. Document the aeration buffer zone distance and the measured phosphine level at the start of aeration (or equivalent concentration at the start of fumigation) used to determine the required aeration buffer zone distance.</p> <p>“EMISSIONS REDUCTION TECHNOLOGY (SCRUBBERS)—No aeration buffer zones are required during aeration of fumigation structures equipped with specifically designed equipment to reduce phosphine emissions by at least 95 percent.</p> <p>“SINGLE AERATIONS—A single aeration is defined as only one fumigation occurring on a site or in a facility at a time, such that successive aeration buffer zones do not overlap in time AND their footprints do not overlap. Use the following information to select the appropriate aeration buffer zone if conducting a single fumigation. Choose the scenario description from the list below that best matches your fumigation and aeration specifications. Situations in which multiple fumigation enclosures are aerated concurrently through the same ventilation stack or manifold should be considered single fumigation events. In such a case, any necessary aeration buffer zone should be determined from the total volume aerated through the stack or manifold. The total volume is equal to the sum of the volumes of each individual fumigation enclosure.</p> <p>“Passive Aeration: “Use the following information to determine the required aeration buffer distance for fumigation enclosures aerated by non-mechanical means.</p> <table border="1" data-bbox="365 1336 1688 1401"> <tr> <td data-bbox="365 1336 709 1401">Aeration Buffer Distance (feet) ↘</td> <td data-bbox="709 1336 1688 1401">Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓</td> </tr> </table>	Aeration Buffer Distance (feet) ↘	Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓	
Aeration Buffer Distance (feet) ↘	Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓			

Description	Label Language for Phosphine and the Metal Phosphides Products							Placement on Label	
		Less than 907	907 – 1,813	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625			
	Fumigation Enclosure Volume (cubic feet) ↓	2,500,000 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer		
		2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	No aeration buffer	210	260		
		5,000,001 – 7,500,000	No aeration buffer	No aeration buffer	275	345	385		
		Greater than 7,500,000	No aeration buffer	190	355	425	460		
<p>“Active Aeration, Ground-Level Release, No Stack: “Use the following information to determine the required aeration buffer distance for fumigation enclosures with release heights below the roofline level and aerated by fans or any other mechanical devices, but not aerated through an aeration stack.</p>									
Aeration Buffer Distance (feet) ↓	Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓								
	Less than 182	182 – 363	364 – 906	907 – 1,813	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625		
Fumigation Enclosure Volume (cubic feet) ↓	1,000 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	10	
	1,001 – 10,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	10	10	
	10,001 – 25,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	20	40	
	25,001 – 250,000	No aeration buffer	No aeration buffer	No aeration buffer	20	60	70	80	
	250,001 – 500,000	No aeration buffer	No aeration buffer	No aeration buffer	20	205	250	270	
	500,001 – 750,000	No aeration buffer	No aeration buffer	No aeration buffer	190	280	305	325	

Description	Label Language for Phosphine and the Metal Phosphides Products								Placement on Label
	750,001 – 1,000,000	No aeration buffer	No aeration buffer	No aeration buffer	250	315	355	385	
	1,000,001 – 2,500,000	No aeration buffer	No aeration buffer	195	385	485	540	575	
	2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	340	535	665	765	810	
	5,000,001 – 7,500,000	No aeration buffer	175	435	640	835	905	940	
	Greater than 7,500,000	No aeration buffer	235	490	755	925	985	1,045	
<p>“Active Aeration, Roofline Level, No Stack: “Use the following information to determine the required aeration buffer distance for fumigation enclosures with release heights at the roofline level and aerated by fans or any other mechanical devices, but not aerated through an aeration stack.</p>									
Aeration Buffer Distance (feet) ↘		Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓							
		Less than 364	364 – 906	907 – 1,813	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625		
Fumigation Enclosure Volume (cubic feet) ↓	1,000,000 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer		
	1,000,001 – 2,500,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	320	420		
	2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	385	580	655	710		
	5,000,001 – 7,500,000	No aeration buffer	No aeration buffer	550	750	845	900		
	Greater than 7,500,000	No aeration buffer	325	655	880	955	1,005		

Description	Label Language for Phosphine and the Metal Phosphides Products								Placement on Label																																																																																																				
<p data-bbox="365 240 594 264">“Ground-Level Stack.</p> <p data-bbox="365 274 1724 396">“Use the following information to determine the required aeration buffer distance for fumigation enclosures aerated through a stack with a release height below the roofline level and a minimum of 10 feet above the ground. Buffer distance tables are provided for release heights of 10 to 24 feet, 25 to 49 feet, and 50 feet or greater. For aeration stacks with release heights at or above the roofline level, refer to the Roofline Level Stack buffer distance table, below.</p> <p data-bbox="365 440 848 464">“Buffer distances for ≥10-foot release height</p> <table border="1" data-bbox="365 472 1692 1227"> <thead> <tr> <th colspan="2" data-bbox="365 472 594 578" rowspan="2">Aeration Buffer Distance (feet) ↘</th> <th colspan="7" data-bbox="594 472 1692 513">Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓</th> </tr> <tr> <th data-bbox="594 513 747 578">Less than 182</th> <th data-bbox="747 513 905 578">182 – 363</th> <th data-bbox="905 513 1062 578">364 – 906</th> <th data-bbox="1062 513 1220 578">907 – 1,813</th> <th data-bbox="1220 513 1377 578">1,814 – 2,500</th> <th data-bbox="1377 513 1535 578">2,501 – 3,263</th> <th data-bbox="1535 513 1692 578">3,264 – 3,625</th> </tr> </thead> <tbody> <tr> <td data-bbox="365 578 422 1227" rowspan="8">Fumigation Enclosure Volume (cubic feet) ↓</td> <td data-bbox="422 578 594 659">250,000 or less</td> <td data-bbox="594 578 747 659">No aeration buffer</td> <td data-bbox="747 578 905 659">No aeration buffer</td> <td data-bbox="905 578 1062 659">No aeration buffer</td> <td data-bbox="1062 578 1220 659">No aeration buffer</td> <td data-bbox="1220 578 1377 659">No aeration buffer</td> <td data-bbox="1377 578 1535 659">No aeration buffer</td> <td data-bbox="1535 578 1692 659">No aeration buffer</td> </tr> <tr> <td data-bbox="422 659 594 740">250,001 – 500,000</td> <td data-bbox="594 659 747 740">No aeration buffer</td> <td data-bbox="747 659 905 740">No aeration buffer</td> <td data-bbox="905 659 1062 740">No aeration buffer</td> <td data-bbox="1062 659 1220 740">No aeration buffer</td> <td data-bbox="1220 659 1377 740">165</td> <td data-bbox="1377 659 1535 740">215</td> <td data-bbox="1535 659 1692 740">240</td> </tr> <tr> <td data-bbox="422 740 594 821">500,001 – 750,000</td> <td data-bbox="594 740 747 821">No aeration 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1377 984">485</td> <td data-bbox="1377 902 1535 984">525</td> <td data-bbox="1535 902 1692 984">560</td> </tr> <tr> <td data-bbox="422 984 594 1065">2,500,001 – 5,000,000</td> <td data-bbox="594 984 747 1065">No aeration buffer</td> <td data-bbox="747 984 905 1065">240</td> <td data-bbox="905 984 1062 1065">410</td> <td data-bbox="1062 984 1220 1065">560</td> <td data-bbox="1220 984 1377 1065">660</td> <td data-bbox="1377 984 1535 1065">735</td> <td data-bbox="1535 984 1692 1065">785</td> </tr> <tr> <td data-bbox="422 1065 594 1146">5,000,001 – 7,500,000</td> <td data-bbox="594 1065 747 1146">165</td> <td data-bbox="747 1065 905 1146">305</td> <td data-bbox="905 1065 1062 1146">485</td> <td data-bbox="1062 1065 1220 1146">660</td> <td data-bbox="1220 1065 1377 1146">830</td> <td data-bbox="1377 1065 1535 1146">890</td> <td data-bbox="1535 1065 1692 1146">920</td> </tr> <tr> <td data-bbox="422 1146 594 1227">Greater than 7,500,000</td> <td data-bbox="594 1146 747 1227">240</td> <td 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buffer	No aeration buffer	No aeration buffer	165	215	240	500,001 – 750,000	No aeration buffer	No aeration buffer	No aeration buffer	165	260	290	305	750,001 – 1,000,000	No aeration buffer	No aeration buffer	No aeration buffer	240	305	325	350	1,000,001 – 2,500,000	No aeration buffer	No aeration buffer	280	410	485	525	560	2,500,001 – 5,000,000	No aeration buffer	240	410	560	660	735	785	5,000,001 – 7,500,000	165	305	485	660	830	890	920	Greater than 7,500,000	240	350	560	785	920	965	1,000	Aeration Buffer Distance (feet) ↘		Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm) ↓									Less than 182	182 – 363	364 – 906	907 – 1,813	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625										
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Description	Label Language for Phosphine and the Metal Phosphides Products									Placement on Label
	Fumigation Enclosure Volume (cubic feet) ↓	500,000 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	
		500,001 – 750,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	100	
		750,001 – 1,000,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	100	280	310	
		1,000,001 – 2,500,000	No aeration buffer	No aeration buffer	No aeration buffer	385	480	530	565	
		2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	385	565	680	775	815	
		5,000,001 – 7,500,000	No aeration buffer	100	480	680	860	920	950	
		Greater than 7,500,000	No aeration buffer	310	565	815	950	1,015	1,075	
"Buffer distances for ≥50-foot release height										
Fumigation Enclosure Volume (cubic feet) ↓	Aeration Buffer Distance (feet) ↓	Measure Phosphine Gas Concentration OR Equivalent Treatment Concentration (ppm) ↓								
		Less than 182	182 – 363	364 – 906	907 – 1,813	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625		
	1,000,000 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer		
	1,000,001 – 2,500,000	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	325	460	490		
	2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	No aeration buffer	490	645	725	785		
5,000,001 – 7,500,000	No aeration buffer	No aeration buffer	325	645	840	910	945			

Description	Label Language for Phosphine and the Metal Phosphides Products								Placement on Label																													
<p data-bbox="365 354 600 375">"Roofline Level Stack.</p> <p data-bbox="365 386 1719 477">"Use the following information to determine the required aeration buffer distance for fumigation enclosures aerated through a stack with a release height equal to or above the roofline level. This can include temporary tubing that is adjacent to the fumigation enclosure, so long as it extends to or above the roofline level.</p> <table border="1" data-bbox="365 516 1688 948"> <thead> <tr> <th colspan="2" data-bbox="365 516 709 623" rowspan="2">Aeration Buffer Distance (feet) ↘</th> <th colspan="4" data-bbox="709 516 1688 553">Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm)</th> </tr> <tr> <th colspan="4" data-bbox="709 553 1688 586" style="text-align: center;">↓</th> </tr> <tr> <th colspan="2" data-bbox="365 623 709 651"></th> <th data-bbox="709 586 953 623">Less than 1,814</th> <th data-bbox="953 586 1197 623">1,814 – 2,500</th> <th data-bbox="1197 586 1440 623">2,501 – 3,263</th> <th data-bbox="1440 586 1688 623">3,264 – 3,625</th> </tr> </thead> <tbody> <tr> <td data-bbox="365 651 457 948" rowspan="4" style="writing-mode: vertical-rl; transform: rotate(180deg);">Fumigation Enclosure Volume (cubic feet) ↓</td> <td data-bbox="457 651 709 704">2,500,001 or less</td> <td data-bbox="709 651 953 704">No aeration buffer</td> <td data-bbox="953 651 1197 704">No aeration buffer</td> <td data-bbox="1197 651 1440 704">No aeration buffer</td> <td data-bbox="1440 651 1688 704">No aeration buffer</td> </tr> <tr> <td data-bbox="457 704 709 786">2,500,001 – 5,000,000</td> <td data-bbox="709 704 953 786">No aeration buffer</td> <td data-bbox="953 704 1197 786">No aeration buffer</td> <td data-bbox="1197 704 1440 786">45</td> <td data-bbox="1440 704 1688 786">65</td> </tr> <tr> <td data-bbox="457 786 709 867">5,000,001 – 7,500,000</td> <td data-bbox="709 786 953 867">No aeration buffer</td> <td data-bbox="953 786 1197 867">10</td> <td data-bbox="1197 786 1440 867">45</td> <td data-bbox="1440 786 1688 867">70</td> </tr> <tr> <td data-bbox="457 867 709 948">Greater than 7,500,000</td> <td data-bbox="709 867 953 948">No aeration buffer</td> <td data-bbox="953 867 1197 948">30</td> <td data-bbox="1197 867 1440 948">55</td> <td data-bbox="1440 867 1688 948">70</td> </tr> </tbody> </table> <p data-bbox="365 987 1730 1143">"MULTIPLE FUMIGATIONS. Multiple fumigations occur when the aeration buffer zones of more than one fumigation enclosure are in place concurrently at any time during their duration, such that the areas of the aeration buffer zones overlap spatially. If the periods of the aeration buffer zones overlap for at least one minute AND their individual buffer zone footprints overlap by at least 1 foot, then a multiple fumigation has occurred. For multiple fumigations the required aeration buffer zone distance must be calculated using the following process:</p> <ul data-bbox="415 1187 1698 1344" style="list-style-type: none"> • Identify which buffer zone distance table from above to use to determine the aeration buffer zone distance for the multiple fumigation: <ul style="list-style-type: none"> ○ Passive Aeration Tables. If every fumigation enclosure is passively aerated, then the multiple fumigation aeration buffer zone must be determined using the Passive Aeration buffer distance table above. 	Aeration Buffer Distance (feet) ↘		Measure Phosphine Gas Concentration <i>OR</i> Equivalent Treatment Concentration (ppm)				↓						Less than 1,814	1,814 – 2,500	2,501 – 3,263	3,264 – 3,625	Fumigation Enclosure Volume (cubic feet) ↓	2,500,001 or less	No aeration buffer	No aeration buffer	No aeration buffer	No aeration buffer	2,500,001 – 5,000,000	No aeration buffer	No aeration buffer	45	65	5,000,001 – 7,500,000	No aeration buffer	10	45	70	Greater than 7,500,000	No aeration buffer	30	55	70	
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Greater than 7,500,000	No aeration buffer	No aeration buffer	490	785	945	1,015	1,080																															

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	<ul style="list-style-type: none"> ○ Active Aeration Tables. If any single fumigation enclosure is actively aerated, then the multiple fumigation aeration buffer zone must be determined using one of the active aeration buffer distance tables above: <ul style="list-style-type: none"> ▪ No Stack Tables. If any single fumigation enclosure does not have an aeration stack, then the aeration buffer must be determined using one of the no stack buffer zone distance tables above. <ul style="list-style-type: none"> • Active Aeration, Ground-Level Release, No Stack. If any single fumigation enclosure has a release height below its roofline level, then the aeration buffer zone distance must be determined using the Active Aeration, Ground-Level Release, No Stack table above. • Active Aeration, Roofline Level, No Stack. If every fumigation enclosure has a release height at its roofline level, then the aeration buffer zone distance must be determined using the Active Aeration, Roofline Level, No Stack table above. ▪ Aeration Stack Tables. If any single fumigation enclosure has an aeration stack, then the aeration buffer zone distance must be determined using one of the aeration stack buffer distance tables above: <ul style="list-style-type: none"> • If any single fumigation enclosure is equipped with an aeration stack that has a release height below the roofline level, then the aeration buffer zone distance must be determined using one of the Ground-Level Stack tables above. Determine the lowest released height from among the fumigation enclosures (i.e., ≥ 10, ≥ 25, or ≥ 50 feet and use the corresponding table to determine the correct aeration buffer zone. • If every fumigation enclosure equipped with an aeration stack that has a release height at or above its roofline level, then the aeration buffer zone distance must be determined using the Roofline Level Stack table above. • Determine the highest measured phosphine gas concentration prior to aeration from among the fumigation enclosures. • Calculate the total volume of the fumigation structures. <p>“Once the correct aeration buffer zone distance table has been identified, use the highest measured phosphine concentration and total volume of the fumigation enclosures to look up the required aeration buffer zone in the Single Fumigations section</p>	

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	of the Aeration Buffer Zones in the Directions for Use. This buffer zone distance must be used for the aeration buffer zones for each site.”	
<p>Buffer Zone Entry Restrictions</p> <p>For products registered for use on commodities, equipment, or other use sites; this language does not apply to rodent burrow uses</p>	<p>Create a “Buffer Zone Entry Restrictions” section and include the following language:</p> <p>“Entry by any person, except the certified applicator supervising the fumigation, or persons under his/her direct supervision, is prohibited in an aeration buffer zone. Authorized persons who enter an aeration buffer zone must follow the personal protective equipment requirements specified for fumigation handlers on this label. If a structure within the aeration buffer zone is not occupied, ensure that persons do not enter the structure until the aeration buffer zone is terminated. For structures that have been vacated, persons may not re-enter until one air sample for phosphine, taken in the breathing zone on each floor of the structure after the termination of the aeration buffer zone indicates 0.3 ppm or less phosphine as an 8-hour time weighted average. The sampling requirement does not apply to unoccupied buildings used for storage (e.g., sheds, barns, garages). Local, state, or federal officials performing inspection, sampling, or other similar official duties related to the fumigation are not excluded from the treatment structure or aeration buffer zone by this labeling. The certified applicator supervising the fumigation and the owner of the establishment where the fumigation is taking place are not authorized to, or responsible for, excluding those officials from the treatment structure or aeration buffer zone.</p> <p>“Exceptions to Buffer Zone Entry Restrictions: Two exceptions are permitted for entry into an aeration buffer zone.</p> <ol style="list-style-type: none"> 1. Occupied Structure Exception: Occupants of a structure that is within an aeration buffer zone may remain in the structure, provided continuous real-time monitoring indicates that phosphine concentrations are 0.3 ppm or less as an 8-hour time weighted average within the occupied structure. Fumigation handlers must monitor the air concentrations. This exception only applies to structures occupied by occupational workers. It does not apply to homes, apartment buildings, schools, hospitals, nursing homes, employee housing centers, or other prohibited sites. To use this exception, the FMP must state the distance of the occupied structure to the treatment enclosure, the method of conducting the real time monitoring for phosphine during the period when the aeration buffer zone is in force, and specific procedures for immediate intervention, such as cessation of aeration, evacuation of building, or other procedures if the concentration of phosphine exceeds 0.3 ppm as an 8-hour time weighted average at any time. 2. Transit Exception: Limited transit through an aeration buffer zone is allowed if brief and unavoidable. Routine or repeated work-related tasks are prohibited in the aeration buffer zone. No person is allowed to transit through an aeration buffer zone for more than 30 cumulative minutes in a 24-hour period. In order for individuals to use this exception, the FMP must state the distance from the treatment structure to areas where transit is anticipated, the estimated length of time persons in transit will be in the aeration buffer zone, and the rationale why transit through the aeration buffer zone is not expected to exceed 30 minutes.” 	<p>Directions for Use, under heading “Buffer Zone Entry Restrictions”</p>

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
	Changes to Product Labels for Products that Allow Applications to Rodent Burrows	
Restrict Use to Registered Target Species Only For products that allow applications to rodent burrows	<p>“For in-burrow applications: This product may only be applied to the underground burrow systems of the target pests listed below.</p> <p>“Woodchucks, yellowbelly marmots (rockchucks), prairie dogs (except Utah prairie dogs, <i>Cynomys parvidens</i>), Norway rats, roof rats, mice, ground squirrels, moles, voles, pocket gophers and chipmunks.</p> <p>“This product must not be applied in the underground burrow systems of any species not listed above.”</p>	Directions for Use, under the direction for burrowing pest control
Pre-Application Burrow Check For products that allow applications to rodent burrows	<p>“Nontarget species, including endangered or threatened species, may exploit or inhabit the burrows of target species. Check all burrows to determine if any nontarget species is inhabiting the burrows. If nontarget species or their signs are present, do not treat burrows.”</p>	Directions for Use, under the direction for burrowing pest control
Conservations Areas Application Buffer For products that allow applications to rodent burrows	<p>“Do not apply within 100 feet of any conservation areas. Conservation areas include public lands and parks, national and state wilderness areas and wildlife refuges, national and state forests, and national and state grasslands. Any land between the conservation areas and the application area can be included in the buffer (including Conservation Reserve Program (CRP) and Agricultural Conservation Easement Program (ACEP) areas). Applications made within a conservation area are acceptable when made in accordance with an approved pesticide management plan for the conservation area and the restrictions on this label.”</p>	Directions for Use, under the direction for burrowing pest control
	Changes to Product Labels for Products that Allow Applications to Burrows AND Any Other Site	
Aeration Buffer Zone Clarification for Rodent Burrow Fumigations For products that allow applications to burrows AND any other site	<p>Add the following language to the “Aeration Buffer Zones” section of the Directions for Use, under the heading “Important Information” and to the “Aeration Buffer Zones” section of the Directions for Use, under the heading “Aeration Buffer Zone Selection”</p> <p>“No aeration buffer zone is required for applications made in burrows.”</p>	Directions for Use, Aeration Buffer Zones Section
	Changes to Product Labels for EPA Registrations 68387-7 and 68387-8	
Description of PPE Fit	<p>Create a new subsection, below subsection C. Safety Shoes and adjust the lettering of the existing subsections such that the existing item D. becomes item E. and so forth. Add the following language:</p> <p>“D. CLOTHING</p>	Section V. Personal Protective Equipment

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
For EPA registrations 68387-7 and 68387-8	"Wear loose-fitting or well-ventilated long-sleeved shirt and long pants when handling compressed gas product. Do not wear jewelry or watches when handling this product."	
Update Existing Buffer Zone Language For EPA registrations 68387-7 and 68387-8	Remove the following text in Section III.A.14.: "Special instructions are provided in Section IV.H.8 to establish buffer zones during fumigation and aeration of cold storage fumigations to ensure worker and bystander safety during rapid aeration of chambers containing fresh commodities." Replace the removed text from Section III.A.14. with the following statement: "An aeration buffer zone may be necessary during aeration following fumigation. To determine if an aeration buffer zone is needed, see the Aeration Buffer Zones section in [insert Aeration Buffer Zones section numbering and title] of this label."	Section III. Safety Requirements
Update Existing Buffer Zone Language For EPA registrations 68387-7 and 68387-8	Remove the following text (i.e., item e.) from subsection C.1. of the section titled "A Checklist Guide for a Fumigation Management Plan", below the "MONITORING" heading: "e. Buffer zones are required during cold storage fumigations unless the fumigation chamber/structure has been leak tested and found to be gas tight (see Section F. below, "APPLICATION PROCEDURES & FUMIGATION PERIOD"). Buffer zones must be established during aeration of chambers fumigated under cold storage conditions (see Section G. below, "POST-APPLICATION OPERATIONS", and Section VIII. A. Special instructions for Aeration after Cold Storage Fumigations for buffer zone requirements). Entry into buffer zone areas requires periodic monitoring and the use of SCBA respirators as set forth in Section V. E. RESPIRATORS and the USDA Treatment Manual."	Section IV: Directions for Use
Remove Existing Buffer Zone Language For EPA registrations 68387-7 and 68387-8	Remove the following text (i.e., item 8.) from section F. APPLICATION PROCEDURES & FUMIGATION PERIOD of the subsection titled "A Checklist Guide for a Fumigation Management Plan", below the "APPLICATION PROCEDURES & FUMIGATION PERIOD" heading: "8. For cold storage fumigations, a 30 foot buffer zone must be established from the outside edge of the structure being fumigated unless the structure has been pressure tested and found to be gas tight per USDA testing protocols (see the USDA Treatment Manual, available from the Animal and Plant Health Inspection Service (APHIS) web site (http://www.aphis.usda.gov))."	Section IV: Directions for Use
Add Buffer Zone Language For EPA registrations 68387-7 and 68387-8	Add the following statement to subsection G. POST-APPLICATION OPERATIONS of the section titled "A Checklist Guide for a Fumigation Management Plan" (Section IV.G.2.G.), above the " For Ambient Fumigation " heading: "An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zone section numbering and title] of this label."	Section IV: Directions for Use

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
<p>Update Existing Buffer Zone Language</p> <p>For EPA registrations 68387-7 and 68387-8</p>	<p>Remove the following language from subsection G. POST-APPLICATION OPERATIONS of the section titled "A Checklist Guide for a Fumigation Management Plan", under the "<u>For Cold Storage Fumigations</u>" heading:</p> <p>"To ensure bystander safety during rapid aeration of chambers containing fresh commodities fumigated under cold storage conditions, the following buffer zones must be maintained:</p> <p style="padding-left: 40px;">The required buffer zones vary based upon the volumes treated.</p> <ul style="list-style-type: none"> ▪ 200 foot buffer for all aeration methods and fumigations ≤ 100,000 ft³ ▪ 350 foot buffer for all aeration methods and fumigations ≤ 500,000 ft³ ▪ 500 foot buffer for all aeration methods and fumigations > 500,000 ft³ <p>"During the first 10 minutes of aeration, no one is permitted within the buffer zone surrounding the exhaust duct outlet. If the exhaust duct is not used for aeration, the buffer zone distances must be measured from the perimeter of the fumigated structure. In either scenario, no one is permitted within the buffer zone until the structure has aerated for 10 minutes and monitoring indicates that the level of phosphine gas is 0.3 ppm or below. For personal safety, gas levels should occasionally be monitored at greater distances, especially downwind to ensure this buffer zone is adequate.</p> <p>"Everyone within the aeration buffer zone must be made aware that a release of fumigant gas is about to take place. If personnel involved with the fumigation choose to remain in the area, they must wear the minimum respiratory protection specified in Section V. E. Anyone not involved with the fumigation must evacuate and remain beyond the buffer zone. If people cannot be restricted from the buffer zone during regular work hours, aeration must be done during another time of the day. When securing the duct outlet area, consider the direction of the wind and face the duct outlet toward an open area, and away from people. Always point the duct outlet upward to aid in dispersing the exhausted gas."</p>	<p>Section IV: Directions for Use</p>
<p>Add Buffer Zone Language</p> <p>For EPA registrations 68387-7 and 68387-8</p>	<p>Add the following statement to section IV.H.1. General Statement, between the first and second paragraphs:</p> <p>"An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label."</p>	<p>Section IV: Directions for Use</p>
<p>Add Buffer Zone Language</p> <p>For EPA registrations 68387-7 and 68387-8</p>	<p>Add the following statement to section VIII. AERATION OF FUMIGATED COMMODITIES, above subsection A. FOOD AND FEEDS:</p> <p>"An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label."</p>	<p>Section VIII: Aeration of Fumigated Commodities</p>

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
<p>Remove Existing Buffer Zone Language</p> <p>For EPA registrations 68387-7 and 68387-8</p>	<p>Remove the following language from section VIII.A. FOOD AND FEEDS:</p> <p>“To ensure bystander safety during rapid aeration of chambers containing fresh commodities fumigated under cold storage conditions, the following buffer zones must be maintained:</p> <p style="padding-left: 40px;">The required buffer zones vary based upon the volumes treated.</p> <ul style="list-style-type: none"> ▪ 200 foot buffer for all aeration methods and fumigations ≤ 100,000 ft³ ▪ 350 foot buffer for all aeration methods and fumigations ≤ 500,000 ft³ ▪ 500 foot buffer for all aeration methods and fumigations > 500,000 ft³ <p>During the first 10 minutes of aeration, no one is permitted within the buffer zone surrounding the exhaust duct outlet. If the exhaust duct is not used for aeration, the buffer zone distances must be measured from the perimeter of the fumigated structure. In either scenario, no one is permitted within the buffer zone until the structure has aerated for 10 minutes and monitoring indicates that the level of phosphine gas is 0.3 ppm or below. For personal safety, gas levels should occasionally be monitored at greater distances, especially downwind to ensure this buffer zone is adequate.</p> <p>Everyone within the aeration buffer zone must be made aware that a release of fumigant gas is about to take place. If personnel involved with the fumigation choose to remain in the area, they must wear the minimum respiratory protection specified in Section V. E. Anyone not involved with the fumigation must evacuate and remain beyond the buffer zone. If people cannot be restricted from the buffer zone during regular work hours, aeration must be done during another time of the day. When securing the duct outlet area, consider the direction of the wind and face the duct outlet toward an open area, and away from people. Always point the duct outlet upward to aid in dispersing the exhausted gas.”</p>	<p>Section VIII: Aeration of Fumigated Commodities</p>
<p>Remove Existing Buffer Zone Language</p> <p>For EPA registrations 68387-7 and 68387-8</p>	<p>Remove the following language from item 4. of item I. in item 3. Of subsection A. PRELIMINARY PLANNING AND PREPARATION of part 2. A Checklist Guide for a Fumigation Management Plan of Section IV.G.:</p> <p>“(follow special requirements for aeration following cold storage fumigation)”</p>	<p>Section IV: Directions for Use</p>
<p>Changes to Product Labels for EPA Registration 68387-7</p>		
<p>Remove Existing Buffer Zone Language</p> <p>For EPA registration 68387-7</p>	<p>Remove Section IV.H.9.c. Cold storage buffer zone requirements for fumigation and aeration. And the text contained therein. Adjust the number of successive sections if necessary.</p>	<p>Section IV: Directions for Use</p>

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
Remove Existing Buffer Zone Language For EPA registration 68387-7	Remove the following sentence from Section IV.H.9.e.8.: “Comply with the buffer zone requirements set forth in Section IV.H. 8. C. (above).”	Section IV: Directions for Use
Remove Existing Buffer Zone Language For EPA registration 68387-7	Remove the following sentence from Section IV.H.9.e.18.: “Comply with the buffer zone requirements set forth in Section IV. H. 8. C (above), Section VIII. AERATION OF FUMIGATED COMMODITIES with attention to the SPECIAL INSTRUCTIONS FOR AERATION AFTER COLD STORAGE FUMIGATIONS, and IX.E. AERATION AND REENTRY).”	Section IV: Directions for Use
Changes to Product Labels for EPA Registration 68387-8		
Remove Existing Buffer Zone Language For EPA registration 68387-8	Remove Section IV.H.8.c: Cold storage buffer zone requirements for fumigation and aeration. And the text contained therein. Adjust the number of successive sections if necessary.	Section IV: Directions for Use
Remove Existing Buffer Zone Language For EPA registration 68387-8	Remove the following sentence from Section IV.H.8.e.8: “Comply with the buffer zone requirements set forth in Section IV.H.8.C. (above).”	Section IV: Directions for Use
Remove Existing Buffer Zone Language For EPA registration 68387-8	Remove the following sentence from Section IV.H.8.e.18.: “Comply with the buffer zone requirements set forth in Section IV.H.9.C (above), Section VIII. AERATION OF FUMIGATED COMMODITIES with attention to the SPECIAL INSTRUCTIONS FOR AERATION AFTER COLD STORAGE FUMIGATIONS, and IX.E. AERATION AND REENTRY).”	Section IV: Directions for Use
Changes to Magnesium Phosphide End Use Product Labels (EPA Registrations 70506-16, 70506-17, 70506-309, 72959-6, and 72959-7)		
Add Buffer Zone Language For EPA Registrations 70506-16, 70506-	Add the following language to Section 18: AERATION OF FUMIGATED COMMODITIES immediately above the section 18.1 header: “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label.”	Section 18: Aeration of Fumigated Commodities

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
17, 70506-309, 72959-6, and 72959-7		
Add Buffer Zone Language For EPA Registrations 70506-16, 70506-17, 70506-309, 72959-6, and 72959-7	Add the following language to Section 18: AERATION OF FUMIGATED EQUIPMENT above the existing statement: “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label.”	Section 18: Aeration of Fumigated Commodities
	Changes to Magnesium Phosphide End Use Product Labels (EPA Registration 72959-11)	
Add Buffer Zone Language For EPA registration 72959-11	Add the following language to Section 17: “AERATION OF FUMIGATED COMMODITIES” immediately above the section 17.1 header: “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label.”	Section 17: Aeration of Fumigated Commodities
	Changes to Product Labels for Aluminum Phosphide End Use Products (EPA Registrations 1015-74, 1015-75, and 1015-76)	
Add Buffer Zone Language For EPA registrations 1015-74, 1015-75, and 1015-76	Add the following language to the section titled “AERATION OF FUMIGATED COMMODITIES” (Section 21 of the labels for EPA registrations 1015-74 and 1015-76; sections are not numbered on the label for EPA registration 1015-75), immediately below the header, above the existing text: “An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label.”	Section 21: AERATION OF FUMIGATED COMMODITIES (for EPA Registrations 1015-74 and 1015-76) AERATION OF FUMIGATED COMMODITIES (for EPA Registration 1015-75)
	Changes to Product Labels for Aluminum Phosphide End Use Products (EPA Registrations 43743-1, 43743-2, 43743-3, 70506-13, 70506-14, 70506-15, 70506-69, 72959-1, 72959-2, 72959-3, 72959-4, 72959-5, 72959-8, 72959-9, and 72959-10)	

Description	Label Language for Phosphine and the Metal Phosphides Products	Placement on Label
<p>Add Buffer Zone Language</p> <p>For EPA registrations 43743-1, 43743-2, 43743-3, 70506-13, 70506-14, 70506-15, 70506-69, 72959-1, 72959-2, 72959-3, 72959-4, 72959-5, 72959-8, 72959-9, and 72959-10</p>	<p>Add the following language to Section 18: "AERATION OF FUMIGATED COMMODITIES" immediately above the section 18.1 header:</p> <p>"An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label."</p>	<p>Section 18: Aeration of Fumigated Commodities</p>
Changes to Product Labels for Aluminum Phosphide End Use Products (EPA Registrations 81951-1 and 81951-2)		
<p>Add Buffer Zone Language</p> <p>For EPA registrations 81951-1 and 81951-2</p>	<p>Add the following language to Section 18: "AERATION OF FUMIGATED COMMODITIES" immediately above the section 18.A. header:</p> <p>"An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label."</p>	<p>Section 18: Aeration of Fumigated Commodities</p>
Changes to Product Labels for Aluminum Phosphide End Use Products (EPA Registrations 100986-1, 100986-2, and 100986-3)		
<p>Add Buffer Zone Language</p> <p>For EPA Registrations 100986-1, 100986-2, and 100986-3</p>	<p>Add the following language to Section 18: AERATION OF FUMIGATED COMMODITIES immediately above the section 18.1 header:</p> <p>"An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [insert Aeration Buffer Zones section numbering and title] of this label."</p>	<p>Section 18: Aeration of Fumigated Commodities</p>

Appendix C: Listed Species Assessment

This Appendix provides general background about the Agency’s assessment of the effects of pesticides on listed species and designated critical habitats under the Endangered Species Act (ESA). Additional background specific to aluminum and magnesium phosphide appears at the conclusion of this Appendix.

Developing Approaches for ESA Assessments and Consultation for FIFRA Actions

In 2015, EPA, along with the Services—the U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS)—and the United States Department of Agriculture (USDA) (referred to as “the agencies”) released their joint Interim Approaches⁸⁶ for assessing the effects of pesticides to listed species. The agencies jointly developed these Interim Approaches in response to the 2013 National Academy of Sciences’ recommendations that discussed specific scientific and technical issues related to the development of assessments of pesticides’ effects to listed species. Since that time, the agencies have been continuing to work to improve the approaches for assessing effects to listed species. After receiving input from the Services and USDA on proposed revisions to the interim method and after consideration of public comments received, EPA released an updated *Revised Method for National Level Listed Species Biological Evaluations of Conventional Pesticides* (“Revised Method”) in March 2020.⁸⁷

The agencies also continue to work collaboratively through a FIFRA Interagency Working Group (IWG). The IWG was created under the 2018 Farm Bill to recommend improvements to the ESA section 7 consultation process for FIFRA actions and to increase opportunities for stakeholder input. This group is led by EPA and includes representatives from NMFS, FWS, USDA, and the Council on Environmental Quality (CEQ). The IWG outlines its recommendations and progress on implementing those recommendations in reports to Congress.⁸⁸

Consultation on Chemicals in Registration Review

EPA initially conducted biological evaluations (BEs) using the interim method on three pilot chemicals representing the first nationwide pesticide consultations (final pilot BEs for chlorpyrifos, malathion, and diazinon were completed in January 2017). These initial pilot consultations were envisioned as the start of an iterative process. Later that year, NMFS issued a final biological opinion for these three pesticides. In 2019, EPA requested to reinstate formal

⁸⁶ <https://www.epa.gov/endangered-species/interim-approaches-pesticide-endangered-species-act-assessments-based-nas-report>.

⁸⁷ <https://www.epa.gov/endangered-species/revised-method-national-level-listed-species-biological-evaluations-conventional>.

⁸⁸ <https://www.epa.gov/endangered-species/reports-congress-improving-consultation-process-under-endangered-species-act>.

consultation with NMFS on malathion, chlorpyrifos and diazinon to consider new information that was not available when NMFS issued its 2017 biological opinion.

In 2020, EPA released draft BEs for the first two chemicals conducted using the 2020 Revised Method—carbaryl and methomyl. Subsequently, EPA has used the Revised Method to complete final BEs for carbaryl, methomyl, atrazine, simazine, glyphosate, clothianidin, imidacloprid, and thiamethoxam. EPA is currently in consultation with the Services on these active ingredients.

In February 2022, EPA received a final malathion biological opinion⁸⁹ from FWS in February 2022 and a final biological opinion from NMFS on malathion, chlorpyrifos and diazinon in June 2022.⁹⁰ In August 2023, the Agency implemented the FWS malathion biological opinion by issuing Endangered Species Protection Bulletins⁹¹ and approving malathion label amendments⁹² to incorporate measures to protect listed species. In March 2024, EPA implemented the NMFS biological opinion for malathion, chlorpyrifos (for non-food uses), and diazinon.⁹³

EPA's New Actives Policy and the 2022 Workplan

In January 2022, EPA announced a policy⁹⁴ to evaluate potential effects of new conventional pesticide active ingredients to listed species and their designated critical habitat and initiate consultation with the Services, as appropriate, before registering these new pesticides. Before the Agency registers new uses of pesticides for use on pesticide-tolerant crops, EPA will also continue to make effects determinations. If these determinations are likely to adversely affect determinations, the Agency will not register the use unless it can predict that registering the new use would not have a likelihood of jeopardizing listed species or adversely modifying their designated critical habitats. EPA will also initiate consultation with the Services as appropriate.

In April 2022, EPA released a comprehensive, long-term approach to meeting its ESA obligations, which is outlined in *Balancing Wildlife Protections and Responsible Pesticide Use*.⁹⁵ This workplan reflects the Agency's most comprehensive thinking to date on how to create a sustainable ESA-FIFRA program that focuses on meeting EPA's ESA obligations and improving

⁸⁹ <https://www.epa.gov/endangered-species/biological-opinions-available-public-comment-and-links-final-opinions>.

⁹⁰ <https://www.epa.gov/endangered-species/biological-opinions-available-public-comment-and-links-final-opinions>.

⁹¹ <https://www.epa.gov/endangered-species/endangered-species-protection-bulletins>.

⁹² <https://www.regulations.gov/document/EPA-HQ-OPP-2009-0317-0154>.

⁹³ <https://www.epa.gov/pesticides/epa-announces-implementation-mitigation-measures-insecticides-chlorpyrifos-diazinon-and#:~:text=For%20chlorpyrifos%2C%20diazinon%2C%20and%20malathion,one%20or%20more%20listed%20species>.

⁹⁴ <https://www.epa.gov/newsreleases/epa-announces-endangered-species-act-protection-policy-new-pesticides>.

⁹⁵ <https://www.epa.gov/endangered-species>.

protection for listed species while minimizing regulatory impacts to pesticide users and collaborating with other agencies and stakeholders on implementing the plan.

On November 16, 2022, EPA released the *ESA Workplan Update: Nontarget Species Mitigation for Registration Review and Other FIFRA Actions*.⁹⁶ As part of this update, EPA announced its plan to consider and include, as appropriate, a menu of FIFRA Interim Ecological Risk Mitigation intended to reduce off-target movement of pesticides through spray drift and runoff in its registration review and other FIFRA actions. These measures are intended to reduce risks to nontarget organisms efficiently and consistently across pesticides with similar levels of risks and benefits. EPA expects that these mitigation measures may also reduce pesticide exposures to listed species.

The *ESA Workplan Update* also discussed additional efforts to expedite and streamline ESA consultation, including the Vulnerable Species Pilot, regional strategies (i.e., a Hawaii strategy), approaches for specific niche pesticide uses (e.g., mosquito adulticide applications), and programmatic approaches to consultation (e.g., the Herbicide Strategy).

In June 2023, EPA announced proposed mitigation for the Vulnerable Species Pilot, an implementation plan, and information on potential expansion of the pilot.⁹⁷ EPA also published interactive maps (StoryMaps) for the 27 pilot species to convey geospatial information about the location of the affected species and the location of draft pesticide application minimization and avoidance zones to protect these species.⁹⁸ Visit the public docket for more information about the Vulnerable Species Pilot (docket EPA-HQ-OPP-2023-0327 at www.regulations.gov).

In July 2023, EPA published the framework of the Draft Herbicide Strategy⁹⁹ for public comment along with various supporting documents. For more information about the Herbicide Strategy, visit the public docket (docket EPA-HQ-OPP-2023-0365 at www.regulations.gov).

EPA continues to work on these pilot efforts and once finalized, expects to implement these through registration review and new active ingredient registration.

ESA Assessments or Biological Opinions Impacting Aluminum and Magnesium Phosphide

In 2010, the Agency transmitted its final biological evaluation and initiated formal consultation with FWS on the effects of the metal phosphides on 11 listed species in the greater San

⁹⁶ <https://www.epa.gov/system/files/documents/2022-11/esa-workplan-update.pdf>.

⁹⁷ <https://www.regulations.gov/document/EPA-HQ-OPP-2023-0327-0002>.

⁹⁸ View the StoryMaps for the 27 pilot species here:

<https://storymaps.arcgis.com/collections/896d140363174c9d8ee78e4c471bd7fd>.

⁹⁹ <https://www.regulations.gov/document/EPA-HQ-OPP-2023-0365-0009>.

Francisco Bay area.¹⁰⁰ The Agency will complete a nationwide listed-species assessment and any necessary consultation with the Services before completing the metal phosphides registration reviews.

On May 17, 2010, the U.S. District Court for the Northern District of California Ordered a Stipulated Injunction¹⁰¹ establishing interim use limitations for 53 pesticides, including aluminum and magnesium phosphide. The interim use limitations establish buffer zones to the critical habitats of 11 listed species in areas surrounding the San Francisco Bay and remain in effect until EPA has completed listed species consultation with the Services. These interim use limitations apply to registered uses of the metal phosphides for in-burrow rodent control. Users making in-burrow applications with aluminum and magnesium phosphide products in the counties surrounding the San Francisco Bay¹⁰² should consult EPA's Map Tool to Identify Interim Pesticide Use Limitations to understand where these products may not be applied. The map tool is available online at <https://www.epa.gov/endangered-species/san-francisco-bay-area-map-tool-identify-interim-pesticide-use-limitations>.

¹⁰⁰ <https://www.epa.gov/endangered-species/endangered-species-litigation-and-associated-pesticide-limitations>

¹⁰¹ <https://www.epa.gov/endangered-species/original-2010-court-order-cbd-v-epa>

¹⁰² Marin, Sonoma, Napa, Solano, Contra Costa, Alameda, Santa Clara, and San Mateo Counties

Appendix D: Endocrine Disruptor Screening Program

The Federal Food Drug and Cosmetic Act (FFDCA) §408(p) requires EPA to develop a screening program to determine whether certain substances (including pesticide active and other ingredients) may have an effect in humans similar to an effect produced by a “naturally occurring estrogen, or other such endocrine effects as the Administrator may designate.” (21 U.S.C. 346a(p)). In carrying out the Endocrine Disruptor Screening Program (EDSP), FFDCA section 408(p)(3) requires that EPA “provide for the testing of all pesticide chemicals,” which includes “any substance that is a pesticide within the meaning of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), including all active and pesticide inert ingredients of such pesticide.” (21 U.S.C. 231(q)(1) and 346a(p)(3)). However, FFDCA section 408(p)(4) authorizes EPA to, by order, exempt a substance from the EDSP if the EPA “determines that the substance is anticipated not to produce any effect in humans similar to an effect produced by a naturally occurring estrogen.” (21 U.S.C. 346a(p)(4)).

The EDSP initiatives developed by EPA in 1998 includes human and wildlife testing for estrogen, androgen, and thyroid pathway activity and employs a two-tiered approach. Tier 1 consists of a battery of 11 screening assays to identify the potential of a chemical substance to interact with the estrogen, androgen, or thyroid pathways. Tier 2 testing is designed to identify any adverse endocrine-related effects caused by the substance and establish a dose-response relationship for any adverse estrogen, androgen, or thyroid effect. If EPA finds, based on that data, that the pesticide has an adverse endocrine effect on humans, FFDCA § 408(p)(6) also requires EPA, “... as appropriate, [to] take action under such statutory authority as is available to the Administrator ... as is necessary to ensure the protection of public health.” (21 U.S.C. 346a(p)(6))¹⁰³.

Between October 2009 and February 2010, EPA issued Tier 1 test orders/data call-ins (DCIs) for its first list of chemicals (“List 1 chemicals”) for EDSP screening and subsequently required submission of EDSP Tier 1 data for a refined list of these chemicals. EPA received data for 52 List 1 chemicals (50 pesticide active ingredients and 2 inert ingredients). EPA scientists performed weight-of-evidence (WoE) analyses of the submitted EDSP Tier 1 data and other scientifically relevant information (OSRI) for potential interaction with the estrogen, androgen, and/or thyroid signaling pathways for humans and wildlife.¹⁰⁴

In addition, for FIFRA registration, registration review, and tolerance-related purposes, EPA collects and reviews numerous studies to assess potential adverse outcomes, including potential outcomes to endocrine systems, from exposure to pesticide active ingredients. Although EPA has been collecting and reviewing such data, EPA has not been explicit about how its review of required and submitted data for these purposes also informs EPA’s obligations and commitments under FFDCA section 408(p). Consequently, on October 27, 2023, EPA issued a

¹⁰³ For additional details of the EDSP, please visit <https://www.epa.gov/endocrine-disruption>.

¹⁰⁴ Summarized in *Status of Endocrine Disruptor Screening Program (EDSP) List 1 Screening Conclusions*; EPA-HQ-OPP-2023-0474-0001; <https://www.regulations.gov/document/EPA-HQ-OPP-2023-0474-0001>

Federal Register Notice (FRN) providing clarity on the applicability of these data to FFDCa section 408(p) requirements and near-term strategies for EPA to further its compliance with FFDCa section 408(p). This FRN, entitled *Endocrine Disruptor Screening Program (EDSP): Near-Term Strategies for Implementation' Notice of Availability and Request for Comment* (88 FR 73841) is referred to here as EPA's EDSP Strategies Notice. EPA also published three documents supporting the strategies described in the Notice:

- *Use of Existing Mammalian Data to Address Data Needs and Decisions for Endocrine Disruptor Screening Program (EDSP) for Humans under FFDCa Section 408(p)*;
- *List of Conventional Registration Review Chemicals for Which an FFDCa Section 408(p)(6) Determination is Needed*; and,
- *Status of Endocrine Disruptor Screening Program (EDSP) List 1 Screening Conclusions* (referred to here as List 1 Screening Conclusions).

The EDSP Strategies Notice and the support documents are available on www.regulations.gov in docket number EPA-HQ-OPP-2023-0474. As explained in these documents, EPA is prioritizing its screening for potential impacts to the estrogen, androgen, and thyroid systems in humans, focusing first on conventional active ingredients. Although EPA voluntarily expanded the scope of the EDSP to screening for potential impacts to the estrogen, androgen, and thyroid systems in wildlife, EPA announced that it is not addressing this discretionary component of the EDSP at this time, considering its current focus on developing a comprehensive, long-term approach to meeting its Endangered Species Act obligations (See EPA's April 2022 ESA Workplan¹⁰⁵ and November 2022 ESA Workplan Update¹⁰⁶). However, EPA notes that for 35 of the List 1 chemicals (33 active ingredients and 2 inert ingredients), Tier 1 WoE memoranda¹⁰⁷ indicate that available data were sufficient for FFDCa section 408(p) assessment and review for potential adverse effects to the estrogen, androgen, or thyroid pathways for wildlife. For the remaining 17 List 1 chemicals, Tier 1 WoE memoranda made recommendations for additional testing. EPA expects to further address these issues taking into account additional work being done in concert with researchers within the EPA's Office of Research and Development (ORD).

As discussed in EPA's EDSP Strategies Notice and supporting documents, EPA will be using all available data to determine whether additional data are needed to meet EPA's obligations and discretionary commitments under FFDCa section 408(p). For some conventional pesticide active ingredients, the toxicological databases may already provide sufficient evaluation of endocrine potential for estrogen, androgen, and/or thyroid pathways and EPA will generally not need to obtain any additional data to reevaluate those pathways, if in registration review, or to provide an initial evaluation for new active ingredient applications. For instance, EPA has endocrine-related data for numerous conventional pesticide active ingredients through either a two-generation reproduction toxicity study performed in accordance with the current guideline

¹⁰⁵ https://www.epa.gov/system/files/documents/2022-04/balancing-wildlife-protection-and-responsible-pesticide-use_final.pdf

¹⁰⁶ <https://www.epa.gov/system/files/documents/2022-11/esa-workplan-update.pdf>

¹⁰⁷ <https://www.epa.gov/endocrine-disruption/endocrine-disruptor-screening-program-tier-1-screening-determinations-and>

(referred to here as the updated two-generation reproduction toxicity study; OCSPP [870.3800 - Reproduction and Fertility Effects](#)) or an extended one-generation reproductive toxicity (EOGRT) study ([OECD Test Guideline 443 - Extended One-Generation Reproductive Toxicity Study](#)). In these cases, EPA expects to make FFDCA 408(p)(6) decisions for humans without seeking further estrogen or androgen data. However, as also explained in the EPA's EDSP Strategies Notice, where these data do not exist, EPA will reevaluate the available data for the conventional active ingredient during registration review to determine what additional data, if any, might be needed to confirm EPA's assessment of the potential for impacts to estrogen, androgen, and/or thyroid pathways in humans. For more details on EPA's approach for assessing these endpoints, see EPA's EDSP Strategies Notice and related support documents.

Also described in the EPA's EDSP Strategies Notice is a framework that represents an initial approach by EPA to organize and prioritize the large number of conventional pesticides in registration review. For conventional pesticides with a two-generation reproduction toxicity study performed under a previous guideline (i.e., an updated two-generation reproduction toxicity study or an EOGRT is not available), EPA has used data from the Estrogen Receptor Pathway and/or Androgen Receptor Pathway Models to identify a group of chemicals with the highest priority for potential data collection (described in EPA's EDSP Strategies Notice as Group 1 active ingredients). For these cases, although EPA has not reevaluated the existing endocrine-related data, EPA has sought additional data and information in response to the issuance of EPA's EDSP Strategies Notice to better understand the positive findings in the ToxCast™ data for the Pathway Models and committed to issuing DCIs to require additional EDSP Tier 1 data to confirm the sufficiency of data to support EPA's assessment of potential adverse effects to the estrogen, androgen, and/or thyroid pathways in humans and to inform FFDCA 408(p) data decisions. For the remaining conventional pesticides (described in EPA's EDSP Strategies Notice as Group 2 and 3 conventional active ingredients), EPA committed to reevaluating the available data to determine what additional studies, if any, might be needed to confirm EPA's assessment of the potential for impacts to endocrine pathways in humans. Phosphine was placed in Group 2 since ToxCast™ data for the Pathway Models are not available¹⁰⁸.

¹⁰⁸ *List of Conventional Registration Review Chemicals for Which an FFDCA Section 408(p)(6) Determination is Needed*; EPA-HQ-OPP-2023-0474-0002; <https://www.regulations.gov/document/EPA-HQ-OPP-2023-0474-0002>

Appendix E: Summary of Anticipated Tolerance Changes for Phosphine Resulting from Use of Phosphine Gas or Aluminum/Magnesium Phosphide

The Agency plans to exercise its FFDCa authority to update the tolerance expression to appropriately cover the metabolites and degradates of phosphine and the metal phosphides and to specify the residues to be measured for each commodity for enforcement purposes. EPA anticipates amending the tolerance expression to read as follows:

Tolerances are established for residues of the insecticide phosphine, including its metabolites and degradates, in or on the commodities in the table below. Compliance with the tolerance levels specified below is to be determined by measuring only phosphine, in or on the commodity.

Summary of Anticipated Tolerance Changes for Phosphine Resulting from Use of Phosphine Gas or Aluminum/Magnesium Phosphide (40 CFR §180.225).			
Commodity/Correct Commodity Definition	Established Tolerance (ppm)	Anticipated Revised Tolerance (ppm)	Comments
40 CFR 180.225(a) (1)			
Almond	0.1	no change anticipated	
Avocado	0.01	no change anticipated	
Banana	0.01	no change anticipated	
Barley, grain	0.1	no change anticipated	
Cabbage, Chinese, bok choy	0.01	no change anticipated	
Cabbage, Chinese, napa	0.01	no change anticipated	
Cacao, dried bean	--	0.1	Commodity definition correction.
Cacao bean, dried bean	0.1	--	
Cashew	0.1	no change anticipated	
Citron	--	0.01	Commodity definition correction.
Citron, citrus	0.01	--	
Coffee, green bean	--	0.1	Commodity definition correction.
Coffee, bean, green	0.1	--	
Corn, field, grain	0.1	no change anticipated	
Corn, pop, grain	0.1	no change anticipated	
Cotton, undelinted seed	0.1	no change anticipated	
Date, dried	--	0.1	Commodity definition correction.
Date, dried fruit	0.1	--	
Dill, seed	0.01	no change anticipated	
Eggplant	0.01	no change anticipated	
Endive	0.01	no change anticipated	
Grapefruit	0.01	no change anticipated	
Hazelnut	0.1	no change anticipated	
Kumquat	0.01	no change anticipated	
Lemon	0.01	no change anticipated	
Lettuce	0.01	no change anticipated	
Lime	0.01	no change anticipated	
Mango	0.01	no change anticipated	

Millet, grain	0.1	no change anticipated	
Mushroom	0.01	no change anticipated	
Nut, brazil	0.1	no change anticipated	
Oat, grain	0.1	no change anticipated	
Okra	0.01	no change anticipated	
Orange, sweet	0.01	no change anticipated	
Papaya	0.01	no change anticipated	
Peanut	0.1	no change anticipated	
Pecan	0.1	no change anticipated	
Pepper	0.01	no change anticipated	
Persimmon	0.01	no change anticipated	
Pistachio	0.1	no change anticipated	
Rice, grain	0.1	no change anticipated	
Rye, grain	0.1	no change anticipated	
Safflower, seed	0.1	no change anticipated	
Salsify, tops	0.01	no change anticipated	
Sesame, seed	0.1	no change anticipated	
Sorghum, grain, grain	--	0.1	Commodity definition correction.
Sorghum, grain	0.1	--	
Soybean, seed	0.1	no change anticipated	
Sunflower, seed	0.1	no change anticipated	
Sweet potato, roots	0.01	no change anticipated	
Tangelo	0.01	no change anticipated	
Tangerine	0.01	no change anticipated	
Tomato	0.01	no change anticipated	
Vegetable, legume, group 6, except soybean	0.01	no change anticipated	
Walnut	0.1	no change anticipated	
Wheat, grain	0.1	no change anticipated	
(2) Tolerances are established for residues of the fumigant in or on all RACs resulting from preharvest treatment of pest burrows in agricultural and non-crop land areas.			
All raw agricultural commodities resulting from preharvest treatment of pest burrows	0.01	no change anticipated	
(3) Residues resulting from fumigation of processed food:			
Processed food	0.01	no change anticipated	
(4) Residues resulting from fumigation of animal feed:			
Animal feed	0.1	no change anticipated	

Appendix F: US/International Tolerances and Maximum Residue Limits

Summary of U.S. and International Tolerances and Maximum Residue Limits for Phosphine.				
<i>Residue Definition:</i>				
U.S. - 40 CFR 180.224: Plant: Phosphine Livestock:				
Canada - Phosphine				
Codex – Hydrogen Phosphide				
Other ¹ -				
<i>Commodity</i>	<i>Tolerance (ppm)/Maximum Residue Limit (mg/kg)</i>			
	U.S.	Canada	Codex	Other
Almond	0.1	0.1	0.01 Tree nuts	
Avocado	0.01	0.01		
Banana	0.01	0.01		
Barley, grain	0.1	0.1	0.1 Cereal grains	
Cabbage, Chinese, bok choy	0.01	0.01		
Cabbage, Chinese, napa	0.01	0.01		
Cacao, dried bean	0.1	0.1	0.01	
Cashew	0.1	0.1	0.01 Tree nuts	
Citron	0.01	0.01		
Coffee, green bean	0.1	0.1		
Corn, field, grain	0.1	0.1	0.1 Cereal grains	
Corn, pop, grain	0.1	0.1		
Cotton, undelinted seed	0.1			
Date, dried	0.1	0.1 dates	0.01 Dried fruit	
Dill, seed	0.01	0.01	0.01 Spices	
Eggplant	0.01	0.01		
Endive	0.01	0.01		
Grapefruit	0.01	0.01		
Hazelnut	0.1	0.1	0.01 Tree nuts	
Kumquat	0.01	0.01		
Lemon	0.01	0.01		
Lettuce	0.01	0.01		
Lime	0.01	0.01		

Summary of U.S. and International Tolerances and Maximum Residue Limits for Phosphine.

Residue Definition:

U.S. - 40 CFR 180.224:

Plant: Phosphine

Livestock:

Canada - Phosphine

Codex – Hydrogen Phosphide

Mango	0.01	0.01	
Millet, grain	0.1	0.1 pearl millet, proso millet	0.1 Cereal grains
Mushroom	0.01		
Nut, brazil	0.1	0.1	0.01 Tree nuts
Oat, grain	0.1	0.1	0.1 Cereal grains
Okra	0.01	0.01	
Orange, sweet	0.01	0.01 oranges	
Papaya	0.01	0.01	
Peanut	0.1	0.1	0.01
Pecan	0.1	0.1	0.01 Tree nuts
Pepper	0.01	0.01 bell peppers, non-bell peppers, pepper hybrids	
Persimmon	0.01	0.01	
Pistachio	0.1	0.1	
Rice, grain	0.1	0.1	0.1 Cereal grains
Rye, grain	0.1	0.1	0.1 Cereal grains
Safflower, seed	0.1	0.1	
Salsify, tops	0.01	0.01	
Sesame, seed	0.1	0.1	
Sorghum, grain, grain	0.1	0.1	0.1 Cereal grains
Soybean, seed	0.1	0.1 dry soybeans	
Sunflower, seed	0.1	0.1	
Sweet potato, roots	0.01	0.01	
Tangelo	0.01	0.01	
Tangerine	0.01	0.01	
Tomato	0.01	0.01	

Summary of U.S. and International Tolerances and Maximum Residue Limits for Phosphine.

Residue Definition:

U.S. - 40 CFR 180.224:

Plant: Phosphine

Livestock:

Canada - Phosphine

Codex – Hydrogen Phosphide

Vegetable, legume, group 6, except soybean	0.01	<p>0.01 Dry (adzuki beans, beans, blackeyed peas, broad beans, catjang seeds, chickpeas, cowpea seed, field peas, guar seeds, kidney beans, lablab beans, lentils, lima beans, moth beans, mung beans, navy beans, pigeon peas, pink beans, pinto beans, rice beans, southern peas, tepary beans, urd beans)</p> <p>0.01 edible podded (dwarf peas, jackbeans, moth beans, peas, pigeon peas, runner beans, snap beans, snow peas, soybeans, sugar snap peas, sword beans, wax beans, yardlong beans)</p> <p>0.01 grain lupin</p> <p>0.01 succulent shelled (blackeyed peas, broad beans, cowpeas, English peas, garden peas, green peas, lima beans, peas, pigeon peas, southern peas)</p>		
Walnut	0.1	0.1 black walnuts, English walnuts,	0.01 Tree nuts	
Wheat, grain	0.1	0.1	0.1 Cereal grains	
US [40 CFR §180.225(a)(2)]				
Tolerances are established for residues of the fumigant in or on all RACs resulting from preharvest treatment of pest burrows in agricultural and non-crop land areas.				
All raw agricultural commodities resulting from preharvest treatment of pest burrows	0.01			
US [40 CFR §180.225(a)(3)]				

Summary of U.S. and International Tolerances and Maximum Residue Limits for Phosphine.

Residue Definition:

U.S. - 40 CFR 180.224:
 Plant: Phosphine
 Livestock:

Canada - Phosphine

Codex – Hydrogen Phosphide

Residues resulting from fumigation of processed food				
Processed food	0.01			
US [40 CFR §180.225(a)(4)]				
Residues resulting from fumigation of animal feed				
Animal feed	0.1			

Completed: T. Morton; 11/10/21 using Global MRL

Appendix G: Examples for a Minimum Written Fumigation Management Plan for Phosphine Gas and Aluminum and Magnesium Phosphide Product Label Language

All labels for registered phosphine and aluminum and magnesium phosphide products must carry language describing how to design and implement a Fumigation Management Plan (FMP) in the Directions for Use section of the product label. FMP label requirements were established in a Memorandum of Agreement (MOA) between EPA and product registrants, announced in the Federal Register on February 2, 2001 (see 66 FR 8790, available online at <https://www.federalregister.gov/documents/2001/02/02/01-2773/amendment-to-reregistration-eligibility-decision-for-aluminum-phosphide-and-magnesium-phosphide>). The language in this appendix is an example of the minimum base-line label language describing how to design and implement an FMP.

Phosphine and metal phosphide product registrants adding FMP language to new or existing product labels or who choose to edit existing FMP language already on labels may use the following language as appropriate for the products. Registrants that choose to use the following language as written should confirm that the language makes sense within the context of their product label (e.g., confirm that references to other sections of the product label are correct and/or that numbering, and lettering of section headers is consistent). In some instances, the language below contains text in square bracket ([]), which is meant to be replaced with product-specific text (e.g., “[insert product name]” should be replaced with the name of the product). Other slight changes to the language below also may be necessary so that it fits within the larger structure of a product label.

Registrants are to use the minimum example language, taking into account that slight modification may be needed based on the specific registered uses of the product in question. For example, for aluminum and magnesium phosphide, the language below includes information on rodent burrow fumigations. Such language should not be included on labels for products that are not registered for in-burrow treatments for rodent control. Language describing in-transit fumigations should be considered similarly. Registrants may also add additional components to their own FMP language however, the FMP must contain all of the following elements:

- Certified applicator responsibilities, including a list of factors that must be considered in putting together an FMP
- The steps for the preparation of an FMP, including a description of the purpose of an FMP and the checklist guide for preparation of an FMP. The checklist should include the following elements:
 - A. Preliminary Planning and Preparation
 - B. Personnel

- C. Monitoring
- D. Notification
- E. Sealing Procedures
- F. Application Procedures & Fumigation Period
- G. Post-Application Instructions

PHOSPHINE GAS: The following label language provides an example of the minimum requirements of a complete Fumigation Management Plan (FMP) for this active ingredient

[Insert correct numbering/lettering within the product label] REQUIRED WRITTEN FUMIGATION MANAGEMENT PLAN

The certified applicator is responsible for working with the owners and/or responsible employees of the structure and/or area to be fumigated to develop and follow a Fumigation Management Plan (FMP). State, county and local authorities may also have specific requirements. The FMP must be written PRIOR TO EVERY treatment. The FMP is intended to ensure a safe and effective fumigation. The FMP must address characterization of the structure and/or area, and include appropriate monitoring and notification requirements, consistent with, but not limited to, the following:

1. The use of this product is strictly prohibited on single and multi-family residential properties, nursing homes, schools, daycare facilities and hospitals.
2. Inspect the structure and/or area to determine its suitability for fumigation.
3. When sealing is required, consult previous records for any changes to the structure, seal leaks, and monitor any occupied adjacent buildings to ensure safety.
4. Prior to each fumigation, review the product label, any existing FMP, SDS, Applicators Manual and other relevant safety procedures with company officials (supervisors, foreman, safety officer, etc.) and appropriate employees.
5. Consult company officials in the development of procedures and appropriate safety measures for nearby workers that will be in and around the area during application and aeration.
6. Consult with company officials to develop an appropriate monitoring plan that will confirm that nearby workers and bystanders are not exposed to levels above the allowed limits during application, fumigation and aeration. This plan must also demonstrate that nearby residents will not be exposed to concentrations above the allowable limits.
7. Consult with company officials to develop procedures for local authorities to notify nearby residents in the event of an emergency.

8. Confirm the placement of placards to secure entrance or access into any area under fumigation.
9. An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [\[insert Aeration Buffer Zones section numbering and title\]](#) of this label. Use this completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.
10. Confirm the required safety equipment is in place and the necessary manpower is available to complete a safe and effective fumigation.
11. [\[Choose one option below depending on registered uses of product:\]](#)
 - Written notification must be provided to the receiver of a vehicle that is fumigated in-transit.

[\[OR\]](#)

- [\[Product Name\]](#) may not be applied directly to railcars, containers, or other transport vehicles for in-transit fumigation.

These factors must be considered in putting an FMP together. It is important to note that some plans will be more comprehensive than others. All plans must reflect the experience and expertise of the applicator and circumstances at and around the structure and/or area. In addition to the FMP, the applicator must read the entire label, which includes the container label and the Applicator Manual, and must follow the directions carefully, and abide by all restrictions. If the applicator has any questions about the development of an FMP, contact [\[insert company name and contact information\]](#) for further assistance.

The FMP and related documentation, including monitoring records, must be on-site and available for review during the fumigation and must be maintained for a minimum of 2 years.

STEPS FOR PREPARATION OF THE REQUIRED WRITTEN FUMIGATION MANAGEMENT PLAN

Purpose

A Fumigation Management Plan (FMP) is an organized, written description of the required steps involved to help ensure a safe, legal, and effective fumigation. It will also assist you and others in complying with pesticide product label requirements. The following information is designed to help assist you in addressing all the necessary factors involved in preparing for and completing a fumigation.

This information is intended to help you organize any fumigation that you might perform PRIOR TO ACTUAL TREATMENT. It is meant to be somewhat prescriptive, yet flexible enough to allow the experience and expertise of the fumigator to make changes based on circumstances that may exist in the field. By following a step-by-step procedure, yet allowing for flexibility, a safe and effective fumigation can be performed.

Before any fumigation begins, carefully read and review the entire label, which includes the container label and the Application Manual. This information must also be given to the appropriate company officials (supervisors, foreman, safety officer, etc.) in charge of the structure and/or area. Preparation is the key to any successful fumigation. If you do not find specific instructions for the type of fumigation that you are to perform described in the Application Procedures and FMP sections of this label (see [\[insert appropriate section references\]](#)), you must construct a similar set of procedures using this document as your guide or contact [\[insert company name\]](#) for assistance. Finally, before any fumigation begins you must be familiar with and comply with all applicable federal, state and local regulations.

A Checklist Guide for a Fumigation Management Plan

This checklist is provided to help you take into account factors that must be addressed prior to performing all fumigations. It emphasizes safety steps to protect people and property. The checklist is general in nature and cannot be expected to apply to all types of fumigation situations. It is to be used as a guide to prepare the required plan. Each item must be considered, however, it is understood that each fumigation is different and not all items will be necessary for each fumigation structure.

A. PRELIMINARY PLANNING AND PREPARATION [\[Registrants should amend this section \(i.e., sites and pests listed\) to align with registered uses of products.\]](#)

1. Determine the purpose of the fumigation.
 - a. Elimination of insect infestation
 - b. Elimination of rodent/vertebrate pests
 - c. Plant pest quarantine.
2. Verify that the commodity or target pest is listed under the Directions for Use in the Applicator's Manual
3. Determine the type of fumigation, for example:
 - a. Space: tarp, mill, warehouse, food plant, spot treatment, packaging facility, temperature-controlled storage structures suitable for fumigation.
 - b. Transport Vehicle: railcars, trucks, vans, containers, refrigerated containers for railcars or trucks

- c. Commodity: raw agricultural commodities, processed foods, perishable processed foods or nonfoods
 - d. Type of Storage: vertical silo, farm storage, flat storage, cold temperature storage spaces
 - e. Vessels or ships (not for use on barges), refrigerated containers. In addition to the Application Manual, read the U.S. Coast Guard Regulations 46CFR 147A.
4. Fully acquaint yourself with the structure and commodity to be fumigated, including:
- a. The general structure layout, construction (materials, design, age, maintenance,) of the structure, fire or combustibility hazards, connecting structures and escape routes, above and below ground, and other unique hazards or structure characteristics. Prepare the FMP with the owner/operator/person in charge. Draw or have a drawing or sketch of structure to be fumigated, delineating features, hazards, and other structural issues.
 - b. The number and identification of persons who routinely enter the area to be fumigated (i.e., employees, visitors, customers, etc.).
 - c. The specific commodity to be fumigated, its mode of storage, and its condition.
 - d. The previous treatment history of the commodity, if available.
 - e. Accessibility of utility service connections.
 - f. Nearest telephone or other means of communication and mark the location of these items on the drawing/sketch.
 - g. Emergency shut-off stations for electricity, water and gas. Mark the location of these items on the drawing/sketch.
 - h. Current emergency telephone numbers of local health, fire, police, hospital and physician responders.
 - i. Name and phone number (both day and night) of appropriate company officials.
 - j. Check, mark and prepare the points of fumigation application.
 - k. Review the entire label, which includes both the container label and Application Manual.
 - l. Exposure time considerations.
 - i. Product to be used.
 - ii. Minimum fumigation period, as defined and described by the label use directions.
 - iii. Down time required to be available.
 - iv. Aeration requirements.
 - v. Measure and recorded commodity temperature.

- m. Determination of dosage.
 - i. Cubic footage or other appropriate space/location calculations.
 - ii. Structure sealing capability and methods.
 - iii. Maximum allowable dosage rates.
 - iv. Temperature, humidity and wind.
 - v. Commodity/space volume.
 - vi. Past history of fumigation of structure
 - vii. Exposure time.
 - viii. Commodity Type
 - ix. Pest and life stage

B. PERSONNEL

1. Confirm in writing that all personnel in and around the structure to be fumigated have been notified prior to application of the fumigant. Consider using a checklist that each employee initials indicating they have been notified.
2. Instruct all fumigation personnel to read the Application Manual. Fumigation personnel must be trained in the proper method of application, the hazards that may be encountered, and the selection of personal protection devices, including detection equipment. Confirm that all applicators have been trained in the use of [Product Name] Fumigant Gas and have received the required refresher training every two years.
3. Confirm that all personnel are aware of and know how to proceed in case of an emergency situation.
4. Instruct all personnel on how to report any accident and/or incidents related to fumigant exposure. Provide a telephone number for emergency response reporting.
5. Instruct all personnel to report to proper authorities any theft of fumigant and/or equipment related to fumigation.
6. Establish a meeting area for all personnel in case of emergency.

C. MONITORING

1. Perimeter Safety

- a. Monitoring of phosphine concentrations must be conducted in enclosed areas to prevent excessive exposure and to determine where exposure may occur. Document where monitoring will occur.
- b. Keep a log or manual of monitoring records for each fumigation site. This log must at a minimum contain the timing, number of readings taken, and level of concentrations found in each location.
- c. When monitoring for leaks, document even if there is no phosphine present above the safe levels. In such cases, subsequent leak monitoring is not routinely required. However, spot checks must be made, especially if conditions significantly change.
- d. Monitoring must be conducted during aeration and corrective action taken if gas levels exceed the allowed levels in an area where bystanders and/or nearby residents may be exposed.

2. Efficacy

- a. For stationary structures, gas readings (i.e., measurements) must be taken from within the fumigated enclosure to ensure proper phosphine concentrations. This can be safely achieved from outside the enclosure using monitors, detectors, sampling lines, portals, etc. If the phosphine concentrations have fallen below the target level, additional product may be added.
- b. All phosphine readings must be documented.

3. Prior to Aeration

- a. At the completion of fumigation, prior to aeration, measure the phosphine concentration within the fumigation enclosure to determine if and what size aeration buffer zone is required during aeration (see the “Aeration Buffer Zones” section in [\[insert Aeration Buffer Zones section numbering and title as appropriate\]](#) of the Directions for Use).
- b. These readings must be obtained from within the fumigation enclosure and can be taken via monitors, detectors, sampling lines, portals, etc operated by personnel outside of the enclosure. If internal readings cannot be taken, then use the equivalent concentration of phosphine gas applied at the beginning of fumigation to determine any aeration buffer zone requirements.
- c. These readings and any required aeration buffer zone must be documented. Use the completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.

D. NOTIFICATION

1. Confirm that all appropriate local authorities (fire departments, police departments, etc.) have been notified as per label instructions, local ordinances if applicable, or instructions of the client.
2. Prepare written procedure (“Emergency Response Plan”) which contains explicit instructions, names, and telephone numbers so as to be able to notify local authorities if phosphine levels are exceeded in an area that could be dangerous to bystanders and/or domestic animals.
3. Confirm that the receivers of in-transit vehicles/containers under fumigation have been notified and are trained according to the [\[insert appropriate title and numbering of the section of the Applicator’s Manual that describes the training requirements for receivers of in-transit fumigations\]](#) section of this Applicator’s Manual.

E. SEALING PROCEEDURES

1. Sealing must be adequate to control pests. Care must be taken to ensure that sealing materials will remain intact until the fumigation is complete.
2. If the structure has been fumigated before, review the previous FMP for previous sealing information.
3. Make sure that construction/remodeling has not changed the building in a manner that will affect the fumigation.
4. Warning placards must be placed on every possible entrance to the fumigation site.

F. APPLICATION PROCEDURES & FUMIGATION PERIOD

1. Plan carefully and apply all fumigants in accordance with the label requirements.
2. When entering into the area under fumigation always work with two or more people under the direct supervision of a certified applicator wearing appropriate respirators (refer to PPE section of label).
3. Apply fumigant from outside the fumigation space.
4. Provide watchmen when a fumigation site cannot otherwise be made secure from entry by unauthorized persons.

5. When entering structures always follow OSHA rules for confined spaces.
6. Document that the receiver of vehicles fumigated in transit has been notified and is trained to receive commodity under fumigation.
7. Turn off any electric lights in the fumigated area of the structure, as well as all non-essential electrical motors.
8. If you have any questions, contact [\[insert company name\]](#).

G. POST-APPLICATION OPERATIONS

1. An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [\[insert Aeration Buffer Zones section numbering and title\]](#) of this label. To use either the Occupied Structures Exemption or Transit Exemption from an aeration buffer zone, you must include the relevant information in the FMP as described in the “Buffer Zone Entry Restrictions” of the Directions for Use.
2. Provide watchmen when you cannot secure the fumigation site from entry by unauthorized persons during the aeration process.
3. Ventilate and aerate in accordance with structural limitations.
4. Turn on ventilating or aerating fans where appropriate.
5. Use a suitable gas detector before reentry into a fumigated structure to determine phosphine concentration.
6. Keep written records of monitoring to document completion of aeration.
7. Consider temperature when aerating.
8. Ensure aeration is complete before moving a treated vehicle onto public roads.
9. Remove warning placards when aeration is complete.
10. Inform business/client that employees/other persons may return to work or otherwise be allowed to reenter the aerated structure.

ALUMINUM PHOSPHIDE AND MAGNESIUM PHOSPHIDE: The following label language provides an example of the minimum requirements of a complete Fumigation Management Plan (FMP) for these active ingredients

[Insert correct numbering/lettering within the product label] REQUIRED WRITTEN FUMIGATION MANAGEMENT PLAN

The certified applicator is responsible for working with the owners and/or responsible employees of the structure and/or area to be fumigated to develop and follow a Fumigation Management Plan (FMP). State, county and local authorities may also have specific requirements. The FMP must be written PRIOR TO EVERY treatment [for products that allow treatment in rodent burrows add; “including fumigation treatment for burrowing pests”]. The FMP is intended to ensure a safe and effective fumigation. The FMP must address characterization of the structure and/or area, and include appropriate monitoring and notification requirements, consistent with, but not limited to, the following:

1. For burrowing rodent applications: The use of this product is strictly prohibited within 100 feet of any building where humans and/or domestic animals do or may reside, on single or multi-family residential properties and nursing homes, schools (except athletic fields), daycare facilities and hospitals. For a list of approved burrowing rodent application sites, see [\[insert reference to relevant page/section of label\]](#).
2. Inspect the structure and/or area to determine its suitability for fumigation.
3. When sealing is required, consult previous records for any changes to the structure, seal leaks and monitor any occupied adjacent buildings.
4. Prior to each fumigation, review any existing FMP, SDS, complete product label, including Applicator’s Manual, and other relevant safety procedures with company officials (supervisors, foreman, safety officer, etc.) and appropriate employees.
5. Consult company officials in the development of procedures and appropriate safety measures for nearby workers that will be in and around the area during application and aeration.
6. Consult with company officials to develop an appropriate monitoring plan that will confirm that nearby workers and bystanders are not exposed to levels above the allowed limits during application, fumigation and aeration. This plan must also demonstrate that nearby residents will not be exposed to concentrations above the allowable limits.

7. Consult with company officials to develop procedures for local authorities to notify nearby residents in the event of an emergency.
8. Confirm the placement of placards to secure entrance or access into any area under fumigation.
9. An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [\[insert Aeration Buffer Zones section numbering and title\]](#) of this label. Use this completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.
10. Confirm the required safety equipment is in place and the necessary manpower is available to complete a safe and effective fumigation.
11. [\[Choose one option below depending on registered uses of product:\]](#)
 - Written notification must be provided to the receiver of a vehicle that is fumigated in-transit.

[\[OR\]](#)

 - [\[Product Name\]](#) may not be applied directly to railcars, containers, or other transport vehicles for in-transit fumigation.

These factors **must** be considered in putting an FMP together. It is important to note that some plans will be more comprehensive than others. All plans should reflect the experience and expertise of the applicator and circumstances at and around the structure and/or area.

In addition to preparing the FMP, the applicator must read the entire label which includes the container label and Applicator's Manual, and must follow the directions carefully and abide by all the restrictions. If the applicator has any questions about the development of an FMP contact [\[insert company name and contact information\]](#) for further assistance.

The FMP and related documentation, including monitoring records, must be maintained for a minimum of 2 years.

STEPS FOR PREPARATION OF THE REQUIRED WRITTEN FUMIGATION MANAGEMENT PLAN

Purpose

A Fumigation Management Plan (FMP) is an organized, written description of the required steps involved to help ensure a safe, legal and effective fumigation. It will also assist you and others in complying with pesticide product label requirements. The following information is designed

to help assist you in addressing all the necessary factors involved in preparing for and fumigating a structure and/or area.

This information is intended to help you organize any fumigation that you might perform PRIOR TO ACTUAL TREATMENT. It is meant to be somewhat prescriptive, yet flexible enough to allow the experience and expertise of the fumigator to make changes based on circumstances which may exist in the field. By following a step-by-step procedure, which allows for flexibility, an effective fumigation may be performed.

Before any fumigation begins, carefully read and review the entire label which includes the container label and Applicator's Manual. This information must also be given to the appropriate company officials (supervisors, foreman, safety officer, etc.) in charge of the site. Preparation is the key to any successful fumigation. If you do not find specific instructions for the type of fumigation that you are to perform described in the Application Procedures and FMP sections of this label (see [\[insert appropriate section references\]](#)), you must construct a similar set of procedures using this document as your guide or contact [\[insert company name\]](#) for assistance. Finally, before any fumigation begins you must be familiar with and comply with all applicable federal, state and local regulations. The success of the fumigation is not only dependent on your ability to do your job but also upon carefully following all rules, regulations and procedures required by governmental agencies.

A CHECKLIST GUIDE FOR A FUMIGATION MANAGEMENT PLAN

This checklist is provided to help you take into account factors that must be addressed prior to performing all fumigations. It emphasizes safety steps to protect people and property. The checklist is general in nature and cannot be expected to apply to all types of fumigation situations. It is to be used as a guide to prepare the required plan. Each item must be considered, however, it is understood that each fumigation is different and not all items will be necessary for each fumigation site.

A. PRELIMINARY PLANNING AND PREPARATION [\[Registrants should amend this section \(i.e., sites and pests listed\) to align with registered uses of products.\]](#)

1. Determine the purpose of the fumigation
 - a. Elimination of insect infestation
 - b. Elimination of vertebrate pests
 - c. Plant pest quarantine
2. Verify that the commodity or target pest is listed under the Directions for Use in the Applicator's Manual
3. Determine the type of fumigation, for example:
 - a. Space: tarp, mill, warehouse, food plant or outdoor area

- b. Transport Vehicle: railcar, truck, van or container
 - c. Commodity: raw agricultural or processed foods or non-food
 - d. Type of Storage: vertical silo, farm storage, flat storage, etc.
 - e. Vessels: ship or barge. In addition to the Applicator's Manual, read the U.S. Coast Guard Regulations 46CFR Part 147A.
 - f. Outdoor rodent burrows
4. Fully acquaint yourself with the structure and commodity to be fumigated, including:
- a. The general structure layout, construction (materials, design, age, maintenance), of the structure, fire or combustibility hazards, connecting structures and escape routes, above and below ground and other unique hazards or structure characteristics. Prepare, with the owner/operator/person in charge a drawing or sketch of structure to be fumigated, delineating features, hazards and other structural characteristics.
 - b. The number and identification of persons who routinely enter the area to be fumigated (i.e., employees, visitors, customers, etc.)
 - c. The specific commodity to be fumigated, its mode of storage and its condition.
 - d. The previous treatment history of the commodity, if available.
 - e. Accessibility of utility service connections.
 - f. Nearest telephone or other means of communication. Mark the location of these items on the drawing/sketch.
 - g. Emergency shut-off stations for electricity, water and gas. Mark the location of these items on the drawing/sketch.
 - h. Current emergency telephone numbers of local Health, Fire, Police, Hospital and Physician responders.
 - i. Name and phone number (both day and night) of appropriate company officials.
 - j. Check, mark and prepare the points of fumigant application locations if the job involves entry into the structure for fumigation.
 - k. Review the entire label which includes both the container label and Applicator's Manual.
 - l. Exposure time considerations
 - i. Product to be used
 - ii. Minimum fumigation period, as defined and described by the label use directions
 - iii. Down time required to be available
 - iv. Aeration requirements

- v. Clean-up requirements, including dry or wet deactivation methods, equipment and personnel needs, if necessary.
- vi. Measured and recorded commodity temperature and moisture.
- m. Determination of dosage
 - i. Cubic footage or other appropriate space/location calculations
 - ii. Structure sealing capability and methods
 - iii. Maximum allowable label dosage rates
 - iv. Temperature, humidity and wind
 - v. Commodity/space volume
 - vi. Past history of fumigation of structure
 - vii. Exposure time

B. PERSONNEL

1. Confirm in writing that all personnel in and around the structure and/or area to be fumigated have been notified prior to application of the fumigant. Consider using a checklist that each employee initials indicating they have been notified.
2. Instruct all fumigation personnel to read the Applicator's Manual. Fumigation personnel must be trained in the proper method of application, the hazards that may be encountered, and the selection of personal protection devices including detection equipment.
3. Confirm that all applicators have been trained in the use of [Product Name] and have received the required refresher training every two years.
4. Confirm that all personnel are aware of and know how to proceed in case of an emergency situation.
5. Instruct all personnel on how to report any accident and/or incidents related to fumigant exposure. Provide a telephone number for emergency response reporting.
6. Instruct all personnel to report to proper authorities any theft of fumigant and/or equipment related to fumigation.
7. Establish a meeting area for all personnel in case of emergency.

C. MONITORING

1. PERIMETER SAFETY

- a. Monitoring phosphine concentrations must be conducted in enclosed areas to prevent excessive exposure and to determine where exposure may occur. Document where monitoring will occur.
- b. Keep a log or manual of monitoring records for each fumigation site. This log must at a minimum contain the timing, number of readings taken and level of concentrations found in each location.
- c. When monitoring, document even if there is no phosphine present above the safe levels. In such cases, subsequent monitoring is not routinely required. However, spot checks must be made occasionally, especially if conditions change significantly.
- d. Monitoring must be conducted during aeration and corrective action taken if gas levels exceed the allowed levels in an area where bystanders and/or nearby residents may be exposed.

2. EFFICACY

- a. For stationary structures, gas readings (i.e., measurements) must be taken from within the fumigated enclosure to ensure proper phosphine concentrations. This can be safely achieved from outside the enclosure using monitors, detectors, sampling lines, portals, etc. If the phosphine concentrations have fallen below the target level, additional product may be added.
- b. All phosphine concentration readings must be documented.

3. Prior to Aeration

- a. At the completion of fumigation, prior to aeration, measure the phosphine concentration within the fumigation enclosure to determine if and what size aeration buffer zone is required during aeration (see the “Aeration Buffer Zones” section in [\[insert Aeration Buffer Zones section numbering and title as appropriate\]](#) of the Directions for Use).
- b. These readings must be obtained from within the fumigation enclosure and can be taken via monitors, detectors, sampling lines, portals, etc operated by personnel outside of the enclosure. If internal readings cannot be taken, then use the equivalent concentration of phosphine gas applied at the beginning of fumigation to determine any aeration buffer zone requirements.
- c. These readings and any required aeration buffer zone must be documented. Use this completed FMP to document monitored concentrations of phosphine prior to aeration and any necessary aeration buffer zone.

D. NOTIFICATION

1. Confirm the appropriate local authorities (fire departments, police departments, etc.) have been notified as per label instructions, local ordinances (if applicable), or instructions of the client.
2. Prepare written procedure (“Emergency Response Plan”), which contains explicit instructions, names and telephone numbers so as to be able to notify local authorities if phosphine levels are exceeded in an area that could be dangerous to bystanders and/or domestic animals.
3. Confirm that the receivers of in-transit vehicles/containers under fumigation have been notified and are trained according to the [\[insert appropriate title and numbering of the section of the Applicator’s Manual that describes the training requirements for receivers of in-transit fumigations\]](#) section of this Applicator’s Manual.

E. SEALING PROCEDURES

1. Sealing must be adequate to control the pests. Care should be taken to ensure that sealing materials will remain intact until the fumigation is complete.
2. If the structure has been fumigated before, review the previous FMP for previous sealing information.
3. Make sure that construction/remodeling has not changed the building in a manner that will affect the fumigation.
4. Warning placards must be placed on every possible entrance to the fumigation structure.

F. APPLICATION PROCEDURES & FUMIGATION PERIOD

1. Plan carefully and apply all fumigants in accordance with the label requirements.
2. When entering into the area under fumigation, always work with two or more people under the direct supervision of a certified applicator wearing appropriate respirators (refer to [\[insert PPE section of label\]](#)).
3. Apply fumigant from the outside where appropriate.
4. Provide watchmen when the possibility of entry into the fumigated site by unauthorized persons cannot otherwise be assured.

5. When entering structures, always follow OSHA rules for confined spaces.
6. Document that the receiver of vehicles/containers fumigated in-transit has been notified.
7. Turn off any electric lights in the fumigated area of the structure as well as all non-essential electrical motors.
8. If you have any questions, contact [\[insert company name\]](#).

G. POST-APPLICATION OPERATIONS

1. An aeration buffer zone may be necessary during aeration following fumigation. To determine if a buffer zone is needed during aeration, see the Aeration Buffer Zones in [\[insert Aeration Buffer Zones section numbering and title\]](#) of this label. Determine if an aeration buffer zone is required, as described above in section C and in the Aeration buffer Zones section of this label
2. Provide watchmen when the fumigation structure cannot be secured from entry by unauthorized persons during the aeration process.
3. Aerate in accordance with structural limitations.
4. Turn on ventilating or aerating fans where appropriate.
5. Use a suitable gas detector before re-entry into a fumigated structure to determine phosphine concentration.
6. Keep written records of monitoring to document completion of aeration.
7. Consider temperature when aerating.
8. Ensure that aeration is complete before moving a treated vehicle onto public roads.
9. Remove warning placards when aeration is complete.
10. Inform business/client that employees/other persons may return to work or otherwise be allowed to re-enter the aerated structure.