

## ANNEX A-10

### TEMPLATE: FUMIGATION MANAGEMENT PLAN (FMP) FOR PHOSPHINE FUMIGATION OF FOOD COMMODITIES IN SHEETED STACKS

**About FMPs:** Fumigation Management Plans (FMPs) are widely recognized fumigation good practice, and are mandatory in the US. They are written documents that provide specific logistical, performance and contact information to better assure that fumigation follows systemic planning and execution for efficacy and safety.

**FMP Requirements for USAID Partners:** As described in the Overview, fumigation compliance requires USAID partners to complete a Fumigation Management Plan (FMP) for EACH fumigation event, and to keep these FMPs on file for 2 years. Compliance further requires that the plan and the fumigation event itself substantively confirm with the FMP template that follows. **In areas where Partners make substantial changes to the FMP template provided herein, they must submit the proposed changes to USAID for approval.**

**Modifying this template:** USAID partners must review this FMP template for compliance with local requirements and adjust accordingly. Other adjustments to local circumstances and capabilities are possible. *However*, any substantive changes must be requested in the USAID Program's PERSUAP (the template for which is provided as Annex A-9 to this PEA) or subsequently in writing to the Program's AOR, who will forward for clearance to the relevant Bureau Environmental Officer.

**Purposes of this FMP template.** This FMP template is NOT:

- A substitute for training in phosphine fumigation.
- A how-to manual for phosphine fumigation.
- Applicable without significant modifications to the fumigation of whole structures, containers, or vehicles.

This FMP template IS intended to very substantially reduce the effort required by USAID partners to develop a compliant FMP, and to conduct compliant (and therefore safer and more effective) fumigation of food commodities in sheeted stacks.

More specifically, this FMP template is a succinct summary of acceptable technical practice for phosphine fumigation of USAID-funded Food Commodities in sheeted stacks in a form that: (1) guides a trained fumigator to produce safe and efficacious results, (2) allows a USAID partner to better oversee their fumigation services provider; and (3) supports fumigation compliance reporting required by USAID Program PERSUAPs.

This template FMP embodies the acceptable technical practices for fumigation set out in Annexes A-7 and A-11.

#### **Key sources:**

van Someran Graver, J. E. 2004. *Guide to Fumigation Under Gas-Proof Sheets*. Food and Agriculture Organization of the United Nations. Produced by the Australian Centre for International Agricultural Research, Canberra, Australia. Available at [http://www.fao.org/inpho\\_archive/content/documents/vlibrary/ad416e/FAOHomeIndex.htm](http://www.fao.org/inpho_archive/content/documents/vlibrary/ad416e/FAOHomeIndex.htm) (on-line e-book; includes accompanying videos) and <http://http://aci-ar.gov.au/files/node/543/FAO%20full%20text.pdf> (print-ready PDF).

“Standard Operating Procedure for Contractors Undertaking Phosphine Fumigation and Insecticide Spraying in WFP Stores” (Nov 2003 revision). World Food Program. Available at:  
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“North Dakota Fumigation Management Plan Intermediate to Large Operations” North Dakota State University Department of Agriculture. Available at  
<http://www.ag.ndsu.nodak.edu/aginfo/pesticid/pdf/fum/FMP%20int-lg.pdf>

Proper Disposal of Animal Carcasses in Michigan: An Industry Guide to the Bodies of Dead Animals Act. Michigan Department of Agriculture, Lansing, Michigan. Available at  
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USAID Food Assistance Program Name:

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**PHOSPHINE FUMIGATION MANAGEMENT PLAN (FMP) (sheeted stacks only)**

This FMP template provides a step-by-step process to ensure safe and effective fumigation and train fumigation personnel

**Commodity and Ownership**

<b>Planned Fumigation Dates:</b>	
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A. OVERALL PROGRAM & CONTACT INFORMATION	
Lead Awardee	
Program Name	
Fumigation Compliance Lead	
Information	

**ATTENTION:**  
To ensure full safety and efficacy, completion of this FMP is mandatory for each fumigation event.\*

\*Some information may remain the same across fumigation events.

B. FACILITY INFORMATION	
Name of Facility	
Location	
Responsible Manager (Name, Organization & Title )	
Information	

C. FUMIGATOR INFORMATION	
Lead Fumigator	
Organization	
Contact Information	
Expiration Date (if any)	

D. COMMODITY TO BE FUMIGATED	
Commodity(ies) & Amount in tons (est) (e.g. maize 200mt)	
Owner of Commodity	
How Commodity is Packaged	
# of Stacks & Size (e.g., 4 stacks 3m X 2m X 2m)	
Last Fumigation	<i>Enter date if known. Otherwise, enter "unknown"</i>
Condition	<i>Moldy? Visibly infested?</i>
Moisture %	
Purpose of Fumigation	

E. FUMIGANT PRODUCT INFO & DOSAGE	
E1. Fumigant product name/description)	
E2. Ambient Temp (expected indoor temp range)	
E3. Quantity Required	
E4. Required Time @ Concentration* (e.g. 7 days @ 200ppm)	
E5. Planned Downtime*(days + hours, includes aeration.)	

**\*REQUIRED:**  
Document calculations E3, E4 & E5 in Annex #A. note that effective phosphine fumigation typically requires 7-10 days.

## Emergency Planning and Safety

<b>G1. ADVANCE NOTIFICATION PLAN FOR ABUTTERS</b> Specify the procedures for notifying those living and working within 100m of the facility. The fumigation team needs to alert relevant entities, particularly households, about fumigation activities.		
<b>G2. ADVANCE NOTIFICATION PLAN FOR LOCAL AUTHORITIES</b> Specify the procedure for notifying local authorities, as required or agreed with these authorities.		
<b>H. EMERGENCY RESPONSE PLAN</b> Describe the procedure to be followed if phosphine concentrations exceed (1) 0.3ppm (or local TLV, if more stringent), or (2) 1 ppm (or local STEL, if more stringent) (TLV= threshold limit value; STEL = short term exposure limit. See PEA Annex A-3.		

I. FUMIGATION PLAN & EXCLUSION ZONE			
REQUIRED ACTION:	Y	N	Confirming Initials
I1. Obtain plot or make scale sketch <b>map</b> of facility and surroundings. (note grid paper is provided as final page of this template)			
I2. Mark <b>locations of stacks</b> to be fumigated.			
I3. On plot, mark <b>exclusion zone</b> that maintains at least a 6M perimeter from stacks to be fumigated, and which INCLUDES buildings or rooms with walls common to the room in which the stack is being fumigated. An exception must be requested if the exclusion zone cannot be maintained.			
I4. Determine if a <b>watchman</b> or watchmen will be required to maintain the exclusion zone. If yes, inform the facility manager immediately.			
I5. On plot, mark <b>shut-off points</b> for electricity, water, gas, if any.			
I6. On plot mark doors/gates to be secured to enforce exclusion zone and locations of <b>warning signs</b> to be posted.			
I7. On plot, mark locations of <b>hazard monitoring</b> (at least 3 locations just outside exclusion zone, where gas is mostly likely to accumulate).			
I8. On plot, mark locations of <b>phosphine trays</b> and monitoring lines.			
I9. Attach plot to this Fumigation Management Plan as Annex #F			

J. COMMUNICATION AND TRAINING			
REQUIRED ACTIONS	Y	N	Confirming Initials
J1. Fumigation team reviews <b>product label</b> , MSDS, and applicator/product manual. Lead applicator provides detailed verbal briefing if required.			
J2. Lead applicator briefs the team regarding the symptoms of <b>phosphine poisoning</b> and first aid. (See Fumigation PEA Annex A-8)			
J3. Lead applicator briefs the team regarding the planned <b>fumigation process</b> with reference to the site plot (I10) WITH FACILITY MANAGER PRESENT			
J4. Lead applicator briefs the team & facility manager on EMERGENCY RESPONSE PLAN (H1) & roles and responsibilities for implementing the plan are agreed.			
J5. All employees engaged in fumigation instructed on the use, impact, and mitigation measures of phosphine fumigation.			

## Equipment and Supplies

K. NUMBER OF SHEETS, SAND SNAKES AND TRAYS REQUIRED	
REQUIRED ACTION:	Quantity Required
K1. Determine <b>number of fumigation sheets</b> required (note that joining sheets requires a <u>1(one) meter</u> overlap, tightly rolled & then clipped or weighted. If clips are used, they must be applied every 20cm.) <i>(Indicate number &amp; size of sheets, standard 18meterX12meter sheets preferred)</i>	
K2. Determine <b>length of sand snakes</b> required (double rows must be used) <i>(in meters)</i>	
K3. Determine number of <b>phosphine tablet trays</b> required	

L. CONDITION, QUANTITY & ADEQUACY OF EQUIPMENT & SUPPLIES			
FUMIGATION MAY NOT PROCEED UNLESS ALL ANSWERS ARE "YES"			
CONFIRM THAT:	Y	N	Confirming Initials
L1. Required quantity of sheets (K1) meeting specifications (M1) are available			
L2. Required length of sand snakes (K2) are available			
L3. Required number of tablet trays (K3) are available			
L4. <b>Respiratory equipment and protective gear</b> meeting specifications (M2) are available FOR THE FULL TEAM and all personnel can achieve a complete face seal. No one enters the fumigation area without protective gear.			
L5. (1) <u>Dry, clean cotton gloves</u> in good condition; (2) rubber boots; (3) liquid-tight coveralls are available FOR THE FULL TEAM			
L6. <b>Detection (monitoring) equipment</b> meeting specifications (M3) is available to monitor HAZARD			
L7. Detection (monitoring) equipment meeting specifications (M3) is available to monitor EFFICACY			
L8. <b>Warning signs</b> (placards) IN APPROPRIATE LANGUAGES and WITH APPROPRIATE PICTOGRAMS and compliant with host country regulations (if any) are available in quantity required by plot (I6)			
L9. Required quantity of fumigant (E3) is available			

<p>Properly maintained <b>canister-type full facemask respirator</b>. The canister must (1) be rated to protect against phosphine, (2) not expired, (3) not damaged, and (4) canisters previously used must not be opened more than 6 months ago &amp; not have exceeded their rated time-in-use.</p> <p>OR</p> <p>Properly maintained self-contained breathing apparatus.(SCBA)</p> <p>Other varieties of respiratory protection may be acceptable, see PEA Annex A-3. <u>NOTE. Canister/cartridge type respirators are NOT adequate to enter a fumigation enclosure (e.g. go into a sheeted container)</u></p>			
<p>All equipment must be properly <b>calibrated and maintained</b>. Detector tubes, if used, must NOT be expired. Efficacy monitoring equipment must be able to read in the 200-500ppm + range. Hazard monitoring equipment must be able to accurately read in over the 0.3-3ppm + range.</p> <p>See PEA Annex T-9 for more information</p>			
<b>N. RESPIRATORY AND DETECTION EQUIPMENT</b>			
Required Action: Complete log of all Respiratory and Detection Equipment.			
DESCRIPTION <i>e.g., Canister Respirator</i>	Manufacturer & Model #	Manufacture Date (If Known)	Serial Number

*\*Note: advance notice of 24 or more hours may be required by country laws or regulations.*



## Application and Monitoring

O. SUITABILITY OF FACILITY, STACKS AND TEAM FOR FUMIGATION			
By following these steps, mandatory fumigation will be safe and effective. <b>FUMIGATION MAY NOT PROCEED UNLESS ALL CRITERIA ARE MET.</b>			
MANDATORY STEPS. CONFIRM THAT:	Criterion Is...		Confirming Initials
	Met	Not Met	
O1. Commodities being fumigated are not required for use before the end of the <b>planned down time</b> (E5) + 1 day			
O2. Expected <b>temperature</b> during the fumigation period will be 15°C or above.			
O3. Stacks are NOT built around pillars or against walls, and that there is <b>sufficient clearance</b> (1m) around each stack to effectively sheet and seal.			
O4. <b>Surface issues:</b> EITHER (1) the floor under <u>and for 1 (one) meter around stack</u> is crack-free concrete OR (2) the stack is placed on top of intact fumigation tarps. (If multiple tarps are used, they must be joined by tightly rolling a 1m overlap & weighting or clipping the join).			
O5. The marked exclusion zone (see I3) can be maintained for the <b>duration of the fumigation</b> (7-10 days or more). (Exclusion = no people EXCEPT for fumigation personnel with proper breathing equipment in this zone.)			
O6. A <u>trained</u> 2-person (or larger) team is available for application of fumigant and aeration and the team holds any required country licenses.			
O7. If watchmen are required to maintain the exclusion zone, they will be available over the entirety of the fumigation period, including aeration time.			
O8. The warehouse contains only the commodity to be fumigated.			

P1. <u>Notify Abutters</u> per Notification Plan (G1). In particular, ensure that nearby residents have been informed of activity,			
P3. If applicable, execute Local Authorities Notification Plan (G2)*			
P5. Assure that doors are ready to be locked. (Locks and keys available)			

Q. PLACING SHEETING AND COVERING STACKS			
REQUIRED ACTIONS IN EXACTLY THIS ORDER	Y	N	Confirming Initials
Q1. <u>Position sheets</u> . Carry, do not drag the sheets into position			
Q2. <u>Cover stacks</u> . Unfold the sheets towards the stack. Place the sheet over the stack and position with 1 (one) meter of sheet lying on the ground. Unroll the sheet to cover the entire stack. If more than one sheet is used, join the sheets. Joins require a 1(one) m overlap, tightly rolled, and then clipped every 20cm or weighted.			
Q3. <u>Set sand snakes</u> . Smooth out any wrinkles and folds in sheets, and then place two rows of sand snakes on the sheets along the sides of the stack. Ensure that a good seal is achieved along the whole length and take special care at the corners.			
Q4. <u>Place monitoring lines</u> . Place two monitoring lines from the top and one from the bottom of each stack for efficacy monitoring. Cut small holes to insert tubes and seal holes in gas sheets with tape. Gas monitoring lines should extend outside of the exclusion area. Place duct tape over the free tube ends, except when measuring gas concentrations. Tubes MAY NOT be located near placement positions for phosphine tablets.			

R1. Watchmen go on duty (if required to maintain the exclusion zone) & remain OUTSIDE the zone until aeration is complete (W9)			
R3. Turn off electric lights & any sources of sparks			
R5. Lay out the trays for aluminum phosphide tablets/pellets around the stack. Remove the sand snakes that hold down the sheets next to the trays.			
R7. Position tablets/pellets in a single layer on each tray. To avoid fire risk, do not pile tablets or pellets. Slide trays under the sheets and replace the sand snakes. To minimize worker exposure to gas being released, placement of trays should be completed within 15 minutes. Work from the back of the stack towards the exit doors. Pellets may NOT touch bagged commodities.			
R9. Leave the warehouse and lock ALL doors			

S. MONITOR GAS CONCENTRATIONS FOR EFFICACY AND HAZARD & LOG RESULTS			
REQUIRED ACTIONS	Y	N	Confirming Initials
S1. <u>Hazard Monitoring</u> . 1 hour, 2 hours, 4 hours & 24 hours after applying fumigant, and every 24 hours thereafter, monitor for hazard at all points designated on the fumigation plot (I7). Record results on attached log (#D).			
S2. <u>Hazard Monitoring Response</u> . If concentrations exceed 0.3ppm (or the local TLV,* if more stringent), assure that individuals move through the area only in passing. If concentrations exceed 1.0ppm (or the local STEL, if more stringent) evacuate the area. NOTE ANY SUCH ACTIONS IN EXCEPTIONS LOG (#C).			

S3. <u>Efficacy Monitoring</u> : Monitor EACH monitoring line 24 hours after fumigation application; every 24 hours thereafter. Monitor within stacks to confirm it was an effective fumigation application. Record results in attached logsheet (#E). NOTE ANY EXCEPTIONS IN LOG.			

*\*threshold limit value. \*\*short-term exposure limit see PEA Annex T-9.*

T1. Efficacy monitoring results show that the required phosphine gas concentration was sustained over the required period in each stack		(Copy from E4)	
T2. Efficacy monitoring results show that the required concentration was NOT sustained over the required period in one or more stacks.			

U1. Fumigation team puts on respirators and other PPE per L4 and L5 before entering exclusion zone.			
U3. Remove sand snakes from the corners of up to 2 stacks so that sheet covering each can be lifted. (If the stacks are large relative to the size of the room, ONLY 1 stack can be opened at a time.)			
U5. Allow gas to leave stack and warehouse for a half-day to 1 day			
U7. Repeat U1. Then completely remove all sheets covering stacks.			
U9. ONLY AFTER CONCENTRATION IS LESS than 0.3 ppm (or local TLV value, if more stringent), lead fumigator informs facility manager that the area is safe to enter.			

## Disposal and Cleanup

V1. Personnel involved put on respirators and other PPE per L4 & L5.			
V3. Remove residue to a safe outdoor area			
V5. Standing upwind to avoid any evolved phosphine, mix residue slowly into soapy water, assuring the residue is fully reacted.			

W1. Crush empty phosphide tablet/pellets containers and dispose per host country requirements. If none, bury.			
W3. Collect all dead animals wearing disposable gloves (if available). If not available, pick up with shovel or inside-out plastic bag.			
W5. Wash hands thoroughly with soap.			

## Annexed Logs and Documentation

<b>#C. ISSUES, INCIDENTS AND EXCEPTIONS LOG</b>												
Log here any issues, incidents or exceptions that arise during the fumigation, including but not limited to phosphine concentrations > TLV outside the exclusion zone, violations of the exclusion zone, known or suspected problems with PPE discovered after the initial inspection, members of the fumigation team who become ill, addition of fumigant to reach or sustain required concentrations, etc.												
<b>#D. PHOSPHINE CONCENTRATION LOG: HAZARD MONITORING</b>												
Per S1, log phosphine gas concentrations taken at designated locations outside the exclusion area, in ppm.												
LOCATION*	MONITORING TIME (TIME 0 = APPLICATION OF FUMIGANT)											
	1 hr	2 hr	4 hr	24 hr	2 days	3 days	4 days	5 days	6 days	7 days	8 days	9 days
A												
B												
C												
D												

\*As designated on plot map, Annex #F. Add locations as needed.

#E. PHOSPHINE CONCENTRATION LOG: EFFICACY MONITORING										
Per S3, log phosphine gas concentrations taken from monitoring lines, in ppm.										
MONITORING LINE*	MONITORING TIME (TIME 0 = APPLICATION OF FUMIGANT)									
	24 hrs	2 days	3 days	4 days	5 days	6 days	7 days	8 days	9 days	10 days
1										
2										
3										
4										

\*As designated on plot map, Annex #F. Add lines as needed.

#### #F. SCALE MAP/PLOT OF FACILITY AND SURROUNDINGS, SHOWING EXCLUSION ZONE

(use this grid for a sketch map, if a more formal site map is not available. See section I for requirements)

