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Agricultural Marketing Service

Federal Grain Inspection Service

Fumigation Handbook

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Agricultural Marketing Service
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Program Handbook

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Foreword

The Fumigation Handbook provides official inspection personnel with basic information regarding fumigants and fumigation procedures. This handbook transmits policies and procedures by type of carrier when the fumigation of grain is required as a result of (1) insect infestation found during loading, (2) contractual specifications, and (3) phytosanitary inspection certification.

The information contained in this handbook is applicable to the Federal Grain Inspection Service (FGIS) field offices and to delegated and designated agencies. More specifically, this handbook references programs of FGIS under the agency, "Agricultural Marketing Service," henceforth referred to as "AMS."

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CHAPTER 1
GENERAL INFORMATION

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1.1 PURPOSE

This handbook contains the policies and procedures of FGIS for the fumigation of grain and certain other commodities. To successfully interpret and apply these policies and procedures, it is essential that FGIS and agency personnel become familiar with basic information regarding fumigants and fumigation.

1.2 DEFINITIONS

The following definitions relate to terms used in this handbook or terms likely to be used by persons in or associated with the fumigation industry:

Aerosol. A suspension of liquid or solid particles of a chemical in the air. Unlike gases, these particles penetrate commodities. Aerosols are often referred to as smokes, mists, or fogs.

Aluminum Hydroxide. Residue remaining after the decomposition of the fumigant aluminum phosphide. Small amounts of unreacted aluminum phosphide may also remain in the gray-white aluminum hydroxide dust. Aluminum hydroxide is a clay-like compound that is nonpoisonous.

Aluminum Phosphide. A chemical that reacts with moisture to release the fumigant, phosphine, or hydrogen phosphide. The aluminum phosphide fumigant formulation contains approximately 55 percent aluminum phosphide and 45 percent inert ingredients to regulate the release of the fumigant and suppress flammability. Inert ingredients may include ammonium carbamate, ammonium bicarbonate, urea, and paraffin.

Application Method. The process used to administer a fumigant formulation.

Certified Applicator. Any individual who is certified to use or supervise the use of any restricted-use pesticide covered by their certification. This definition is contained in the Code of Federal Regulations (CFR) (40 CFR 171.2(a)(8)) promulgated by the U.S. Environmental Protection Agency (EPA).

Concentration. The actual amount of fumigant present in the airspace in any given part of the structure being fumigated at any given time.

Dosage. The amount of fumigant formulation applied, often expressed as the weight of the fumigant per volume of space treated or the weight of chemical per weight of commodity.

Efficacy. The power to produce a desired effect (i.e., a satisfactory kill of infestation in the egg, pupae, larval, or adult stage).

Fumigant. A chemical which, at the required temperature and pressure, exists in the gaseous state in sufficient concentrations to be lethal to a targeted pest.

Fumigant Formulation. The chemical or mixture of chemicals comprised of all active and inert (if any) ingredients, which releases a fumigant. Fumigant formulations may exist in any of the three physical states: liquid, gas, or solid.

Fumigation. The action of releasing a toxic chemical in the gaseous state to control a targeted pest.

Gas. The state of matter distinguished from the solid and liquid states by very low density and viscosity, relatively great expansion and contraction with changes in pressure or temperature, the ability to diffuse readily, and the spontaneous tendency to become distributed uniformly throughout any container.

Gas Permeable Separation. One that is porous enough to allow air and water vapor into the fumigate pack and the release fumigate out of the pack, but which will keep the residue created in the pack.

Granule. Finely divided chemical formulation as small particles. A granular formulation of aluminum phosphide is packaged in moisture-permeable envelopes or sachets.

Hydrogen Phosphide. Another name (state) for phosphine.

FGIS In-Transit Fumigation. An official FGIS procedure used to fumigate qualifying shipments whereby the carrier may sail before the results are verified. Based on prior USDA research, efficacy of the treatment is assumed to be accomplished, provided that all the carrier criteria and treatment requirements are met and verified by FGIS personnel.

Magnesium Phosphide. A chemical compound that reacts with moisture to release the fumigant, phosphine, or hydrogen phosphide. These formulations contain magnesium phosphide as the active ingredient.

Metal Phosphide. A generic term when referring to aluminum or magnesium phosphide formulations. Metal phosphides are solids that react with moisture and temperature to liberate hydrogen phosphide. These fumigants can contain either aluminum or magnesium formulations. There are other metal phosphide compounds; however, they are not used for fumigation.

Parts by Volume. The relative number of gas molecules present in a given volume of air, such as parts per million (ppm) or parts per billion (ppb). These values are frequently used in human and mammalian toxicology and in applied industrial hygiene to indicate concentration.

Pellets. Aluminum phosphide formulated as a spherical-shaped mass 3/8 of an inch in diameter, weighing about 0.6 grams that release 0.2 grams of phosphine.

Phosphine (PH3). A colorless, odorless gas having a low molecular weight, low boiling point, and specific gravity of 1.21 in relation to air. The gas diffuses rapidly and is capable of penetrating deeply into materials, such as bulk grains. Phosphine is flammable at concentrations above 1.79 percent by volume in air.

Recirculation. The act of moving a fumigant (accomplished with fans located inside the fumigated space) throughout a space being fumigated to prevent stratification and provide an even distribution of the fumigant.

Restricted-Use Pesticide. A pesticide that is classified for restricted use under the provisions of Section 3(d)(1)(c) of the Federal Insecticide, Fungicide, and Rodenticide Act, as amended (Pub. L. 92-516, 86 Stat. 973). Statements indicating that a pesticide is classified as "restricted use" must appear on the EPA-approved label. Aluminum phosphide is classified as "restrictive use." Restricted use pesticides can only be used by or under the supervision of a certified applicator.

Residue. The active ingredient(s), metabolite(s), or degradation product(s) that can be detected after the use of a pesticide.

Residual Pesticide. A pesticide that is active only at or near the point of application and persists for extended periods in sufficient concentrations to be lethal to targeted pests. An example of a residual pesticide is Malathion. Residual pesticides are often referred to as contact insecticides.

Sachet. A moisture permeable envelope containing aluminum phosphide in a granular formulation. Each sachet weighs approximately 34 grams and will release about 11 grams of phosphine. The envelopes may also be placed in cloth strips referred to as bag blankets or belts.

Separation. A permeable or impermeable partition(s) between two or more distinct lots of grain within a specific stowage space.

Specific Gravity—Gas. The weight of a gas compared to the weight of an equal volume of air under prescribed conditions of temperature and pressure. The specific gravity of phosphine gas is 1.21 with the value of air being 1.0. Therefore, phosphine is slightly heavier than air.

Static Fumigation. A method of fumigation in which the carrier/cargo must remain stationary for the EPA-specified exposure time period and the treatment efficacy verified before being allowed to move into commercial channels.

Tablet. Aluminum phosphide formulation in a spherical or flat and round shape weighing approximately three grams that release approximately one gram of phosphine.

Tubing. Hollow cylinder constructed of polyethylene or similar material attached to a blower motor by bolt, clamp, screw, or other semi-permanent device, used in conveying gases in the recirculation system of fumigation.

FGIS Witness of Fumigation. An official FGIS service whereby the verification of a fumigant's application to a specified cargo is provided. This service alone does not guarantee efficacy. FGIS simply observes the fumigation and documents what fumigation information is provided by the fumigator.

1.3 FUMIGANT PROPERTIES

a. General. Fumigation is defined as the process of releasing and dispersing a toxic chemical that reaches a targeted pest in the gaseous state.

An ideal fumigant should have the following characteristics:

(1) Highly toxic to all life stages of the targeted pest.

(2) Low toxicity to plants and humans and other non-target organisms.

(3) Readily available and economical to use.

(4) Imparts no harmful residue to the commodity.

(5) Easily detected warning properties.

(6) Nonflammable, non-corrosive, and non-explosive under normal application conditions.

(7) Non-injurious to product quality, seed germination, or end-use quality.

(8) Highly volatile with excellent penetration properties and easy to aerate.

(9) No adverse effect on the environment.

Unfortunately, no single fumigant has been developed that possesses all of these properties.

The efficacy of fumigants is influenced, in part, by the method of application. Fumigants may be applied singly or combined with other chemicals to improve efficacy or minimize potential hazards, such as flammability. For example, aluminum phosphide formulations contain one or more of the following: ammonium carbamate, ammonium bicarbonate, urea, and paraffin. These materials regulate release of phosphine and suppress flammability.

Fumigant formulations can be applied as a gas or solid. The commodity to be treated must be in a sealed enclosure to retain the fumigant for a sufficient length of time to control the target pest. Such sealed enclosures may include the use of wood, plastic, fiberglass, steel, or concrete.

Under the treatment situations covered in this handbook, aluminum phosphide has proved successful in controlling all life stages of insects injurious to stored grain. Substantial research has been conducted to verify the safety and effectiveness of aluminum phosphide under various conditions. Aluminum phosphide has been selected based on its physical, chemical, and biological properties.

TABLE 1.1 – ESSENTIAL PROPERTIES OF PHOSPHINE

Molecular Weight	**34.0**
Boiling Point[1]	**- 87.4C (-125.3F)**
Specific Gravity (Air = 1)[2]	**1.21**
Lower Explosion Limit[3]	**1.79%**
Comments: Highly toxic, slightly heavier than air, excellent penetration properties, easy to aerate. [1] Boiling point at 760 mm pressure. [2] Values greater than 1.0 are heavier than air. [3] Percent by volume of gas in air.	

b. Aluminum Phosphide.

Aluminum phosphide reacts with moisture in the air to produce phosphine (hydrogen phosphide) which is highly toxic to all forms of animal and human life. Phosphine is a colorless, odorless gas. However, an odor of carbide, decaying fish, or garlic occurs from contaminants as the aluminum phosphide produces phosphine. Aluminum phosphide formulations are composed of approximately 55 percent aluminum phosphide and 45 percent inert ingredients, such as ammonium carbamate, ammonium bicarbonate, urea, and paraffin.

Aluminum phosphide is manufactured in pellet, tablet, and granular formulations. The pellets weigh about 0.6 grams and release 0.2 grams of phosphine, and the tablets weigh approximately three grams and release one gram of phosphine. Pellets or tablets are often placed in moisture permeable enclosures to retain the residual dust. The granules are placed in moisture-permeable envelopes, sachets, or bags that may in turn be placed in cloth strips, blankets, or belts.

Each sachet weighs about 34 grams and releases about 11 grams of phosphine. The acceptable formulations and applications of aluminum phosphide listed in this handbook employ the use of these three basic formulations.

When the aluminum phosphide formulations react with the moisture in the air, ammonia and carbon dioxide are released along with the phosphine. The formulations of aluminum phosphide react slowly to produce phosphine. Reaction of the formulation generally starts about 1–2 hours after exposure to the atmosphere. The rate of reaction varies with moisture and temperature and will take place more quickly on days with higher moisture (humidity) and temperature.

When reaction of the aluminum phosphide with moisture is complete, a fine, gray-white powder remains. This powder is composed of nonpoisonous aluminum oxide hydrate and a small amount of unreacted aluminum phosphide. In bulk grain, this small amount of unreacted aluminum phosphide reacts quickly in the handling or unloading process without hazard to workers or leaving objectionable residues on the commodity. Several manufacturers have developed special packaging devices for pellets or tablets to retain the residual dust the same as with granules, which are placed in envelopes, sachets, or bags. These packages allow easy removal of all residual dust after aeration of the commodity. These packages or other similar devices (designed to retain residual dust) are used for processed commodities, such as corn meal, flour, and milled rice, in order to meet the EPA requirement that under no condition should any processed commodity come in contact with aluminum phosphide residues.

1.4 SAFETY

The fumigation policies and procedures contained in this handbook are based on extensive research. In conducting the research, a major objective was the evaluation of safety for all parties involved with the fumigation. The results of the research studies have demonstrated the safety of the fumigation procedures contained herein.

In performing their responsibilities under this handbook, official personnel should have no occasion for exposure to dangerous concentrations of fumigants. However, it is prudent that all official personnel be familiar with some basic safety precautions.

a. Restricted Use Pesticide.

Perhaps the first level of safety is the classification of pesticides by the EPA. In reviewing aluminum phosphide, the EPA classified the fumigant as a restricted use pesticide. This means that only certified applicators can purchase and apply these fumigants.

b. Certified Applicator.

A certified applicator is any individual who is certified by the proper licensing authority to use or supervise the use of any restricted use pesticides covered by their certification. Certification is defined by the EPA as the recognition by a certifying agency that a person is competent and thus authorized to use or supervise the use of restricted use pesticides. The certification is conducted by individual states or local agencies under guidelines established by the EPA. The certified applicator adds another measure of safety to the fumigation program by supervising individuals using restricted use pesticides.

c. EPA Labeling.

The EPA registers labeling for pesticides. By EPA regulation, each label must contain the following information:

(1) The name, brand, or trademark under which the product is sold.

(2) The name and address of the producer, registrant, or person by whom the product was produced.

(3) The net contents (weight or measure) of the product.

(4) The product registration and establishment number.

(5) An ingredient statement listing the name and percentage by weight of each active ingredient and the total percentage by weight of all inert ingredients.

(6) Warning or precautionary statement. The specific text is determined by the toxicity category of the pesticide established by the EPA. There are four categories of toxicity. The most toxic category requires the use of the term "Danger," the next lower toxic category requires the term "Warning," and the two least toxic categories require the term "Caution" to appear on the label. In addition, since aluminum phosphide is in the most toxic category, a statement of practical medical treatment must also appear on the label.

d. Directions for Use.

(1) The classification use, general or restricted. Restricted use pesticides, such as aluminum phosphide, have the following statement on the label:

> "For retail sale to and use by certified applicators only. For use by certified applicators or persons under their direct supervision, and only for those uses covered by the certified applicator's certification. Refer to the directions to this applicator's Manual for requirements of the physical presence of a certified applicator."

The EPA labeling provides a great deal of useful information. All FGIS and agency personnel involved with the fumigation procedures in this handbook should retain a copy of the label(s) for reference purposes and become familiar with the safety precautions listed on the label.

e. Symptoms of Exposure.

Although there should be no occasion where FGIS or agency personnel encounter hazardous fumigant concentrations in implementing the procedures in this handbook, it is advisable to be fully aware of the symptoms of exposure to phosphine.

Symptoms of exposure to phosphine include the following:

(1) Slight or mild poisoning which produces a feeling of fatigue, ringing in the ears, nausea, pressure in the chest, and uneasiness. All of these symptoms will normally disappear when the person is removed to fresh air.

(2) Moderate exposure that leads to general fatigue, nausea, gastro-intestinal symptoms accompanied by vomiting, stomachache, diarrhea, disturbance of equilibrium, strong pains in the chest, and difficulty in breathing.

(3) Exposure to very high concentrations which rapidly produces strong difficulty in breathing, bluish-purple skin color, difficulty in walking or reaching, subnormal blood oxygen content, unconsciousness, and death. Death can be immediate or may be delayed until several days later.

f. Treatment.

As discussed earlier, the EPA-approved label contains information regarding practical treatment regimes. If any of the symptoms previously described are experienced, a physician should be contacted immediately. To expedite proper treatment, it is advisable to have a copy of the EPA approved label available for the physician. Generally, the most up-to-date information regarding medical treatment for exposure is available from the fumigant manufacturer. The EPA approved label contains the manufacturer or distributor's name, address, and phone number. FGIS field offices and agencies should maintain a list of emergency phone numbers including those of the nearest hospital.

g. Exposure Limits.

Exposure limits for various pesticides and other substances have been developed by several organizations. Since the exposure limits are continually reviewed, no exposure limits for aluminum phosphide are shown here. Current exposure limits for these fumigants may be obtained from the FGIS Safety Staff. Collateral duty safety and health officers should be aware of the latest exposure limits for aluminum phosphide.

CHAPTER 2
IN-TRANSIT FUMIGATION – VESSELS

CONTENTS

2.1 POLICY

Section 800.86(d)(1) of the regulations under the United States Grain Standards Act (USGSA), and applicable provisions of the Agricultural Marketing Act (AMA), as amended, require that an applicant be promptly notified when bulk grains or certain other commodities loaded aboard certain types of oceangoing vessels are found to be infested. The applicant will then have one of the following options:

a. Continue loading, in which case, a separate inspection certificate will be issued for the quantity of grain determined to be infested and all other grain in common stowage with the infested grain;

b. Unload the quantity of grain determined to be infested and an additional amount of other grain in common stowage with the infested grain; or

c. Continue loading and fumigate the grain under official personnel observation and the provisions of this chapter. If the applicant chooses this option, an inspection certificate will be issued without the special grade designation "infested," or the designation of U.S. Sample Grade, which only applies to brown rice for processing.

Note: In a situation where not all ship holds go "infested," only the "infested" holds would need to be fumigated according to official procedures in order to have the entire lot free of the "infested" designation.

The applicant *may* elect to use the procedures outlined in this instruction when in-transit fumigation is required by the buyer or seller or to fulfill phytosanitary requirements even though the grain or commodity is not found to be infested. Additionally, an applicant may request that official personnel witness these fumigations.

2.2 DEVELOPMENTAL HISTORY

Since 1975, FGIS, in cooperation with the Agricultural Research Service (ARS) and the grain, fumigant, and maritime industries, has been involved with research studies to develop safe, effective, and economical fumigation methods for bulk grain loaded aboard oceangoing vessels.

Based on the data obtained from these studies, ARS has provided FGIS with recommendations for the safe and effective in-transit fumigation of bulk grain aboard several types of vessels. Accordingly, FGIS has issued policies and procedures encompassing the in-transit fumigation of bulk grain aboard certain carriers using metal phosphide[1] fumigant formulations registered by the EPA.

[1] Metal phosphide is the fumigant formulation, while phosphine is the toxic gas evolved from the formulation

2.3 PARAMETERS

FGIS approves in-transit fumigation of bulk grain and rice in vessels, only within the following parameters:

a. Acceptable Vessels.

The following vessel types are approved for in-transit fumigation:

(1) Bulk dry-cargo vessels including oceangoing barges.

(2) Tanker-type vessels (not applicable for tubing or recirculation method).

(3) Liquified natural gas carriers that have been converted to bulk carriers.

(4) Lakers or tween deck vessels with the same structural characteristics as bulk dry cargo vessels.

These vessel types are acceptable only when a certified applicator[2] states that the vessel has been inspected and found to be suitable for fumigation. Acceptable vessels must contain no interior bulkheads, structures, or decks within the tanks or holds that could impede the penetration of the phosphine gas throughout the grain mass.

For example, a tween decker with decks made of steel grating may be fumigated provided the vessel is otherwise suitable for fumigation. In addition, wing tanks on acceptable vessels may be fumigated under this chapter. If the wing tanks have bleeder holes connected to the main hold or tank and the bleeder holes remain open, the main hold or tank connected to the wing tank must also be fumigated.

[2] A certified applicator is any individual who is certified to use or supervise the use of any restricted use pesticides covered by their certification in the CFR (40 CFR 171.2(a)(8).)

Tween deck vessels officially classified as “Freedom Mark II,” or “Flush,” are acceptable for in-transit fumigation, provided, all tween decks are retracted fully and remain in that position during loading. Some vessels classed as “multipurpose” may also meet the carrier requirements, provided that the stowage space is configured to approximate that of a bulk carrier. A listing of tween deckers currently approved by FGIS is maintained on the FGIS website.

For consistency of review and compliance, tween deckers can only be assessed and approved at the level of FGIS headquarters.

(5) Self-unloading vessels require special attention. Every opening in the bottom of each hold must be capable of holding a gas-tight seal to ensure the fumigant does not escape into the common work area below the holds. Gas-tight partitions with doors may also have to be permanently designed, built, and installed in the work area to contain any escaping fumigant during transit.

b. Acceptable Bulk Commodities.

Commodities that are acceptable for in-transit fumigation are barley, canola, corn, flaxseed, mixed grain, oats, rice, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

c. Acceptable Fumigant Formulations.

EPA-registered metal phosphide formulations (either solid or granule) are the only approved formulations for in-transit fumigation.

d. Acceptable Fumigant Application Methods.

(1) Surface Treatment.

(a) Spread the fumigant (packaged to retain residual dust (i.e., belts, ropes, blankets, strips, sleeves, etc.) on the exposed grain surface. If possible, anchor packages to prevent shifting during transit.

(b) Uniformly spread, scatter, or step pellets or tablets into the exposed grain surface.

(2) Subsurface Treatment (Trench-in).

Place fumigant (packaged to retain residual dust) or uniformly spread, pellets or tablets in a shallow trench approximately 0.3 meters (1 foot) deep and cover with grain. When using a package product, ensure that only the two ends of the package fumigant remain visible above the grain surface.

(3) Recirculation System.

This method uses a combination of tubing and an explosion proof blower motor. The blower is used to aid fumigant distribution by re-circulating phosphine gas throughout the hold, and therefore, it must have the capability of moving the fumigant at a minimum rate of 300 cubic feet per minute. During transit, the blower forces high gas concentrations in the head space to lower parts of the hold.

The fumigant industry has demonstrated the effectiveness of the Recirculation System. Additionally, USDA's ARS tested the Recirculation System aboard the M/V Gamal Abdul Nasser in December 1987.

(a) Install a 4-inch (minimum) corrugated slotted/perforated tubing in a pattern(s) on the hold bottom that will provide for the uniform distribution of the fumigant throughout the hold.

Figure 2.1 – Recirculation System Installation, shown below, illustrates the suggested installation configuration of the tubing for the recirculation system. Notice how the tubing runs from corner to corner.

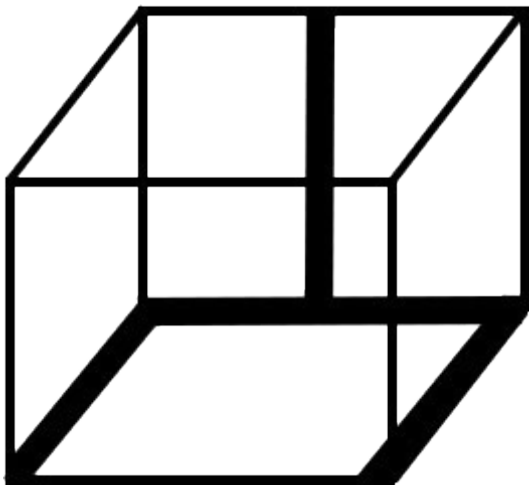

FIGURE 2.1 – RECIRCULATION SYSTEM INSTALLATION

(b) Complete the wiring of the explosion proof motor with the blower.

Note: Official personnel are not responsible for checking wiring diagrams or performing any electrical test on the blower. The fumigator is responsible for demonstrating the operation of the blower to official personnel.

(c) Place the blower motor inside the manway opening and attach tubing to the motor housing securely, using a semi-permanent method, such as a bolt, screw, clamp, etc.

Note: Tape is not allowed for the purpose of attaching the tubing to the blower housing, but tape may be used to help seal the joint between the blower housing and the tubing.

(d) From the output side of blower motor, insert the 4-inch (minimum) solid tubing down through the manway opening and attach it to the slotted tubing (minimum 4-inch) on the hold bottom. Attach the 6-inch perforated/slotted tubing to the input side of the blower motor housing using a semi-permanent method such as a bolt, screw, clamp, etc.

Note: Tape is not allowed for the purpose of attaching the tubing to the blower housing, but tape may be used to help seal the joint between the blower housing and the tubing.

(e) After the loading is completed, stretch the 6-inch perforated/slotted tubing onto the surface of the grain.

Note: If the hold is loaded with "slack," then 6-inch tubing is not considered installed.

(f) Official personnel must verify that the blower is operational, and that the air flow is moving in the correct direction. The air must be pulled from the top (input side) and pushed down (output side) through the tubing to the bottom of the hold. Figure 2.2 – Air Flow Diagram, shown below, illustrates the correct direction of the air flow, and placement of the solid and slotted tubing.

(g) Apply fumigant using surface or subsurface method.

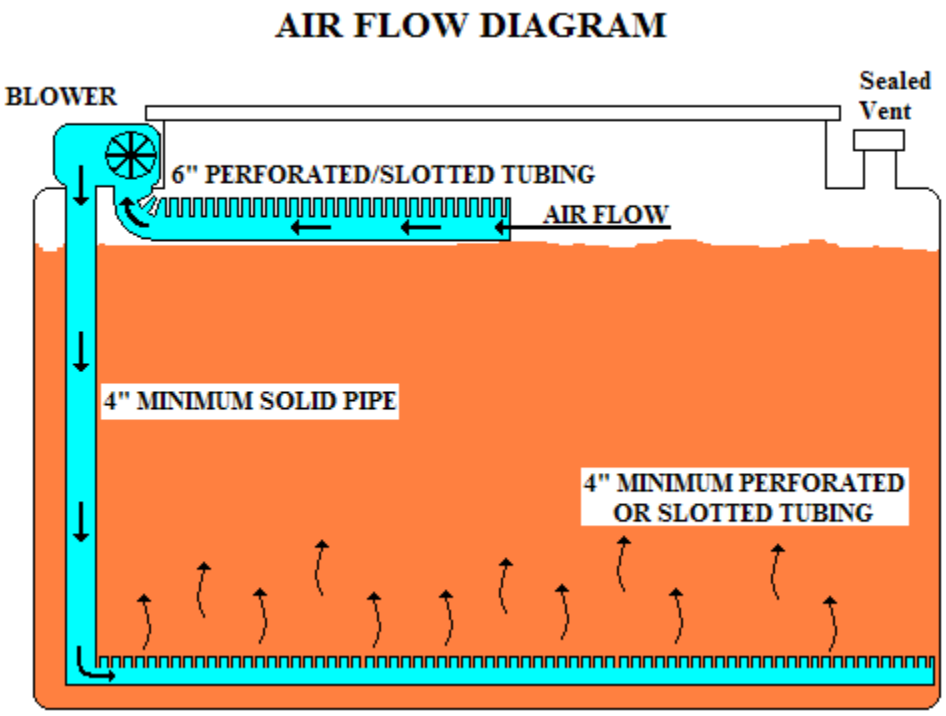

FIGURE 2.2 – AIR FLOW DIAGRAM

e. FGIS In-Transit Fumigation Procedure.

This certification of efficacy by FGIS requires adherence to *all* applicable procedures in this chapter of the Fumigation Handbook.

f. Contract Variance.

FGIS will, upon request, witness the contract specified fumigation procedure and issue a letterhead statement. Official personnel will indicate on the work record that the lot was fumigated in accordance with contract procedures.

g. FGIS Witness of Fumigation.

Upon request, FGIS observes a lot being fumigated but does not guarantee the efficacy. This service is provided when fumigation is requested per contract terms; when a vessel does not qualify for FGIS in-transit fumigation because the vessel is not an approved type vessel; when the cargo is not an acceptable bulk commodity (e.g., bulk soybean meal), or when the cargo is in sacks. See the "Acceptable Vessels" list in Chapter 2, section 3(a), for vessels and commodities that qualify for in-transit fumigation.

h. Acceptable Separation Materials.

Bulk grain above or below a permeable material separation, such as burlap or woven polypropylene, may be fumigated. Bulk grain below impermeable separation materials, such as plastic, cardboard, or wood can only be fumigated in-transit by the recirculation method. However, grain under wood separation material may be fumigated without using the in-transit recirculation method, if the wood material is made permeable by using the procedures outlined in Chapter 2, section 3(h)(1).

Typically, separations are composed of 4-foot by 8-foot plywood sheets, burlap, polypropylene-weave, or polyethylene, layered singularly or in combination with one or both types. When a rigid plywood layer is not used in building a separation, plywood sheets (splash boards) may be placed on top of the flexible separation to protect it from damage resulting from grain hitting the surface of the separation. Sometimes, the type of separation is specified in the contract(s).

When fumigation of the hold(s) is required upon completion of loading, each separation within a hold must be permeable to facilitate sufficient gas dispersal to guarantee the efficacy of the treatment. To achieve this permeability, either of the following procedures must be used:

(1) Plywood.

(a) Permeable Drilled/Cut Plywood. After the lot is loaded, a burlap or polypropylene-weave cover is placed over the reasonably leveled grain in the hold. A layer of plywood sheets covering the entire surface area is then placed on top of the cover.

Each plywood sheet must have three rows of one-inch (25mm) *minimum* diameter holes spaced lengthwise approximately 19 inches (475mm) apart (see Figure 2.3 – Plywood: 3-Rows of 1-Inch Diameter Holes).

Alternatively, each plywood sheet could have three rectangular vertical openings of 1.5 inches (38mm) minimum by 24 inches (610mm), spaced lengthwise and indented 12 inches from each end (see Figure 2.4 – Plywood: 3-Rows of Rectangular Openings). The middle opening is to be centered approximately 33.75 inches (857mm) from each of the two end slots.

Regardless of the method of fumigation, holes/openings are required. When plywood is requested as a separation in the hold, and the grain below the separation must be fumigated, either of the following patterns may be used to cut holes/openings in each plywood sheet, in order to allow for fumigant gas dispersal:

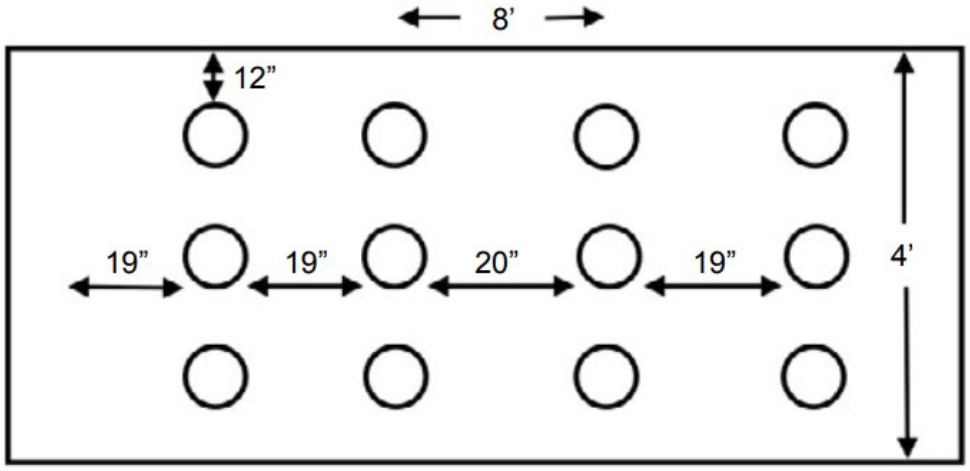

FIGURE 2.3 – PLYWOOD: 3-ROWS OF 1-INCH DIAMETER HOLES

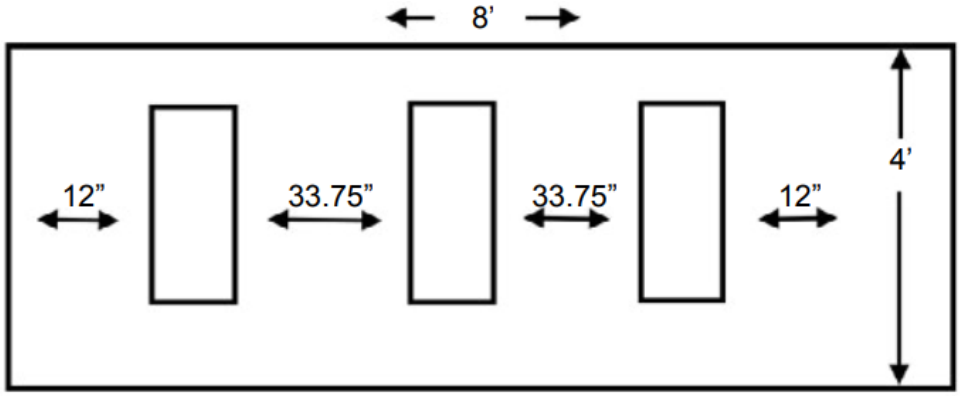

FIGURE 2.4 – PLYWOOD: 3-ROWS OF RECTANGULAR OPENINGS

(b) Splash Boards. After the lot is loaded, a burlap or polypropylene-weave cover is placed over the entire surface of the grain in the hold. Multiple 4-foot by 8-foot plywood/particle board sheets may be scattered over the cover to hold it in place. The loading spout(s) is then placed over the splash boards. Pouring grain above the boards continues at a reduced rate until the spout stream builds a grain mass of sufficient size to anchor the separation before resumption of loading at a faster rate. The splash boards do not need holes. As the surface area of the hold increases the number of boards may also increase; however, the coverage must not exceed approximately 50 percent of the surface area to accommodate fumigation, if needed.

(2) Flexible Separations. Burlap, polypropylene-weave, and polyethylene may all be used, either singularly or combined with the other two to form a separation. Since polyethylene is not permeable to the fumigant, it should only be used if neither lot in the hold is to be treated, or if only the lot portion above the separation is to be fumigated. However, if the portion below the polyethylene separation needs to be fumigated, then the recirculation method is to be used and tubing must be in place before the grain is loaded.

2.4 FGIS OFFICIAL FUMIGATION SERVICES

The metal phosphide fumigant formulations may be applied to the grain, aboard acceptable vessels, only after the loading of the grain into the hold or tank is completed. Partially loaded holds, slack holds and tanks may all be fumigated, provided that no additional grain is subsequently loaded into that hold or tank thereafter.

When another lot of grain is to be loaded at a different elevator, on top of a previous lot, the fumigant formulation may be applied only after the completion of loading all grain into the hold or tank. Certification of the first lot is withheld, pending the proper application of the fumigant, after completing the loading of the grain in the second lot.

The fumigated holds or tanks must remain closed for the entire voyage, unless there exists an emergency situation, (e.g., structural damage, fire, etc.). Appropriate respiratory protection equipment and fumigant gas detection equipment must all be on board the vessel, and at least two crew members must be trained in their use.

a. Applicant's Responsibilities.

The applicant for inspection must do the following:

(1) Make the necessary arrangements to secure the service of a certified applicator from fumigation firm.

(2) Follow the procedures outlined in this chapter, and verify that the certified applicator follows the EPA-registered label requirements for metal phosphide fumigant formulations, and the U.S. Coast Guard regulations regarding shipboard fumigation in the CFR (46 CFR 147A), as well as applicable State and local laws or regulations.

(3) Immediately notify the certified applicator and FGIS of changes to the loading/stowage plan, as change could affect the lot’s suitability for fumigation.

b. Certified Applicator's Responsibilities.

The certified applicator must do the following:

(1) Inspect or cause to be inspected by qualified individuals the holds or tanks for suitability to retain the fumigant gas for the entire voyage. This inspection may be conducted any time prior to fumigation. FGIS recommends that the inspection be done prior to loading when the holds or tanks are empty. The vessel inspection must consider all aspects which relate to the vessel's ability to retain the fumigant for the entire voyage. Structures and systems to evaluate include, but are not limited to, the following:

(a) Integrity of hatch covers, vents, manholes, and other openings to the holds or tanks. Special attention should be given to the condition of gaskets on all openings.

(b) Structural or other systems that may allow the fumigant to leak from one area to another, such as coffer dams, pumping systems, all-weather tunnels, keel ducts, bilges, smoke/fire detection or suppression systems, electrical systems, deck lockers, and bulkheads and decks.

(2) Identify the holds or tanks which cannot be fumigated because of their inability to retain the fumigant. Extra care must be exercised in inspecting holds or tanks that extend under the vessel's housing structure or with a common bulkhead to living quarters to ensure that no fumigant can leak into these areas.

(3) Provide a written statement on the company's letterhead to FGIS or agency personnel, indicating which holds or tanks are suitable for fumigation and which are not, including the reason for unsuitability. This statement must be signed by the certified applicator conducting the inspection and the officer in charge of the vessel. See Attachment 1 for an example of this type of statement.

(4) Determine the fumigant application method and the amount of fumigant to be applied to each hold or tank (see Attachment 5).

(5) Conduct a pre-fumigation conference with the officer-in-charge of the vessel, in the presence of FGIS or agency personnel, and provide each party with a copy of the EPA-registered label from the metal phosphide fumigant formulation.

If the certified applicator typically uses the same fumigant for multiple cargoes, official personnel may waive the requirement for furnishing a specimen label for each fumigation. However, the certified applicator must provide the label specimen to official personnel when there has been a change in labeling, a new fumigant is used, or when requested specifically by official personnel.

Additionally, the certified applicator must prepare a written statement on company letterhead (see Attachment 2), signed by the certified applicator and the officer in charge of the vessel, specifying the following information:

(a) The identification of the holds or tanks to be fumigated.

(b) The method of application of the fumigant formulation.

(c) The safety precautions to be followed by the vessel's crew during the voyage, symptoms of exposure to the fumigant, and the first-aid procedures to be followed in the event of accidental exposure.

(d) Personal respiratory protection and gas detection equipment for phosphine are on board the vessel, and at least two crew members have been trained in their use.

(e) A listing of areas on the vessel that are judged to be safe and areas judged not to be safe during the fumigation.

(f) A checklist of areas that must be monitored daily (at least) for fumigant leaks.

(g) Instructions for aerating the holds or tanks. The instructions must specify that the holds or tanks must not be aerated at sea unless there exists an emergency situation.

(h) Instructions for the retrieval and disposal of fumigant formulation residue and its accompanying packaging, such as sachets, bag blankets, or sleeves, upon arrival at the destination port.

(6) When the recirculation method is used, attach the 6-inch perforated/slotted tubing to the input side of the blower motor housing, using a semi-permanent method such as a bolt, screw, clamp, etc.

Note: Tape is not allowed for the purpose of attaching the tubing to the blower housing but may be used to help seal the joint between the blower housing and the tubing.

Prior to attaching the tubing, demonstrate to FGIS personnel that each blower is moving air in the proper direction.

(7) Apply the fumigant formulation at the dosage prescribed on the EPA-registered label.

(8) Close and seal all unsealed openings to the hold or tank after application of the fumigant formulation is completed.

(9) Verify that the fumigant is being contained within the hold or tank and is not a hazard to the vessel's crew.

(10) Install warning placards on all entrances to all fumigated holds or tanks. Placards must be placed on the *outside* of each manway. Each placard must exhibit the hazardous material symbol for poisonous gas (skull and crossbones symbol) and include the fumigation date, fumigant formulation used, the minimum fumigant retention period as indicated in Attachment 5, and it must show that the fumigated hold or tanks are not to be aerated until arrival at the destination port. When possible, placards in the principal language of the crew and English should be used.

(11) Provide a written statement on company letterhead (see Attachment 4) to the officer-in-charge of the vessel and official personnel, signed by the certified applicator, indicating the following:

(a) The date of the fumigant formulation application.

(b) That the application of the fumigant formulation was in accordance with EPA, U.S. Coast Guard, and FGIS regulations and instructions.

(c) The holds or tanks treated.

(d) The type and quantity of fumigant formulation used in each hold or tank, including the cubic capacity and the depth of each hold or tank.

(e) The method of fumigant formulation application.

(f) The destination of the vessel and the estimated voyage time.

(g) The openings to all fumigated spaces were closed, placarded, and checked to ensure no fumigant was leaking at the time of the vessel's departure.

c. Official Personnel Responsibilities.

Official personnel must do the following:

(1) Obtain a written statement on company letterhead from the certified applicator indicating which holds or tanks are suitable for fumigation, based on the certified applicator's inspection as required (see Chapter 2, section 4(b)(3)).

(2) Verify that the metal phosphide fumigant formulation has an EPA-registered label for in-transit fumigation for the type of grain to be treated.

(3) Attend the pre-fumigation conference, conducted by the certified applicator, and obtain a copy of the signed statement, containing the information required in section 4(b)(5) of Chapter 2.

(4) Observe the application of the fumigant formulation to verify that the dosage, method of application, sealing of the holds or tanks, and the placement of warning placards are as specified in this chapter.

(5) Verify that the metal phosphide fumigant formulation was removed from a *factory-sealed container*. For products not always distributed in factory-sealed containers (e.g., tablets and pellets), verify that the containers are removed from sealed cartons and contain the appropriate formulation.

Caution: Due to the possibility of flash fire, do not stand in close proximity to the containers while they are opened.

(6) Obtain a signed letterhead statement from the certified applicator, containing the information required in section 4(b)(11) of Chapter 2.

(7) Verify that all fumigated holds are closed and sealed prior to vessel departure.

(8) Review all letterhead statements to ensure they contain the required information.

(9) Attach a copy of all fumigation related documents to the Inspection Log (FGIS-921) to have on file.

(10) When the recirculation method is used official personnel must do the following:

(a) Before vessel loading begins, verify that the tubing and blower motor are of the recommended size and are in correct placement in the hold;

(b) Have the certified applicator demonstrate the fan/blower is moving air in the proper direction (see Chapter 2, section 4(b)(6)); and

(c) Ensure that the 6-inch perforated/slotted tubing is attached to the input side of the blower motor housing, securely, using a semi-permanent method (e.g., a bolt, screw, clamp, etc.).

Note: Tape is not allowed for the purpose of attaching the tubing to the blower housing, but tape may be used to help seal the joint between the blower housing and the tubing.

2.5 CERTIFICATION

a. Grain.

If the quantity of grain initially determined to be infested is treated in accordance with this chapter, the certificate representing that quantity of grain will be issued as if the “infested” designation had never been assigned.

b. Rice.

If a lot of Rough Rice or Brown Rice for processing was determined to be infested and downgraded to U.S. Sample Grade, and then treated according to FGIS procedures, the certificate will be issued as if the infestation did not occur and the U.S. Sample Grade designation will be removed. No method of fumigation will remove the U.S. Sample Grade designation from milled rice if the rice is U.S. Sample Grade due to live or dead insects.

c. APHIS-FGIS Memorandum of Understanding.

When insects that are prohibited by the destination country are identified during the official inspection, when the lot is graded “infested” or U.S. Sample Grade, as applicable because of insects, or when fumigation is a quarantine requirement, the vessel may be fumigated under the provisions of this chapter. After the fumigant formulation application is completed, FGIS will inform the Animal and Plant Health Inspection Service (APHIS) that the fumigation was conducted in accordance with FGIS procedures. APHIS will then issue a phytosanitary certificate denoting that the grain was fumigated. Additional information is in the APHIS-FGIS Memorandum of Understanding, found in *FGIS Directive 9180.35*, “Phytosanitary Inspection.”

d. In-Transit Fumigation.

FGIS has established minimum requirements for in-transit fumigation when fumigation is required to remove the special grade “infested” from the official certificate when insect infestation is found during loading, or eliminate the “U.S. Sample Grade” designation, as applicable, or when fumigation is required to satisfy the phytosanitary inspection certification of the cargo, or when official personnel are requested to observe fumigation of a lot and certify that the fumigation was done according to official procedures.

If FGIS requirements for fumigation are satisfied, official personnel will indicate the following on the work record/ship log:

“This (grain/commodity) was fumigated according to official procedures.”

The above statement can also be applied to the Insects in Grain Report, FGIS 921-2, the inspection certificate for grade, or on letterhead stationery.

e. Witness of Fumigation.

This service only certifies that the vessel/cargo was fumigated; it does not certify the accuracy or the efficacy of the fumigation and does not remove the special grade “infested” or eliminate the “U.S. Sample Grade” designation, as applicable.

One or more of the following statements may be shown on a letterhead or certificates:

(1) “Hold(s) No. _____ was/were observed being fumigated with [quantity of fumigant] of [type of fumigant] after lot was loaded into the carrier but the lot was not sampled and examined after fumigation.”

(2) “It is the responsibility of [name of fumigator] to ensure the above named vessel was fit to be fumigated, the proper fumigant dosage was applied, the fumigant is effective, and that all appropriate federal, state, and local laws and regulations were followed.”

(3) “Hold(s) No. _____ was/were observed being fumigated per contract terms using [type of fumigant] after the lot was loaded into the carrier.”

The wording of the above statements may be modified to meet the need of the applicant or carrier, provided that the statement remains factual after modification.

f. Contracted Fumigation Procedures.

If shipments are fumigated according to contract requirements, and those requirements do not meet the guidelines for FGIS in-transit fumigation, FGIS will allow the fumigation to take place. However, only FGIS in-transit fumigation procedures can remove the special grade "infested," and official personnel will not provide a statement indicating that the fumigation was performed according to the official procedures.

Official personnel, however, may provide a statement on the certificate, upon request, if official personnel witness the fumigation process. The following statement will certify the fumigant dosage and the method of application.

"This [grain/commodity] was observed being fumigated with [quantity of fumigant used] of [type of fumigant]) using [application method]."

2.6 QUESTIONS AND ANSWERS

The following questions and answers are designed to aid FGIS and agency personnel in interpreting the procedures contained in this chapter on in-transit shipboard fumigation of grain.

Question 1: What fumigants can be used under FGIS in-transit shipboard fumigation procedures?

Answer: Metal phosphide fumigant formulations registered with the EPA.

Question 2: Grain being loaded aboard a bulk carrier is determined to be infested. A certified fumigator is called out to determine vessel suitability for in-transit fumigation. Can this vessel be fumigated under FGIS in-transit fumigation procedures?

Answer: Yes. The vessel must be inspected by a certified fumigator and found to be suitable for in-transit fumigation.

Question 3: Can bagged wheat or rice be officially fumigated in transit under FGIS procedures?

Answer: No. Only bulk commodities can be fumigated in transit under FGIS procedures.

Question 4: A vessel registered as a “tween decker” contains car decks made of steel grating. Can this vessel be fumigated in transit under FGIS procedures?

Answer: Yes. Car decks made of steel grating will not impede the penetration of the phosphine gas. Vessels with internal decks constructed of solid steel plating or solid wood cannot be fumigated under FGIS procedures.

Question 5: Infested grain is loaded into a wing tank aboard a bulk carrier. Can the grain in the wing tank be fumigated?

Answer: Yes, if the wing tank has bleeder holes connected to the main hold or tank and the bleeder holes remain open, the main tank or hold must also be fumigated. If the wing tank has no bleeder holes or the bleeder holes are closed, only the wing tank has to be fumigated.

Question 6: The dosage for metal phosphide is based on the amount of grain in the hold or tank. Is this a correct statement?

Answer: No. The dosage for metal phosphide is always based on the cubic capacity of the hold or tanks regardless of the amount of grain actually loaded. The minimum dosage for passive fumigant application such as the surface and subsurface (trench-in) method is 45 grams per 1,000 cubic feet of storage space. The minimum dosage for the recirculation method is 33 grams per 1,000 cubic feet of storage space or a pellet formulation at the dosage rate of 45 grams of aluminum phosphide or 30 grams of magnesium phosphide per 1,000 cubic feet of stowage space.

Question 7: Is it permissible under the provisions of this chapter to fumigate grain in one hold while loading is being completed in other holds?

Answer: Yes, providing that no additional grain is to be loaded into that fumigated hold, and the hold is sealed immediately after fumigant application. Under these situations, there is no safety hazard for official personnel. However, in many locations, longshoreman will not allow the application of the fumigant until the completion of loading of all grain aboard the vessel.

Question 8: A lot of grain is loaded into Hold Nos. 1, 2, 3, 4, 5 at Elevator A. The grain in Hold Nos. 3, 4, 5 is infested. A second lot of grain is to be loaded at Elevator B on top of this first lot, without separation. How is the fumigation conducted?

Answer: Fumigation takes place after loading of all grain into Holds No. 3, 4, 5. Certification of the first lot is withheld pending proper application of the fumigant after the completion of loading the grain in the second lot. Where more than one agency or field office is involved, the agency or field office performing the inspection of the first lot must inform the agency or field office that will be inspecting the second lot that infested grain is aboard the vessel and certification for the first lot is being withheld pending proper fumigant application after the completion of loading all grain into the holds or tanks in question.

Question 9: The applicant for fumigation asks (in person or in the load order document) that FGIS witness the fumigation of the lot loaded. What do you do?

Answer: Explain to the applicant the difference between "witness of fumigation" and "FGIS In-Transit Fumigation" and then determine which procedure is to be used. "Witness of fumigation" is a service provided, upon request, whereby FGIS will observe the lot being fumigated but the efficacy is not guaranteed. This service is usually requested when the lot does not qualify for FGIS In-Transit Fumigation (i.e., unapproved vessels, bagged rice or grain, bagged commodities, or soybean meal). "FGIS In-Transit Fumigation" is a procedure used to fumigate qualifying shipments whereby the carrier may sail before the results are verified. The efficacy of the treatment is assumed to be accomplished; provided, all the carrier criteria and treatment requirements contained in Chapter 2 of this Handbook are met and verified by FGIS personnel. "FGIS In-Transit Fumigation" is required to remove the special grade "infested" from the official certificate when insect infestation is found during loading, or eliminate the "U.S. Sample Grade" designation, as applicable, or when fumigation is required to satisfy the phytosanitary inspection certification of the cargo, or when official personnel are requested to observe fumigation of a lot and certify that the fumigation was done according to official procedures.

Question 10: Can a shipment of Dried Distiller Grains be certified as being fumigated according to official FGIS procedures?

Answer: No, there are no FGIS procedures for processed commodities. However, the applicant may request that FGIS witness the fumigation. Commodities that are acceptable for FGIS fumigation are barley, canola, corn, flaxseed, mixed grain, oats, rice, rye, sorghum, soybeans, sunflower seed, triticale, and wheat.

FUMIGATION CHECKLIST

FGIS/agency personnel must complete and sign the Fumigation Checklist (see Attachment 3) to indicate that they have fulfilled their responsibilities under the requirements outlined in this chapter. The Field Office Manager may modify it to suit needs; however, the items below *must* be covered.

Attachment 1: Example of Vessel Suitability

Captain or Officer in Charge of (vessel name).

I hereby certify that I have personally inspected the holds or tanks aboard the above-named vessel on (date) and found the following to be true regarding the suitability of the holds or tanks for in-transit fumigation:

Hold/Tank Number	Suitable	Not Suitable	Reason Not Suitable

Signed: _____
(Certified Applicator)

Acknowledged: _____
(Vessel Captain or Person in Charge of Vessel)

Attachment 2: Example of Statement of Prefumigation Notice Compliance

TO: Person in Charge of (vessel name).

This is to notify you that metal phosphide fumigant (brand name) will be applied to the grain in Hold No(s). (hold nos.) between the hours of (hours) on (date). The fumigant will be applied as (fumigant formulation) by (method of application).

In accordance with applicable federal, state, and local laws, the following information is provided. Information is to be supplied by the certified applicator covering the following topics:

- Safety precautions during voyage.
- Symptoms of exposure.
- First aid procedures.
- Checklist of areas to be monitored for fumigant leaks.
- Instructions for aerating holds or tanks.
- Instructions for retrieval and disposal of fumigant formulation residue and its accompanying packaging at the destination port.

I certify that appropriate personal respiratory protection and fumigant detection equipment for phosphine are on board the vessel and at least two crew members have been instructed in their use.

In general, the following areas of the vessel may be considered as safe during the fumigation:

(list of areas)

The following areas of the vessel are not safe during the fumigation:

(list of areas)

Signed: _____
(Certified Applicator)

Acknowledged: _____
(Vessel Captain or Person in Charge of Vessel)

Attachment 3: Fumigation Checklist

Item	Description	Yes	No
1	**STATEMENT OF VESSEL SUITABILITY**		
1a	Did you obtain a written statement from the certified fumigant applicator that the vessel is suitable for fumigation?		
2	**PRE-FUMIGATION CONFERENCE**		
2a	Did you attend the pre-fumigation conference conducted by the certified fumigant applicator? and:		
	(1) Did you receive a copy of the EPA-registered label for the fumigant to be used?		
	(2) Did the certified fumigant applicator identify holds or tanks to be fumigated		
	(3) Did the certified fumigant applicator state the intended fumigant dosage to be applied?		
	(4) Did the certified fumigant applicator describe the method of fumigant application?		
	(5) Did officer in charge of the vessel state voyage length?		
2b	Did the certified fumigant applicator discuss safety precautions including the following:		
	(1) Symptoms of fumigant exposure.		
	(2) First aid procedures.		
	(3) Instructing two crew members in the use of respiratory protection equipment and phosphine detection equipment.		
	(4) List of areas that are judged to be safe and those judged to be unsafe for crew members during the voyage.		
	(5) Checklist of areas that must be monitored daily for phosphine leaks.		
	(6) Holds or tanks under fumigation must be closed for the entire voyage length.		
2c	Did the certified fumigant applicator provide the officer in charge of the vessel instructions for aerating the holds or tanks upon arrival at the discharge port?		
2d	Did the certified fumigant applicator provide the officer in charge of the vessel instructions for the retrieval and disposal of residue retention device (bags, belts, ropes) at the discharge port?		
3	**IF RECIRCULATION METHOD IS USED (See Section 2.3d(3))**		
3a	Did you verify that the blower motor has the capability to move the fumigant at a minimum rate of 300 cubic feet per minute?		
3b	Did you have the certified applicator demonstrate that the fan/blower is moving air in the proper direction? (See Section 2.4b (6)).		
3c	Did you verify that the 4-inch (minimum) solid tubing is securely attached to the output side of the blower motor housing with a semi-permanent method such as a bolt, screw, clamp, etc.?		
3d	Did you verify that the 4-inch perforated/slotted tubing was placed on the bottom of the hold and attached to the 4-inch (minimum) solid tubing?		
3e	Did you verify that the 6-inch perforated/slotted tubing is securely attached to the input side of the blower motor housing with a semi-permanent method such as a bolt, screw, clamp, etc.?		
4	**OBSERVING FUMIGANT APPLICATION**		
4a	Did you observe the application of the fumigant?		
4b	Did you verify accurate fumigant dosage was applied?		
4c	Did you verify that certified fumigant applicator removed fumigant from factory-sealed containers?		
4d	For fumigants not in factory-sealed containers (e.g., tablets and pellets), did you verify that the certified fumigant applicator removed the containers from sealed cartons and contain the appropriate formulation?		

Item	Description	Yes	No
4e	Did the certified fumigant applicator apply the fumigant by the method stated in the pre-fumigation conference?		
5	**CLOSING AND SEALING OF OPENINGS**		
5a	Were all openings to holds or tanks closed and sealed after application of the fumigant, including main hatch or tank openings, man ways, wing-tank openings, butterworth plates, weep bales, and vent openings?		
6	**INSTALLING WARNING PLACARDS**		
6a	Did the certified fumigant applicator install or have warning placards installed on all entrances to the fumigated holds or tanks?		
6b	Did each warning placard contain the following information: date of fumigant application, fumigant formulation used, the minimum fumigant retention period as indicated in Attachment 5, and the holds or tanks must be kept closed for the entire length of the voyage?		
7	**STATEMENT OF FUMIGANT APPLICATION COMPLIANCE**		
7a	Did you receive a written statement of fumigant application compliance from the certified applicator as required by 2.4b (11) of the Fumigation Handbook? See Attachment 4.		

Remarks - Indicate in the space below any remarks regarding the fumigation process.

Signed: _____
(FGIS/Agency Fumigation Observer)

Attachment 4: Example of Statement of Fumigant Application Compliance

TO: Captain or Officer in Charge of (vessel name).

I hereby certify that metal phosphide fumigant formulation was applied to the grain on the above referenced vessel on (date). I further certify that the fumigant formulation application was made in accordance with U.S. Environmental Protection Agency, U.S. Coast Guard, and applicable State and local laws and regulations and applicable Federal Grain Inspection Service instructions.

The grain in the following holds or tanks was treated:

Hold/Tank Number	Hold/Tank Depth	Type and Quantity of Fumigation Formulation Used	Cubic Capacity of Hold/Tank	Method of Application

It is my understanding that the above-named vessel is destined for (country) with an estimated voyage time of (days).

I certify that immediately following application of the fumigant formulation all openings to the fumigated space were closed and placarded with appropriate warning signs. I further certify that all openings to the fumigated space have been checked and no fumigant gas was leaking at the time of the vessel's departure.

Signed: _____
(Certified Applicator)

Acknowledged: _____
(Vessel Captain or Person in Charge of Vessel)

Attachment 5: Phosphine Application Methods and Mandatory Minimum Exposure Time

The following mandatory procedures represented in Table 3 apply only when fumigation is required to do the following: (1) remove the special grade designation "infested" from the official inspection certificate when insect infestation is found during loading, or eliminate the "U.S. Sample Grade" designation, as applicable; (2) when fumigation is required to satisfy phytosanitary inspection certification of the cargo; (3) when official personnel are requested by contract to observe fumigation of a lot and certify that the fumigation was done according to official procedures.

TABLE 3

Application Method with Phosphine Dosage and Minimum Exposure Time by Cargo Hold Depth*				
Application Method and Dosage Rate Per 1,000 Cubic Feet of Storage Space**	**CARGO HOLD DEPTH IN METERS**			
	< 6	**6 – 12**	**>12 – 20**	**>20**
	MINIMUM EXPOSURE TIME IN DAYS			
Surface (45 grams) or Subsurface (≥45 grams) Application of phosphine per 1,000 cu. ft.	9	15	18	**Not Acceptable**
Surface or Subsurface Application with recirculation ≥33 grams of phosphine per 1,000 cu. ft.	4	7	9	**9**
Surface or Subsurface Application with recirculation ≥ 45 grams of phosphine per 1,000 cu. Ft.	3.5	3.5	3.5	3.5
*** Cargo Hold Depth is the length from the bottom of the hold to the top of the combing.** ****Fumigant quantity is calculated by total volume of the empty cargo hold.**				

Note: It is recommended that fumigated holds remain closed during entire voyage even if the mandatory minimum exposure time is met or exceeded.

Note: When possible, recirculation methods are recommended.

Fumigating Slack Holds and Slack Tanks of Vessels.

Surface or subsurface applications may be used as specific in the chart above.

CHAPTER 3
LAND CARRIER FUMIGATION

CONTENTS

3.1 POLICY

The fumigation of bulk grain in a land carrier(s) is authorized by section 800.84(b)(3) of the regulations under the USGSA, as amended. Additionally, the fumigation of bulk rice in land carriers is approved under the provisions of the AMA. If grain/rice is found to contain live insects in sufficient quantity to affect the grade, the applicant is promptly notified and has the option of the following:

a. In grain or Rough rice, receiving a certificate with the special grade "Infested" or in the case of Brown rice for processing receiving a certificate with the U.S. Sample Grade designation; or

b. Fumigating the grain or rice in accordance with the provisions of this chapter, in which case, a certificate is issued as though the infestation did not exist.

Note: No live or dead insects are permitted in all Milled rice classes; therefore, fumigation would not remove the "Sample Grade" designation on the certificate grade line.

FGIS will require official personnel to witness subsequent fumigant applications by applicator and/or facility if complaints are received concerning infested carriers which were fumigated under these procedures. Witnessing fumigation will ensure that the carrier is properly sealed and the correct dosage, as specified by the applicator, is applied. If witnessing is warranted, the director of the Field Management Division (FMD) will determine which applicators and/or facilities must have official personnel witness the fumigant application before a clear certificate is issued.

3.2 PARAMETERS

Fumigation of infested bulk grain and rice in land carriers is approved only within the following parameters as minimum requirements: (Procedures are the same for stationary and in-transit fumigation unless noted.)

a. Acceptable Carriers.

(1) Stationary (Static) Fumigation. Boxcars, hopper cars with covered tops that can be closed and secured, containers, and trucks with permanently enclosed tops are approved.

(2) In-Transit Fumigation. Boxcars are not approved. Hopper cars (hatch or trough type) must have covered tops that can be closed and secured. Trucks, trailers, containers, and vans are not approved while traveling on public roads; however, these carriers are acceptable if they have permanently enclosed tops, sides, and bottoms, and are transported by rail. Aeration of these carriers is prohibited while en route.

b. Acceptable Bulk Commodities.

Bulk grains that are acceptable include the following: barley, canola, corn, oats, rye, sorghum, soybeans, sunflower, triticale, wheat, and mixed grain. Additionally, bulk rice (includes Brown rice for processing, Rough rice, and Milled rice), edible beans, peas, and lentils are acceptable for fumigation.

c. Acceptable Temperatures.

Follow the EPA label for temperature requirements.

Note: Ambient temperature is the temperature of the surrounding or pervading environment.

d. Acceptable Fumigant Use.

Fumigant	Acceptable Use
Methyl Bromide	Stationary
Sulfuryl Fluoride	Stationary or In-Transit
Phosphine & Carbon Dioxide	Stationary or In-Transit
Metal Phosphide	Stationary or In-Transit
Carbon Dioxide	Stationary or In-Transit

e. Acceptable Fumigant Application Methods.

The application method and dose of the fumigant must be in accordance with the EPA-registered product label and labeling as well as Department of Transportation (DOT) and State regulations. Dust retention devices are required when bulk Brown rice or Milled rice is fumigated. The carrier must be placarded.

f. Acceptable Retention Period.

(1) Stationary Fumigation. The carrier must remain sealed and stationary for minimum retention period as outlined below for an effective kill:

Fumigant	Minimum Retention
Methyl Bromide	24 hours
Sulfuryl Fluoride	24 hours
Phosphine & Carbon Dioxide	24 hours
Metal Phosphide	72 hours
Carbon Dioxide	96 hours

Note: The carrier may not be moved within the local switching area during the minimum retention period when methyl bromide is used.

(2) In-Transit Fumigation. Applicants may ship acceptable carriers treated with fumigants as permitted by EPA and DOT regulations.

3.3 PROCEDURES

a. Applicant's Responsibilities.

The applicant for inspection must do the following:

(1) Notify official personnel of the intent to fumigate infested grain and the location of carrier to be fumigated.

(2) Arrange for a certified applicator to fumigate the infested grain.

(3) Verify that the applicator as well as the applicant follows the procedures outlined in this chapter and applicable EPA, DOT, and State requirements.

(4) If the grain is aerated prior to shipping (stationary fumigation), arrange for a person trained in properties of fumigants to remove the placards. This person must know and understand fumigants, aeration, disposal of spent fumigants, use of respiratory protection equipment, and removal of placards. Contact the consignee if the carrier (see section 3.2a for acceptable carriers) is not aerated prior to shipping (in-transit fumigation) and arrange for an individual trained in the properties of fumigants to remove the placards at destination.

b. Certified Applicator's Responsibilities.

A certified applicator must do the following:

(1) Inspect the involved carrier(s) to determine if it is suitable for fumigation. Fumigate only those carriers deemed suitable. Apply any additional sealing necessary to ensure fumigant gas retention. Make sure the vents, seams, gaskets, and moldings are well sealed. Vents at the end of hopper cars and in the corners of containers must be sealed.

(2) Apply the fumigant in accordance with the EPA label or labeling requirements and the provisions of this chapter.

(3) Place a plastic film using a sticky adhesive spray or tape or apply a self-adhering plastic (not less than 4 mil. thickness) to the opening of trough type hopper cars when fumigating in transit. The plastic film is not required for hatch type hopper cars provided the gaskets on the covers are intact.

(4) Install warning placards in accordance with EPA, DOT, and State regulations. Place placarding on both sides of the hopper car near the ladders and next to the top hatch into which the fumigant is introduced. In addition to these locations, install placards inside the cover or on top of the plastic lining. This is an additional precaution since placards can fall off carriers.

(5) Provide copy of fumigant labeling to official personnel and inform them of dosage used.

(6) Arrange, in conjunction with the applicant, for a trained person to aerate the carrier to a permissible exposure limit as specified by EPA before removing the placards either at point of origin for stationary fumigation or at destination for in-transit fumigation.

Exposure Limits

Chemical	Safe Level
Metal Phosphide	0.3 ppm
Methyl Bromide	5.0 ppm
Carbon Dioxide	10,000 ppm

It is not necessary to aerate the carrier and remove the placards before moving the carrier if aluminum, magnesium, or hydrogen phosphide or carbon dioxide are used. Such carriers may be shipped under fumigation in accordance with EPA and DOT regulations provided the placards remain on the carriers, and the carrier is an acceptable type. A trained person must aerate these carriers at destination before removing the placards.

Methyl bromide is not approved for in-transit fumigation. Therefore, aerate carriers treated with methyl bromide to a safe level and remove the placards before shipping.

c. Official Personnel Responsibilities.

Official personnel must do the following:

(1) Record or maintain a record of all pertinent information (carrier identification, name of applicant, name of applicator, date, time, temperature (commodity and/or ambient as applicable) location of fumigant application, and amount of fumigant used) with the work records.

(2) Issue the Inspection Certificate.

(a) Stationary Fumigation. Verify that the carrier has remained stationary for the prescribed period of time before issuing the inspection certificate. The frequency of these periodic verifications is left to the discretion of official personnel. This can be accomplished by requesting the railroad agent to provide release or shipping dates for specific car numbers. Official personnel, in conjunction with other assignments, could verify that the individual carrier has not been moved.

Date and issue the certificate on the date the minimum retention period is met. Do not issue certificates before the minimum fumigant exposure time has elapsed.

(b) In-Transit Fumigation. Issue the certificate after the following required information is received from the applicant and applicator:

1 Notify official personnel of the intent to fumigate infested grain and the location of carrier to be fumigated.

2 Provide copy of fumigant labeling to official personnel and inform them of dosage used.

3 Record or maintain a record of all pertinent information (carrier identification, name of applicant, name of applicator, date, time, temperature (commodity and/or ambient as applicable) location of fumigant application, and amount of fumigant used) with the work records.

4 Additional information may be required of the applicant, dependent upon various factors, such as the completion of FGIS 921-2., certain fumigation protocol (e.g., Vietnam DDG Fumigation), etc.

Note: If there is a situation where a certificate has been issued and the lot was subsequently fumigated according to official procedures, a "corrected" certificate will be issued.

3.4 CERTIFICATION

"Infested" grain or Rough rice fumigated in accordance with this chapter is certificated as though the "Infested" designation had never been assigned. If all conditions of this chapter are not met, the grain in the subject carrier is certificated as "infested."

U.S. Sample Grade Brown rice for processing which is U.S. Sample Grade due to live insects is certificated as though the insects did not exist provided the carrier is fumigated in accordance with this chapter and the rice is loaded in bulk.

Fumigation is allowed on milled rice. However, the U.S. Sample Grain designation will not be removed even if the conditions in this chapter are met because the U.S. Sample Grade designation is applicable to live or dead insects.

Statements.

Place the following information in the “Remarks” section of the certificate:

a. For individual lots.

“This [grain/commodity] was fumigated according to official procedures.”

b. For unit trains and container booking lots.

“The [grain/commodity] in carrier(s) [carrier identification] was/were fumigated according to official procedures.”

One or more of the below statements may be shown in “Remarks” section of certificate or on a letterhead:

a. Witness Fumigation.

“This [grain/commodity] was observed being fumigated with [quantity of fumigant] of [type of fumigant] after it was loaded into the carrier but was not sampled and examined after fumigation.”

b. "Fumigant-Free".

"On [date] official personnel verified carrier(s) to be gas free [≤0.3ppm].

"[Carrier] was sealed after aeration on [date]."

Note: This type of a statement requires a Gas Free Certification only after a trained person is able to aerate the carrier to a permissible exposure limit as specified by EPA before removing the placards either at point of origin for stationary fumigation or at destination for in-transit fumigation

CHAPTER 4
RIVER BARGE FUMIGATION

CONTENTS

4.1 POLICY

The fumigation of bulk grain in a river barge(s) is authorized by section 800.84(b)(3) of the regulations under the USGSA, as amended. Additionally, the fumigation of bulk rice in river barges is approved under the provisions of the AMA, as amended.

To facilitate the marketing and certification of bulk grain and rice transported via river barge, FGIS will permit stationary (static) fumigation as part of the original inspection service when live insects are found in sufficient quantity to affect the grade. The fumigation procedure will *not* automatically remove the special grade "infested" for grain and Rough rice or the U.S. Sample Grade designation for Brown rice for processing from the inspection certificate because sufficient information is not available to confirm efficacy. Therefore, official personnel must resample the barge after fumigation to determine if the fumigation was effective.

When fumigation is requested as part of the original inspection service, the inspection certificate will reflect the quality factor results obtained from the original sample and infestation based on the condition examination conducted after fumigation. If fumigation does not resolve the infestation situation, subsequent fumigation is considered a change to the lot's identity, and a new original inspection is provided, if requested.

This policy does not affect the review inspection procedures permitted by the regulations.

4.2 PARAMETERS

Stationary fumigation of grain in river barges is approved for use only within the following parameters.

a. Acceptable Bulk Commodities.

Bulk grains/rice that are acceptable include the following: barley, canola, corn, oats, rye, sorghum, soybeans, sunflower, triticale, wheat, mixed grain, Rough rice, and Brown rice for processing.

Note: Stationary fumigation is allowed on milled rice. However, the U.S. Sample Grade designation will not be removed even if the fumigation is effective because the U.S. Sample Grade designation is applicable to live or dead insects.

b. Acceptable Fumigants.

Acceptable fumigants include only those fumigants which have an EPA-approved label for barge fumigation.

c. Acceptable Fumigant Application Methods.

The application method and dose must comply with the EPA-registered product label and labeling, as well as DOT and State regulations. EPA labeling does not permit fumigation with a phosphide when the ambient temperature is below 40 degrees Fahrenheit.

d. Acceptable Retention Period.

Fumigated river barges must remain stationary for the minimum retention period on the label.

4.3 PROCEDURES

a. Applicant's Responsibilities.

The applicant for inspection must do the following:

(1) Notify official personnel of the intent to fumigate infested grain/rice.

(2) Arrange for a certified applicator to fumigate the infested grain/rice.

(3) After completion of the acceptable retention period (see Chapter 4, section 2(d)), arrange for a person trained in the properties of fumigants to remove the placards prior to re-sampling. This trained person must know and understand fumigants, aeration, disposal of spent fumigants, use of respiratory protection equipment, and removal of placards.

(4) Notify official personnel when the barge will be ready for re-sampling, and what kind of fumigant was used.

(5) Arrange for a marine chemist or certified fumigator to issue a gas-free certificate of the cargo compartment within two hours prior to the re-sampling of the barge.

b. Certified Applicator's Responsibilities.

A certified applicator must do the following:

(1) Inspect the carrier and apply the fumigant in accordance with the EPA label or labeling requirements, DOT, and State regulations.

(2) Install warning placards in accordance with EPA, DOT, and State regulations.

(3) Arrange, in conjunction with the applicant, for a trained person to aerate the barge to a permissible exposure limit as specified by EPA before removing the placards.

Exposure Limits

Chemical	Safe Level
Metal Phosphide	0.3 ppm
Methyl Bromide	5.0 ppm
Carbon Dioxide	10,000 ppm

c. Official Personnel Responsibilities.

Official personnel must do the following:

(1) Withhold certification pending subsequent fumigation and verification sampling if the applicant requests fumigation.

(2) Receive a gas-free certificate from a marine chemist or certified fumigator prior to re-sampling the barge. Gas-free certificates are valid for only two hours from the time of issuance. Delegated/designated agencies may select and use alternative measures to assure safe entry into the barge.

(3) Check the fumigated barge for the presence of live insects only using the official barge probe sampling pattern.

Note: For barges, fumigation alone will not remove infested or U.S. Sample Grade.

While sampling, also check for visible insects on the surface of the grain/rice or on the interior bulkheads. FGIS personnel must not enter the barge unless an observer, who can get assistance from trained rescuers capable of rendering any needed assistance, is stationed outside of the stowage space.

(4) Record the number of live insects injurious to grain (live weevils/other live insects) found in the barge. This count includes those insects found in the probe samples or in, on, or about the lot.

(5) Issue the inspection certificate after fumigation.

4.4 CERTIFICATION

a. Certificate Date.

The certificate date is the date the barge is re-sampled to verify fumigation effectiveness.

b. Sampling Date.

The date sampled is the date the original sample was obtained for grading purposes. This does not include the date the barge is re-sampled.

c. Sampling Method.

Indicate the sampling method used to obtain the original sample for grading purposes.

d. Quality Results.

Certificate the grade factors (test weight, moisture, etc.) based on the original sampling service. Certificate the “infested” designation based on the results of the re-sampling activity used to verify fumigation effectiveness.

e. Certificate Statement.

In addition to the normal certification statements used on the certificate, place the following statement in the remarks section of the certificate if the procedures outlined in this handbook were followed:

“This grain/commodity was fumigated according to official procedures.”

CHAPTER 5
AGRICULTURAL MARKETING SERVICE, INTERNATIONAL COMMODITY PROCUREMENT FUMIGATION PROTOCOL

CONTENTS

5.1 GENERAL INFORMATION

This chapter provides the procedure for monitoring aluminum phosphide gas fumigation of bagged wheat flour for compliance with USDA Agricultural Marketing Service (AMS) contract requirements. This procedure is referred to as the “Commodity Procurement Fumigation Protocol” (CPFP), which subjects each lot of bagged wheat flour to a minimum of one phosphine gas fumigation between the time the lot is bagged to the time the lot is delivered to the foreign receiver.

An attempt will be made to have a least one complete CPFP fumigation per contract line item. However, due to expensive time constraints for carriers, AMS may waive all or any part of a CPFP to meet the logistical needs of a particular carrier.

5.2 FUMIGATION STANDARD

a. Verification.

FGIS is required to verify the licensed or certified applicator's (fumigator) readings for temperature, exposure hours, and concentration level of the phosphine gas to ensure the fumigation meets the minimum time and concentration exposure standard.

b. Temperature Limitations.

When inland temperatures are below 40° F, inland fumigators must not fumigate carriers at the time of loading. The AMS International Procurement Division currently holds a 'Notice to the Trade,' EOD-83, which states that Phosphine fumigations below 40° F are not legal under current EPA labeling. The fumigator must fumigate the carrier after arrival at the export port location, provided that the ambient air temperature is above 40° F. If it is not, then the fumigator must perform the fumigation aboard ship.

c. Exposure Time.

The minimum time parameters refer to total hours of product exposure at the recommended concentration level and begin when the concentration is documented to have reached the minimum level (300 parts per million (PPM)) level within 24 hours of application. Table 5.1 – CPFP Minimum Fumigation Standard, below, illustrates the CPFP minimum fumigation standard:

TABLE 5.1 – CPFP MINIMUM FUMIGATION STANDARD

Temperature	Parts Per Million (ppm)	Minimum Exposure Time
Less than 61°F	>300	*See note below
61°F to 68°F	300	144 Hours
More than 68°F	300	96 Hours

Note: Fumigation of bagged wheat flour under storage temperatures between 40° F and 60° F with phosphine gas is less effective than at higher temperatures; therefore, gas concentrations above 300 ppm should be maintained as long as possible past the minimum of 144 hours.

5.3 RESPONSIBILITIES

a. General Responsibility.

(1) Fumigator.

(a) Perform the fumigation, take all ambient temperature and concentration readings, verify the results with official personnel, issue appropriate documentation of the results, and provide timely, legible copies to all interested parties.

(b) Provide official personnel with the training necessary to understand the placement, operation, and result interpretation of any monitoring equipment used by the fumigator.

(c) Coordinate with official personnel the time and place to make the first test, and all subsequent tests until the standards are met: approximately 24 hours after the initial treatment, and every 24 hours for 96–144 hours.

(d) Provide official personnel with sufficient notice to arrange for an inspector to perform verification of fumigator's readings for temperature, exposure hours, and concentration level of the phosphine.

(e) Install sufficient and appropriate monitoring lines or other needed equipment.

(f) Measure the air around the flour bags, *not* the temperature of the flour inside the bags. The temperature at the time of the initial 24-hour monitoring will govern the duration time of the protocol. Do not adjust the total hours if the temperature drops below (or rises above) the threshold temperature.

(g) Determine why the fumigant failed to meet or maintain the minimum 300-ppm concentration and take the necessary corrective action (i.e., adding more fumigant, resealing, or other accepted measures).

(h) Do not count the number of hours elapsed since the last 300-ppm reading toward the total time needed to meet the standard. For example, if the concentration at the 72-hour reading is only 126 ppm, then the lot does not meet the standard's minimum concentration for the last 24 hours. Only 48 hours, when the concentration was known to be at least 300-ppm count toward the total standard time.

(2) Official Personnel.

(a) Verify the fumigator's readings for temperature, exposure hours, and concentration level of the phosphine to ensure the fumigation meets the minimum time and concentration exposure standard. Official personnel will perform these verifications at a reasonable time.

Note: It is not mandatory that official personnel witness the initial treatment.

(b) Understand the placement, operation, and result interpretation of any monitoring equipment used by the fumigator.

(c) Coordinate with the fumigator the time and place to make the first test, and all subsequent tests until the standards are met approximately 24 hours after the initial treatment, and every 24 hours for 96–144 hours.

(d) Coordinate verification times when more than one fumigation company has lots to read at the same, or different, location(s) on the same day.

(e) Verify with the fumigator the results of all ambient temperature and concentration readings.

(f) Ensure that the fumigator is measuring the air around the flour bags, *not* the temperature of the flour inside the bags. The temperature at the time of the initial 24-hour monitoring will govern the duration time of the protocol. Do not adjust the total hours if the temperature drops below (or rises above) the threshold temperature.

(g) Do not count the number of hours elapsed since the last 300-ppm reading toward the total time needed to meet the standard. For example, if the fumigator monitors the concentration at the 72-hour reading and finds the concentration is only 126 ppm, then the lot does not meet the standard's minimum concentration for the last 24 hours. Only 48 hours, when the concentration was known to be at least 300-ppm count toward the total standard time.

b. Container Responsibilities.

(1) Fumigator.

(a) Determine the suitability of containers for fumigation. Carriers must present fumigation-quality containers for loading as defined in the applicable freight tender terms and conditions.

(b) Fumigate the cargo (as elected by the carrier) under tarp prior to loading the container, at a container-stuffing facility or at a container yard prior to loading aboard the mother vessel.

(c) Re-fumigate when vessel loading takes place more than 20 days after the initial fumigation, using the CPFP at every 20-day interval until loaded. The 20-day cycle will begin with the date the last fumigation reached its minimum standard.

(2) Official Personnel.

(a) Do not determine the suitability of containers for fumigation. This is the responsibility of the carrier or fumigator.

(b) Witness and document temperature, concentration level and exposure time, by container.

c. Break-Bulk Vessel Responsibilities. (See Notice to the Trade, EOD-83, for more information on Break-Bulk Vessels as referenced below.)

(1) Fumigator.

(a) Use aluminum phosphide, in dust retention containers, at the rate of 33g/1000 ft³ of hold space and the hatches sealed once fumigation is completed.

(b) Use the same "in-transit" procedures detailed for bulk grain in the FGIS Fumigation Handbook. However, FGIS will *not* guarantee the efficacy of this "in-transit" treatment since the cargo, bagged flour, and probably the vessel, a "tween decker," will not meet the requirements for this procedure.

The vessel will then sail without further monitoring. The assumption is that the cargo will reach the minimum concentration level during the voyage.

(2) Official Personnel.

(a) Monitor the fumigation. The fumigator will use the same "in-transit" procedures detailed for bulk grain in the FGIS Fumigation Handbook. However, FGIS will *not* guarantee the efficacy of this "in-transit" treatment since the cargo, bagged flour, and probably the vessel, a "tween decker," will not meet the requirements for this procedure.

No further monitoring is required because the assumption is made that the cargo will reach the minimum concentration level during the voyage.

5.4 SAFETY

a. Official personnel must follow all applicable FGIS safety guidelines, the safety guidelines shown on the fumigant containers/canisters, and all local warehouse, port, and/or FGIS field office safety guidelines when working near fumigated warehouse stacks, containers, or ships.

b. When monitoring/verifying fumigation, official personnel must accompany the fumigator, and either the official personnel or the fumigator must be equipped with a fully-operational phosphine gas sensor that is able to continuously measure the presence and amount of phosphine gas outside the tarped bags or closed containers.

c. Official personnel must follow the safety guidelines established by *FGIS Directive 9180.48*, "Stowage Examination Services" when boarding or disembarking from barges.

d. Prior to starting the verification process, official personnel must resolve any outstanding safety problems or concerns.

5.5 DOCUMENTATION

a. Services Performed Report, FGIS-992.

(1) After each temperature and concentration reading, official personnel must record the fumigator's findings in the "Comments" section of an FGIS-992 as indicated below.

"On [date and time] official personnel have verified the temperature to be _____° F, phosphine gas concentration to be _____ppm, and the fumigant exposure time to be _____ hours for [contract line item number(s)] representing _____bags of flour (vendor's count)."

(2) Show the above statement regardless of a result(s) that may or may not meet the minimum standard.

(3) Complete one FGIS-992 for each verification service. Maintain the completed FGIS-992 in a file folder for each individual contract line item number. However, in an effort to reduce paperwork, and at the field office's discretion, all readings for each line item number may be shown on a single worksheet.

(4) Each tarp must have a minimum of four FGIS-992 forms (one for each day, assuming no daily reading failed). A master FGIS-992 with the above statement may be completed and then photocopied to eliminate the need for a large quantity of originals.

(5) The fumigator is not required to furnish official personnel with a copy of any documents generated. However, official personnel may request a copy of the fumigation company's tarp/carrier listing (or log) referencing line item numbers. Official personnel may also generate their own master reference list.

b. Official Personnel Generated Worksheet.

For efficiency, practicality, and to limit the amount of paperwork involved in some instances of verification (i.e., 25 containers), official personnel may generate their own worksheet for use in conjunction with FGIS-992. The worksheet must contain all required information.

5.6 CERTIFICATION

When all the tarps under their applicable line item number have met the minimum concentration and time standards, issue to the applicant for verification, an original Commodity Inspection Certificate (FGIS-993).

> "FGIS official personnel monitored the fumigator's readings and verified the temperature and phosphine gas concentration for a period of [96 or 144)] hours for line item No. _____, representing _____bags of flour (vendor's count). The phosphine gas concentration level exceeded the required 300-ppm minimum and the ambient temperature was above _____degrees Fahrenheit."

The above statement provides verification of compliance with the fumigation standards and eliminates the need to show a range or average of all readings for the line item number. The FGIS-992 on file will provide specific daily readings should a question arise.

CHAPTER 6
REVISION HISTORY

CONTENTS

Change No. 8: **October 1, 2023**

FGIS has revised the Fumigation Handbook, making changes to Table 3 on page 2-28. The changes allow for surface or subsurface fumigation of cargo holds with a depth of up to 20 meters. Additionally, the changes make necessary technical corrections pertaining to the nature of the fumigant. Specifically, FGIS is:

- replacing the words “metal phosphide” with the word “phosphine” in the title of the attachment, the title of the table, and the wording in the left-most column of the table
- adding a second footnote denoted by a double asterisk in the left-most block of the second pink row and at the bottom of the table revising the third pink row of the table to read: MINIMUM EXPOSURE TIME IN DAYS”
- revising the left-most block of the first row under the heading MINIMUM EXPOSURE TIME IN DAYS to read “surface or subsurface application” and replacing the words “Not Acceptable” with the number “18” in the block under >12-20
- removing the second row of the table beginning with “Subsurface/Trench-in Application
- add a new second row beginning with “Surface or Subsurface Application and the values of 4, 7, 9, 9 in the boxes to the right
- the 4th row original of the table becomes the third row of the revised table
- adding a second NOTE pertaining to recirculation methods
- adding a sentence at the beginning of the heading Fumigating Slack Holds and Slack Tanks of Vessels

Change No. 7: **July 10, 2020**

The Fumigation Handbook was revised to incorporate policy and procedural changes throughout the entire handbook, since its previous date of revision listed below. Editorial revisions were conducted in compliance with *FGIS Administrative Directive 3010.2*, “Policies, Procedures, and Guidance Issuance.”

For all substantive revisions, updated hyperlinks were embedded within the text to link directly to both external and internal content wherever possible, and explicit reference was made to the following FGIS Directives:

- *FGIS Directive 9180.35*, “Phytosanitary Inspection”

- *FGIS Directive 9180.48*, “Stowage Examination Services”

Additionally, acronyms and organizational details were updated to reflect accurate administrative structure and associated program information (e.g., reference to the USDA Farm Service Agency (FSA) was replaced by the USDA Agricultural Marketing Service (AMS)).

Change No. 6: **June 16, 2014**

Chapter 2, In-Transit Fumigation - Vessels, was revised to the following:

1. Add Policy Bulletin Board #226, Fumigating Slack Holds and Slack Tanks of Vessels.

2. Insert Question #10 in the Q&A section.

3. Update hyperlink to the listing of tween deckers currently approved by FGIS.

Chapter 3, Land Carrier Fumigation, was revised to the following:

1. Require the EPA label to be followed for temperature requirements.

2. Add Sulfuryl Fluoride and Phosphine & Carbon Dioxide to the acceptable fumigant list.

3. Add self-adhering plastic as an acceptable option for placing on trough-type hopper cars when fumigating in transit.

4. Include “remarks” section and letterhead statements.

Change No. 5: **August 12, 2009**

Chapter 1, General Information, was revised to the following:

Clarify the definition of “recirculation” and include a definition for “tubing,” as it is used for fumigation in the recirculation method of fumigant application. Also include minor editorial and format changes.

Chapter 2, In-Transit Fumigation - Vessels, was revised to the following:

1. Require attaching recirculation tubing to the blower fan housing using a semi-permanent method (e.g., bolt, screw, clamp, etc.).

2. Eliminate short probe, long/short probe, long probe, and tubing as fumigant application methods but retain surface, subsurface, and recirculation as the only application methods.

3. Establish minimum fumigant dosage rate (per 1,000 cubic feet of storage space) for the surface, subsurface (trench-in), and the recirculation application method-based cargo hold depth and fumigant exposure time.

4. Establish minimum fumigant exposure time (in days) based on cargo hold depth and fumigant application method.

5. Revise the table for application method, dosage rate, and exposure time to reflect changes.

6. Provide an additional letterhead statement for witnessing fumigation and allow official personnel to modify approved letterhead statements to meet the needs of the applicant.

7. Remove short voyage fumigation and made minor editorial and format changes.