

THE FEDERAL GRAIN INSPECTION SERVICE FUMIGATION POLICY AND PROCEDURES

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ABSTRACT

The Federal Grain Inspection Service (FGIS) implemented an in-transit fumigation program to facilitate the marketing of U.S. grain exports in 1976. FGIS has refined vessel fumigation procedures based on additional in-transit fumigation research information. The presentation reviews the general history of in-transit fumigation, current FGIS policy and procedures regarding fumigation, and responsibilities of those directly involved in the fumigation process.

THE FEDERAL GRAIN INSPECTION SERVICE

The Federal Grain Inspection Service (FGIS), an agency within the United States Department of Agriculture (USDA), is responsible for administering a national inspection and weighing program for grain, oilseeds, pulses, rice, and related commodities. The FGIS facilitates the marketing of these products by establishing grading standards and developing inspection policies and procedures.

Official grain inspection services, for the most part, are permissive in nature. That is, they are provided only upon request. The United States Grain Standards Act, however, requires the inspection and weighing of all export grain. The United States generally exports over 100 million metric tons per year via vessel or ocean barge. Since initiating its in-transit fumigation procedure for ships, the FGIS has observed the fumigation of as many as 1,123 ships within a single year for the control of grain pests during shipment.

IN-TRANSIT FUMIGATION PROCEDURE FOR SHIPS

The FGIS in-transit fumigation procedure evolved due to economics. Exporters requested the FGIS to evaluate the merits of in-transit fumigation to expedite the loading process when insects were detected. At the time of this request, the FGIS required exporters to either discharge infested grain from the carrier or discontinue loading until 12 hours of fumigation had elapsed. If neither option was selected, a certificate was issued identifying the grain as

"infested." Since an "infested" certificate was undesirable, exporters usually discharged or fumigated the cargo. Either option presented considerable delays in loading that translated into additional loading costs for the exporter.

The USDA Agricultural Research Service (ARS), with the assistance of many collaborators, initiated in-transit fumigation research in 1975 to address the exporters' concerns. After several test vessels demonstrated the effectiveness of in-transit fumigation, the FGIS adopted an in-transit fumigation procedure for bulk carriers in 1976. After several more years of ARS research activity, the FGIS amended its procedures to include tanker fumigation in 1982. The ARS, FGIS, and industry continued in-transit fumigation research to refine and improve the procedures. Finally, in 1987, the FGIS republished the fumigation guidelines through the FGIS Fumigation Handbook.

The FGIS Fumigation Handbook (USDA, 1990) provides official inspection personnel with basic information regarding fumigants and fumigation. The handbook describes acceptable conditions for fumigation, explains various fumigant application methods, and assigns specific responsibilities for conducting safe and effective in-transit fumigation aboard ships.

Export grain shipments from the United States are fumigated in transit for several reasons. Some export sales contracts require in-transit fumigation for insect control during the voyage. Phytosanitary inspection requirements also require fumigation prior to certification. In-transit fumigation is also used when insects are detected in sufficient quantities to cause "infested" certification by the FGIS.

When contracts require fumigation, fumigators follow the application procedures listed in the FGIS Fumigation Handbook in accordance with contract requirements. Although the FGIS is not involved directly in this fumigation, inspectors are often asked to observe the fumigation in order to verify treatment.

In some cases, the USDA Animal and Plant Health Inspection Service (APHIS) relies on in-transit fumigation to satisfy phytosanitary inspection requirements when quarantine pests are present. FGIS inspectors observe fumigation at the loading port and relay this information to APHIS personnel in order to complete the phytosanitary inspection certification.

When FGIS determines that a cargo is "infested," exporters have several options for action. They may continue loading and receive an "infested certificate" without any treatment, discharge the infested grain from the vessel, or continue loading and fumigate in-transit. Exporters usually select the in-transit fumigation option because fumigation is less expensive than a discharge operation.

Certain conditions must prevail in order for the exporter to use in-transit fumigation. These conditions involve the type of carrier in which the grain is

loaded, the kind of commodity loaded, the kind of fumigant used, the application method, and the completion of assigned responsibilities.

Ship fumigation research has concluded that certain types of vessels are better suited for in-transit fumigation than others. Acceptable vessels must not contain interior bulkheads, structures, or decks within the stowage area which could impede the penetration of the fumigant (phosphine gas) throughout the grain mass. Based on these findings, the FGIS categorized acceptable vessels for in-transit fumigation. These vessels include bulk dry-cargo vessels and ocean barges, tanker type vessels, converted liquefied natural gas (LNG) vessels, and modified lakers and tween deck vessels.

At times, separation materials are used between different lots of grain within a common stowage area. This loading practice also affects the penetration of fumigants in ships. Therefore, the FGIS has identified acceptable separation materials for fumigation purposes. Bulk grain above or below a permeable separation material, such as burlap or woven polypropylene, is acceptable for fumigation. Bulk grain below an impermeable separation material, such as wood, plastic, or cardboard, is not acceptable for fumigation.

In-transit fumigation research has been limited to the use of aluminum phosphide. Consequently, only aluminum phosphide is recognized and approved by the FGIS for in-transit fumigation.

FUMIGANT APPLICATION METHODS

One of the most important features of the FGIS Fumigation Handbook is the description of different application methods. The application methods are separated into two categories: (1) surface treatments and (2) subsurface treatments.

Surface treatments

Surface treatments require that fumigant formulations be positioned uniformly on the exposed grain surface or stepped into the grain mass. The procedures also recommend anchoring prepackaged formulations to prevent shifting during transit when a surface treatment is used.

Subsurface treatments

Subsurface treatments are subdivided into six different methods. These methods include trenching, short probe, long probe, long probe/short probe combination, tubing, and recirculation.

Trenching

Trenching involves placing prepackaged fumigants in a shallow trench approximately 0.3 m deep and covering it with grain such that only the two ends of the package remain visible above the grain surface.

Probe treatments

Probe treatments provide a means of inserting the fumigant into the grain mass. Short probe treatments place fumigants at a depth of approximately 1.5 m in the grain. Long probe treatments place fumigants at a depth of approximately 4 m in the grain. When probing methods are used, fumigants are placed uniformly across the exposed surface of the grain mass. The long probe/short probe combination method uses at least one long probe in the four corners of the hold, with the remaining dosage applied uniformly across the hold using the short probe method.

Tubing system

The tubing system and recirculation system facilitate the movement of gas to the bottom of the ship hold. The tubing system uses corrugated slotted tubing constructed of polyethylene or similar material having a minimum diameter of 7.6 cm. At least two 76-m lengths of tubing are installed prior to loading to facilitate the distribution of fumigant within the hold. Approximately one-fifth to one-third of the total dosage is mixed with grain and poured into the slotted tube from the top. After filling the tube to two-thirds of the vertical portion, approximately 25 kg of grain without any fumigant is poured into the tube forming a top plug within the tube. The remaining dosage is applied to the grain using either a surface or subsurface treatment. The gas is then distributed passively through the grain mass from the tubing and surface area.

Recirculation system

The recirculation system is similar to the tubing system; however, a low velocity fan is attached to the top end of the tubing. Unlike the tubing system, the fumigant is not placed in the tubing but is applied to the grain surface using either a surface or subsurface method. The fan forces the high gas concentration from the head space to the lower portions of the hold during transit.

Another important aspect of the handbook is the inclusion of the application method/commodity depth/exposure time decision table. This table provides recommended guidelines for utilizing specific application methods based on commodity depth and anticipated voyage or sailing duration. The recommended guidelines contained in the table are based on research information collected from numerous test vessels. The following table details the information contained in the Fumigation Handbook.

PARTIES INVOLVED IN THE FUMIGATION PROCESS

When ships are fumigated in-transit for insect control, three participants are directly involved in the process. These are the exporter, the fumigator, and the FGIS inspector. Each participant has assigned responsibilities to achieve a successful fumigation.

Table 1: Recommended application methods for in-transit fumigation of ship holds using phosphine.

APPLICATION METHOD	EXPOSURE TIME (days)			
	COMMODITY DEPTH (m)			
	< 6	6-12	12-20	> 20
Surface	9	15	*	*
Trench	8	15	18	*
Short Probe	8	15	18	*
Long/Short Probe	4	12	18	*
Long Probe	4	10	18	*
Tubing/Recirculation	4	7	9	9

* Indicates application method not recommended

The exporter

The exporter initiates action to have the vessel fumigated. The exporter is responsible for making the necessary arrangements to secure the services of a fumigation company and complying with government regulations.

The fumigator

The fumigator is responsible mainly for the effectiveness of fumigation. The fumigator must check physically the structural integrity of the stowage area to determine if it is suitable for fumigation. After evaluating the structure, the fumigator identifies which holds are not suitable for fumigation and provides a written statement to inspection personnel indicating vessel suitability.

The fumigator is also responsible for determining the application method and fumigant dosage. The fumigant dosage is based on the cubic capacity of the hold and not the amount of grain present in the stowage space. Fumigators generally apply the fumigant at approximately 1.6 g/m³. The recommended application method table provides the information needed to select the appropriate method.

An important element for successful fumigation is safety. Safety during application, as well as during the voyage, is a major concern of the FGIS program. For this reason, FGIS requires that the fumigator conduct a

prefumigation conference with the officer in charge of the vessel in the presence of the inspector. During the conference, the fumigator discusses and reviews the fumigation procedure, safety precautions to be adhered to during the voyage, exposure symptoms, and first aid in case of accidental exposure. Instructions for proper aeration and fumigant disposal are also discussed. In addition to the conference activity, the fumigator provides the ship with fumigant labels and a written statement conveying the information discussed during the prefumigation conference. After the prefumigation conference, the fumigator applies the fumigant in accordance with government regulations, seals the holds, and applies warning placards. The fumigator also checks for gas leaks after fumigation. Before leaving the vessel, the fumigator provides a written statement to the ship documenting the fumigation activity.

FGIS inspectors

FGIS inspectors are responsible for attending the prefumigation conference and witnessing the actual fumigation. Inspection personnel verify that safety procedures are discussed and reviewed at the prefumigation conference and determine if the dosage and application method comply with the fumigator's statement. FGIS inspectors receive, review, and maintain on file all pertinent fumigation documentation which is included in the official ship file. Upon completion of fumigation and receipt of all fumigation documents, a quality inspection certificate is issued without the "infested" designation.

Although the FGIS fumigation procedures have been proven safe and effective, the FGIS continues its efforts to enhance ship fumigation procedures. The FGIS realizes that additional fumigation research is needed to explore alternative fumigation methods. These new methods, however, must continue to offer industry an economic and practical approach to fumigation. Projects under consideration include possible supplements or substitutes for aluminum phosphide.

REFERENCE

USDA (1990) Fumigation Handbook, Federal Grain Inspection Service, Washington, D.C. 27 pp.