**

USAID Food Assistance Program Name:

# **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

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# COMMODITY AND OWNERSHIP

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| Planned fumigation dates:  |  |

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| **A. OVERALL PROGRAM & CONTACT 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.**  |  |
| Lead Awardee |  |  |  |
|  |  |  |  |
| Program Name |  |  |  |
| Fumigation Compliance Lead |  |  |  |
| Compliance Lead Contact Information |  |  |  |

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| **B. FACILITY INFORMATION** |  | **C. FUMIGATOR INFORMATION** |
| Name of Facility |  |  | Lead Fumigator |  |
| Location |  |  | Organization |  |
| Responsible Manager*(Name,Organization & Title* ) |  |  | Contact Information |  |
| Contact Information |  |  | Certification # & Expiry Date (if any) |  |

| **D. COMMODITY TO BE FUMIGATED**  |  | **E. FUMIGANT PRODUCT INFO & DOSAGE** |
| --- | --- | --- |
| Commodity(ies) &Amount in tons (est)*(e.g. maize 200mt)* |  |  | E1. Fumigant(product name/description) |  |
|  | E2. Ambient Temp*(Expected indoor temp range)* |  |
| Owner of commodity |  |  | E3. Quantity Req’d  |  |
| How commodity is packaged |  |  | E4. Required time @ concentration\* *(e.g. 7 days @ 200ppm)* |  |
| # of stacks & size*(e.g., 4 stacks 3m X 2m X 2m)* |  |  | E5. Planned downtime\**(Days + hours, includes aeration.)* |  |
| Last fumigation  | *Enter date if known. Otherwise, enter “unknown”* |  | \*REQUIRED: DOCUMENT CALCULATIONS E3, E4 & E5 IN ANNEX #A. NOTE THAT EFFECTIVE PHOSPHINE FUMIGATION TYPICALLY REQUIRES 7-10 DAYS. *.*  |
| Condition | *Moldy? Visibly infested?* |  |
| Moisture % |  |  |
| Purpose of Fumigation |  |  |

# EMERGENCY PLANNING AND SAFETY

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| **F. CONTACT INFORMATION: MEDICAL FACILITY, EMERGENCY RESPONSE AUTHORITIES**  |
|  | Location | Telephone |
| Police  |  |  |
| Fire Service  |  |  |
| Clinic/Hospital |  |  |
| Other Local Authority (specify Port Authority, District Council, Chieftaincy, etc.) |  |  |
| Pesticide Regulatory Authority |  |  |
| Chief of Party (or commodity point of contact) |  |  |

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| **G1. ADVANCE NOTIFICATION PLAN FOR ABUTTERS**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. |
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| **G2. ADVANCE NOTIFICATION PLAN FOR LOCAL AUTHORITIES**Specify the procedure for notifying local authorities, as required or agreed with these authorities. |
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| **H. EMERGENCY RESPONSE PLAN** 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 T-9). |
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| **I. FUMIGATION PLAN & EXCLUSION ZONE** |
| Required Action: | Y | N | Confirming initials |
| I1. Obtain plot or make scale sketch **map** of facility and surroundings. (note grid paper is provided as final page of this template) |  |  |  |
| I2. Mark **locations of stacks** to be fumigated. |  |  |  |
| I3. On plot, mark **exclusion zone** 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 **watchman** or watchmen will be required to maintain the exclusion zone. If yes, inform the facility manager immediately.  |  |  |  |
| I5. On plot, mark **shut-off points** for electricity, water, gas, if any. |  |  |  |
| I6. On plot mark doors/gates to be secured to enforce exclusion zone and locations of **warning signs** to be posted. |  |  |  |
| I7. On plot, mark locations of **hazard monitoring** (at least 3 locations just outside exclusion zone, where gas is mostly likely to accumulate). |  |  |  |
| I8. On plot, mark locations of **phosphine trays** and monitoring lines.  |  |  |  |
| I9. Attach plot to this Fumigation Management Plan as Annex #F |  |  |  |

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| **J. COMMUNICATION AND TRAINING**  |
| Required Actions | Y | N | Confirming initials |
| J1. Fumigation team reviews **product label**, MSDS, and applicator/product manual. Lead applicator provides detailed verbal briefing if required. |  |  |  |
| J2. Lead applicator briefs the team regarding the symptoms of **phosphine poisoning** and first aid. (See Fumigation PEA Annex T-10) |  |  |  |
| J3. Lead applicator briefs the team regarding the planned **fumigation process** 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

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

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| **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. **Respiratory equipment and protective gear** 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) Dry, clean cotton gloves in good condition; (2) rubber boots; (3) liquid-tight coveralls are available FOR THE FULL TEAM |  |  |  |
| L6. **Detection (monitoring) equipment** meeting specifications (M3) is available to monitor HAZARD |  |  |  |
| L7. Detection (monitoring) equipment meeting specifications (M3) is available to monitor EFFICACY |  |  |  |
| L8. **Warning signs** (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  |  |  |  |

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| **M. SPECIFICATIONS FOR SHEETS, RESPIRATORY & DETECTION EQUIPMENT**  |
| M1. Fumigation Sheets | M2. Respiratory Protection |
| **Sheets must be**: * resistant to ultraviolet light
* tear-resistant along BOTH length and width
* of material impermeable to phosphine (gas loss must be less than 1 mg/day/m2
* in good condition with ALL holes and tears mended with material-specific adhesive and patch.
* light enough to carry (200-250g/m2) a full standard-size (18mX12m) sheet

250-micron (0.25mm) thickness PVC sheet, PVC on a nylon or terylene scrim, or multi-layer thin-film laminates are all acceptable. Thin coatings on widely woven materials and annealed polypropylene sheets NOT acceptable. | Properly maintained **canister-type full facemask respirator**. 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 & not have exceeded their rated time-in-use. OR Properly maintained self-contained breathing apparatus.(SCBA) Other varieties of respiratory protection may be acceptable, see PEA Annex T-9.NOTE. Canister/cartridge type respirators are NOT adequate to enter a fumigation enclosure (e.g. go into a sheeted container) |
| M3. Monitoring Equipment |
| All equipment must be properly **calibrated and maintained**. 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. See PEA Annex T-9 for more information |

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| **N. RESPIRATORY AND DETECTION EQUIPMENT** |
| Required Action: Complete log of all Respiratory and Detection Equipment.  |
| Description*e.g., Canister Respirator* | Manuf & Model # | Manuf Date (if known) | Serial Number |
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*\*Note: advance notice of 24 or more hours may be required by country laws or regulations.*

# APPLICATION AND MONITORING

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| **O. SUITABILITY OF FACILITY, STACKS AND TEAM FOR FUMIGATION** |
| by following these steps, manadatory fumigation will be safe and effective. Fumigation may NOT proceed unless ALL criteria are met.  |
| Mandatory steps. Confirm that: | Criterion is. . . | ConfirmingInitials |
| Met | Not Met |
| O1. Commodities being fumigated are not required for use before the end of the **planned down time** (E5) + 1 day  |  |  |  |
| O2. Expected **temperature** during the fumigation period will be 15⁰C or above. |  |  |  |
| O3. Stacks are NOT built around pillars or against walls, and that there is **sufficient clearance** (1m) around each stack to effectively sheet and seal. |  |  |  |
| O4. **Surface issues**: EITHER (1) the floor under and for 1 (one) meter around stack 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 **duration of the fumigation** (7-10 days or more). (Exclusion = no people EXCEPT for fumigation personnel with proper breathing equipment in this zone.)  |  |  |  |
| O6. A trained 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.  |  |  |  |

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| **P. WARNING SIGNAGE AND SECURITY** |
| Required Actions | Y | N | Confirming initials |
| P1. Notify Abutters per Notification Plan (G1). In particular, ensure that nearby residents have been informed of activity, |  |  |  |
| P2. Notify Workers and any others with customary access to the exclusion zone. Brief on emergency response plan (H1) |  |  |  |
| P3. If applicable, execute Local Authorities Notification Plan (G2)\* |  |  |  |
| P4. Post warning signage at all points indicated by fumigation plot (I6) |  |  |  |
| P5. Assure that doors are ready to be locked. (Locks and keys available) |  |  |  |
| P6. Assure that watchmen are on-site, if required to maintain the exclusion zone. |  |  |  |

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| **Q. PLACING SHEETING AND COVERING STACKS** |
| Required Actions **IN EXACTLY THIS ORDER** | Y | N | Confirming initials |
| Q1.Position sheets. Carry, do not drag the sheets into position |  |  |  |
| Q2. Cover stacks. 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. Set sand snakes. 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. Place monitoring lines. 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.  |  |  |  |

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| **R. APPLYING FUMIGANT** |
| ATTENTION: PHOSPHINE GAS BEGINS FORMING AS SOON AS THE AIR-TIGHT PACKAGING OF PHOSPHIDE PELLETS/TABLETS IS OPENED. IT IS A DEADLY POISON. IT IS FLAMMABLE. CONTACT OF PHOSPHIDE WITH WATER WILL CAUSE FIRE OR EXPLOSION. SMELL IS NOT A RELIABLE INDICATOR OF DANGER.  |
| Required Actions **IN EXACTLY THIS ORDER** | Y | N | Confirming initials |
| R1. Watchmen go on duty (if required to maintain the exclusion zone) & remain OUTSIDE the zone until aeration is complete (W9) |  |  |  |
| R2. Verify ONLY personnel involved in fumigation are in the exclusion zone  |  |  |  |
| R3. Turn off electric lights & any sources of sparks |  |  |  |
| R4. Ensure that all fumigation personnel are wearing PPE, including respirators, as per L4 & L5 |  |  |  |
| 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.  |  |  |  |
| R6. Distribute UNOPENED tablets/sachets 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. |  |  |  |
| R8. Assure all opened tablets/pellets are used  |  |  |  |
| R9. Leave the warehouse and lock ALL doors |  |  |  |

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| **S. MONITOR GAS CONCENTRATIONS FOR EFFICACY AND HAZARD & LOG RESULTS** |
| Required Actions  | Y | N | Confirming initials |
| S1. Hazard Monitoring. 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. Hazard Monitoring Response. 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. Efficacy Monitoring: 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. |  |  |  |
| S4. Efficacy Monitoring Response. If concentration does not reach or falls below 200ppm before additional fumigant may be added IF SCBA apparatus are used. NOTE ANY SUCH ACTIONS IN EXCEPTIONS LOG (#C). |  |  |  |

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

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| **T. CERTIFY FUMIGATION COMPLETE OR ABORTED** |
| Required: Certify which of the following applies.  | ✓ | Req’d Time @ Concentration*e.g. 200 ppm @ 7 days* |
| 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.  |  |

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| **U. AERATE** |
| Required Actions **IN EXACTLY THIS ORDER** | Y | N | Confirming initials |
| U1. Fumigation team puts on respirators and other PPE per L4 and L5 before entering exclusion zone.  |  |  |  |
| U2. Open all doors and ventilators. Turn on fans, if any.  |  |  |  |
| 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.)  |  |  |  |
| U4. Pull the free corner of each sheet up to the top of the stack with a rope. Team leaves exclusion zone immediately.  |  |  |  |
| U5. Allow gas to leave stack and warehouse for a half-day to 1 day  |  |  |  |
| U6. Repeat U1, U4 & U5 until remaining stacks are opened |  |  |  |
| U7. Repeat U1. Then completely remove all sheets covering stacks. |  |  |  |
| U8. Monitor inside warehouse and directly next to stack until phosphine gas concentration is less than 0.3 ppm (or local TLV value, if more stringent.) |  |  |  |
| 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

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| **V. ALUMINUM PHOSPHIDE RESIDUE REMOVAL & DISPOSAL** |
| ATTENTION: Residues contain 3-5% unreacted materials and are hazardous to breathe and touch!ATTENTION: NEVER DISPOSE OF UNUSED TABLETS/PELLETS WITH THESE METHODS. NEVER PLACE UNUSED PELLETS/TABLETS IN A DRUM WITH OR WITHOUT DETERGENT AS A FIRE OR EXPLOSION MAY OCCUR. |
| Required Actions  | Y | N | Confirming initials |
| V1. Personnel involved put on respirators and other PPE per L4 & L5. |  |  |  |
| V2. Collect residue from trays in bucket or drum. Do not allow any residue to touch food commodity  |  |  |  |
| V3. Remove residue to a safe outdoor area |  |  |  |
| V4. Remove warning signs & stand down watchmen  |  |  |  |
| V5. Standing upwind to avoid any evolved phosphine, mix residue slowly into soapy water, assuring the residue is fully reacted. |  |  |  |
| V6. After any reaction is complete, dispose of mixture in a 0.5m deep disposal pit, at least 100m away from warehouse structures. Fill in hole.  |  |  |  |

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| **W. CLEAN-UP** |
| ATTENTION: Dead animals should be considered a biohazard & must be disposed as soon as possible after aeration is complete |
| Required Actions  | Y | N | Confirming initials |
| W1. Crush empty phosphide tablet/pellets containers and dispose per host country requirements. If none, bury.  |  |  |  |
| W2. Inspect entire warehouse with flashlight, including under pallets and under-roof area for dead rodents and birds |  |  |  |
| W3. Collect all dead animals wearing disposable gloves (if available). If not available, pick up with shovel or inside-out plastic bag.  |  |  |  |
| W4. Dispose of carcasses by (1) burying, wrapped in newspaper or plastic bag 0.6-1.2m deep and at least 60m from any shallow well or surface water; OR (2) burning, where it will not cause a public nuisance and in accordance with local laws; or (3) otherwise in accordance with local laws.  |  |  |  |
| W5. Wash hands thoroughly with soap. |  |  |  |

# Annexed Logs and Documentation

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| **#A. DOCUMENTATION OF DOSAGE CALCULATION**Document the calculations/information used to determine the quantity of fumigant required and the “time @ concentration” efficacy threshold (e.g. 200 ppm @ 7 days) |
| *General recommendation is 3 ALP tablets/metric ton but will vary with commodity, temperature & moisture content. 6 tablets/metric ton may be needed for highly sorptive commodities such as paddy rice, brown rice & pulses. Consult product label.* |
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| **#B. FUMIGATION TIME LOG** |
| #B1. Planned down time (days + hrs) (from H5) | and hours |
| #B2. Fumigant Applied (*Date & Time)* |  |
| #B3. Efficacy Reached (*Day & Time that H4 is achieved)* |  |
| #B4. Aeration Start (*Date & Time)* |  |
| #B5. All-Clear Given (see V9) (*Date & Time)* |  |

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| **#C. ISSUES, INCIDENTS AND EXCEPTIONS LOG** |
| 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.  |
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| **#D. PHOSPHINE CONCENTRATION LOG: HAZARD MONITORING** |
| 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 | 1 day | 2 days | 3 days | 4 days | 5 days | 6 days | 7 days | 8 days | 9 days |
| A |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B |  |  |  |  |  |  |  |  |  |  |  |  |  |
| C |  |  |  |  |  |  |  |  |  |  |  |  |  |
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\*As designated on plot map, Annex #F. Add locations as needed.

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| **#E. PHOSPHINE CONCENTRATION LOG: EFFICACY MONITORING** |
| Per S3, log phosphine gas concentrations taken from monitoring lines, in ppm.  |
| MonitoringLine\* | 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.

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| **#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)

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