7.WORKING INSTRUCTIONS – INFESTATION CONTROL PROCEDURES

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WORKING INSTRUCTIONS - INFESTATION CONTROL PROCEDURES

Pheromone traps for cigarette beetle monitoring	7.01
Recommendations for the monitoring and control of tobacco moth.	7.02
Phosphine - releasing fumigants.	7.03
Requirements (Protocol) for phosphine fumigations.	7.04
UK Health and Safety Executive Guidance Note CS22 Fumigation.	7.05
Safety data sheets for metal phosphine preparations.	7.06
Specification of poly-liners.	7.07
Insecticidal agents approved for use in infestation control.	7.08
Freezing recommendations used to kill cigarette beetle.	7.09
Hygiene requirements for tobacco premises.	7.10
Fumigation Certificate.	7.11

PHEROMONE TRAPS FOR CIGARETTE BEETLE MONITORING

BRITISH AMERICAN TOBACCO

Best Practice

PHEROMONE TRAPS FOR CIGARETTE BEETLE MONITORING

Pheromone traps for the cigarette beetle are currently recommended for use as a monitoring tool to detect the presence and change in levels of cigarette beetles. Whilst these traps capture beetles (males only) as part of the monitoring process, they are **NOT** a method of control for the cigarette beetle.

The design incorporates an enclosed protected adhesive surface that restrains the beetles for subsequent counting. This also minimises the ability of dust to settle on the adhesive and render it inoperable. However, in use it is wise to check the 'operation' of the adhesive each time that beetles are counted and the number recorded, which is best done on a weekly basis. Once beetles are captured do not scrape, or pull them off the traps as you continue using the traps. If the counts become too numerous to count, new traps should be installed and it indicates that infestation in the area of concern is out of control.

The pheromone lures should be kept in a cool place. Freezing or storage at higher temperatures will result in inactivation of the pheromones. There have also been occasions where storage of the adhesive boards under hot conditions over a long period will cause the trap adhesive to soak into the backing cardboard and render the stock of traps inoperative. Storage below 30°C is recommended. Whilst the traps have a shelf life of 12 months, ordering stocks 3 times a year rather than on an annual basis is the preferred strategy.

In addition to replacing the traps should they become inactivated by dust, the life of the pheromone capsule in operation is a maximum of 1 month after which the whole trap should be replaced.

For placement of traps, a spacing of 15 to 20 metres apart in a grid pattern is found to be most useful. It is also recommended that traps are not placed in locations with large air movements or above pieces of equipment which generate heat. Pheromone traps should be placed about head height and are said to be most effective if placed with a backing board and on a horizontal surface on which the attracted beetle can first land and then enter the trap. Traps should be securely fastened to ensure they may not become detached and potentially enter product processing lines. All traps should have the date of placement and a replacement date written on

them in addition to being given an individual number which is also recorded on a site plan. If 'hot spots' of beetles are found the density of traps can be increased to obtain a precise location of their source. As the traps are small they can if necessary be included inside machinery to locate internal sources of infestation. In this mode you must ensure they are secured and do not enter the product stream.

The following attachement contains the addres, telephone / fax and supplies for pheromone traps.

Address	**Telephon/Fax Number**	**Supplies**
Barrettine Environmental Health Barrettine works St Ivel Way Warmley Bristol United Kingdom BS15 5TY	(+44) 117 960 0060 (+44) 117 935 2437	For supplies you are recommended to contact Barrettine directly and identify yourself as part of the British American Tobacco Group.

Pheromone traps are also available from:

Fuji Flavour Company Limited	425 55 5100
3-5-8 Midorigaoka Hamura	425 55 7920
TOKYO 205 JAPAN	

RECOMMENDATIONS FOR THE MONITORING AND CONTROL OF TOBACCO MOTH

Best Practice

RECOMMENDATIONS FOR THE MONITORING AND CONTROL OF TOBACCO MOTH

Moth Life Cycle

The tobacco moth (*Ephestia elutella*) is a pest of cured tobacco with a preference for oriental and to a lesser extent flue-cured tobaccos. They generally only feed on leaf tobacco, not finished goods, are able to withstand prolonged exposure to low temperatures, but are intolerant of high temperatures.

Consequently, the moth is well adapted to survival in temperate regions and whilst they may be found in warmer areas are not reported to reproduce en masse in tropical regions.

The moth in general only completes one life cycle per annum, (Table1). The adults are grey in colour measuring just under 10mm from the head to the tip of the folded wings, they are fragile and never enter the tobacco, but lay eggs on or near stocks. The microscopic larvae or caterpillars that hatch from the eggs enter the tobacco, spend the summer feeding and grow to a size of 15mm. In the autumn the caterpillars leave the tobacco and wander spinning silken threads on the outside of bales, racking or building fabric. A cocoon is spun around the caterpillar which then over winters (Diapause) in this state. Low temperatures at this point aid synchronised development in the spring.

In spring (April/May in the northern hemisphers) synchronised by temperature and photo period, the caterpillars enter pupation with the adults beginning to emerge at the end of April beginning of May to mate and recommence the life cycle.

The following attachement is tabulated summary of life cycle of the moth.

Table 1. ***Ephestia elutella*** **- simplified life cycle (northern hemisphere)**

JANUARY	**FEBRUARY**	**MARCH**	**APRIL**
Over wintering stage - outside the tobacco on packaging or building fabric.			Pupation
MAY	**JUNE**	**JULY**	**AUGUST**
Mass synchronised emergence of adult moth (adults do not feed) - egg laying on tobacco - larvae **enter the tobacco** and feed.			Middle of month, **larvae leave tobacco** and wander.
SEPTEMBER	**OCTOBER**	**NOVEMBER**	**DECEMBER**
larvae wandering and spin cocoon	Over wintering on outside of packaging or on the building fabric.		

Monitoring and treatment

1. Pheromone traps for moth should be in position from the beginning of April until the end of October of each year in the northern hemisphere. Leaf warehouses and primary processing are the only areas that require monitoring.

2. The traps should be placed at head height and positioned 20m apart or one per 3000 m^3 of space and attached securely.

3. Traps should be dated and numbered and inspected weekly, the count for that week computed and records maintained.

4. The adhesive surface should also be checked weekly to determine effectiveness. Replace if rendered inoperative by dust.

5. The pheromone lures should be kept in in a cool place.

6. If the total number of moths on any individual trap reaches 100, the adhesive board of the trap should be renewed. The pheromone lures should be replaced every month.

7. If moth is discovered in leaf warehouses at the beginning of the season, and the count exceeds 5 per week on a trap, a space spraying programme should be commenced.

8. Counts in primary processing will be traceable back to the leaf store which should be treated as in 7. There should be no necessity to space spray in the primary processing area.

9. If incoming oriental stocks are suspected of introducing moth i.e. captures commence late in the season, the tobacco should be inspected for signs of damage and the possible presence of caterpillars. If caterpillars are found these tobaccos should be isolated, fumigated and the area space sprayed to eliminate residual adults.

Recommended Moth Trap

The pheromone traps recommended for tobacco moth monitoring is as follows:

Agrisense *Ephestia elutella* lures which come in packs of 10 and "Storgard Replacement Traps Kits". Each Storgard kit comes without pheromone lures, but contains components to make up 6 traps to be used with the Agrisense pheromone lures.
‘’Mo-Be’’ combined traps (these trap both cigarette beetles & moths)
Gachon Tobacco Moth Traps

Barrettine Environmental Health
Barrettine works
St Ivel Way
Warmley
Bristol
United Kingdom
BS15 5TY
Telephone (+44) 117 960 0060
Fax. (+44) 117 935 2437

PHOSPHINE RELEASING FUMIGANTS

EXAMPLES OF PHOSPHINE-RELEASING FUMIGANTS -

It is recommended that tablets and pellet formulations are NOT used for fumigations.

Only contained formulations such as bags sachets and plate / strip formulations should be used for tobacco fumigations.

Trade Name	Active Ingredient	Form
Recommended		
Detia Gas-EX-B	Aluminium phosphide	Bags
Degesch – Plate	Magnesium phosphide	Plates
Degesch – Strip	Magnesium phosphide	Strips

Phostoxin	Aluminium phosphide	Strips
Zedesa	Aluminium phosphide	Bags
Others		
Alutal	Aluminium phosphide	Tablets
Celphide	Aluminium phosphide	Tablets
Celphine	Aluminium phosphide	Tablets
Celphos	Aluminium phosphide	Tablets
Delicia Gastoxin	Aluminium phosphide	
Detia Gas-EX-P	Aluminium phosphide	Pellets
Detia Gas-EX-T	Aluminium phosphide	Tablets
"L" Fume	Aluminium phosphide	Tablets
Phosfume	Aluminium phosphide	Pellets, tablets
Phostek	Aluminium phosphide	Pellets, tablets
Phostoxin	Aluminium phosphide	Pellets, tablets
Quickfos	Aluminium phosphide	Pellets, tablets
Zedesa	Aluminium phosphide	Pellets, tablets
Detiaphos	Magnesium phosphide	Pellets
Mag-disc	Magnesium phosphide	Plates
Magtoxin	Magnesium phosphide	Pellets, tablets, rounds

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

BRITISH AMERICAN TOBACCO

Best Practice

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

1. Instruction
2. Equipment
3. Fumigation Requirements
4. Troubleshooting

INTRODUCTION

BRITISH AMERICAN TOBACCO

Best Practice

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

1. INTRODUCTION

Fumigation of tobacco is carried out in a closed space under atmospheric pressure in either warehouses, under gas proof sheeting, in shipping containers or specially constructed chambers. The essential element of these fumigation procedures is that the space should be sealed to contain the gas to ensure that the fumigation is both safe and effective. Only at the end of the process is the gas released from the fumigation and here the situation needs to be assessed to ensure personnel do not come into contact with the gas. It should be noted that shipping containers can rarely be rendered gas tight, and hence the success of fumigations in these cannot always be assured.

British American Tobacco requires that fumigation of shipping containers in transit does not take place.

On the basis of all currently available information, provided that the correct dose of fumigant is used and the fumigation is conducted correctly, all stages of development of the cigarette beetle should be killed.

Minimum exposure times

Tobacco temperature		Bale/Case Centre Phosphine Concentration	Minimum exposure time
(^{0}C)	(^{0}F)	(ppm)	(days)
16-20	61-68	300	6
>20	>68	200	4

Note: unlike the previous standard, a total fumigation time is not given. Instead the times given are the minimum exposure times for the specified concentrations required inside the tobacco. In addition to these times it is also necessary to add the time required in order to generate the phosphine gas, plus the time for this gas to then diffuse into the tobacco.

The following document details the equipment and procedures to be used to ensure that conditions are consistent and that clear information is always obtained concerning the quality and safety of the fumigation. Notwithstanding the provision of this document, the contractor shall remain responsible for the safety of its employees, British American Tobacco employees and third parties in relation to the carrying out of any fumigation, and British American Tobacco shall have no liability for any loss or damage which may be suffered by any contractor as a consequence of the contractor acting or omitting to act on the basis of anything contained in or omitted from this document.

EQUIPMENT

BRITISH AMERICAN TOBACCO

Best Practice

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

2. EQUIPMENT

2.1. SAFETY EQUIPMENT.

Phosphine gas and the metal phosphide preparations from which the gas is generated, following reaction with atmospheric water, are highly poisonous both by inhalation of the gas or the metal phosphide particles. Direct contact with skin of metal phosphide particles should also be avoided. Consequently, the safety equipment required should be designed to protect against these hazards. For further details of appropriate safety equipment and procedures see UK Health and Safety Executive Guidance note CS22 "Fumigation" ISBN 0-7176-1218-X published 1996.

2.1.1 Skin Absorption

To reduce absorption through the skin the following items should be worn:

Rubber or PVC gloves

A lightweight coverall e.g. washable cotton or cotton blended material.

Eye protection (see under respiratory protection).

On completion of the fumigation the clothing should be aired for at least 2 hours before laundering and storage for further occasions.

2.1.2. Respiratory Protective Equipment (RPE)

Respiratory protective equipment should always be worn when the concentration of phosphine gas in the atmosphere exceeds the current occupational exposure limit of 0.1ppm or when handling spent metal phosphide preparations.

2 types of equipment are suitable:

Full face canister (filter) apparatus

or

Self contained breathing apparatus (SCBA)

The canister apparatus must only be used when the concentration of phosphine does not exceed 15ppm. Above this concentration, or when the concentration is unknown, then SCBA must be used and a set must always be available for emergency purposes. **On no account** should respiratory protective apparatus that covers the nose and mouth only be used, full face apparatus that also protects the eyes is required.

For the canister apparatus, the canister or filter must be of the correct type to absorb the phosphine gas and the solid metal phosphide particles from the air inhaled. THEY MUST HAVE A MINIMUM INTERNATIONAL DESIGNATION OF THE TYPE B2P3. See below for details of specific apparatus.

Apparatus should be issued on a personal basis and at least 1 spare canister should be kept on the person of each operative when in use. The mask should fit well and be tested on each occasion of use for leaks. Staff with spectacles, contact lenses or excess facial hair e.g. unshaven or with beards, should not be permitted to act as fumigators. **The purification canister/filter should be rendered inoperative by crushing or damaging the attachment threads and discarded at the end of each shift. If the gas is detected by its smell of garlic when the RPE is in use it should be substituted by a spare canister. PURIFICATION CANISTERS SHOULD NOT BE REUSED.**

At the end of a fumigation, the RPE should be cleaned, maintained and stored as recommended in the manufacturers instructions.

The Protector Gemini (Full Face Respirator) is suitable for use with phosphine gas - Code RFF60

The mask should be used with the B2P3 filter canister Code RFF1000

Equipment from other manufacturers is equally acceptable providing written evidence is obtained to document that the equipment will protect against both phosphine gas and metal phosphide particles.

2.2 PHOSPHINE MONITORING EQUIPMENT

2.2.1 Drager Pump and Gas Detection Tubes

Drager Accuro Pump Kit (Code 6400022)

Drager Phosphine Detection Tubes

Operating range 50-1000 ppm (Code CH21201)
Operating range 0.01 - 1 ppm (Code 8101611)

The 0.01 - 1ppm tubes are suitable for leak detection and monitoring clearance of fumigations. **Please note when using gas detection tubes there is a fixed number of pumps to be used for each type of tube, details of these are given in the manufacturers instructions and MUST be followed.**

All above come in packs of ten, each tube is for **once-only** use.
The tubes have a shelf life of approximately 2 years provided they are stored below 25°C. Tubes should not be used beyond the expiry date printed on the pack.

The above items are available from:

Drager Ltd.,
Kittybrewster Industrial Estate,
Blyth,
Northumberland NE24 4RG,
United Kingdom.
Telephone: +44 1670 352891,
Fax No. +44 1670-356-266

or their branches elsewhere in the World.

Or
Barrettine
St Ivel Way,
Warmley,
Bristol,
BS30 8TY
Tel 0044 117 967 2222
Fax 0044 117 961 4122
Email – beh@barrettine.co.uk
www.barrettine.co.uk

Equivalent equipment manufactured by Kitagawa or Auer are equally acceptable.

2.2.2 Electronic Operated Phosphine Meters.

The PortaSens II is a hand held electronic meter which may be used for measuring gas concentration readings and for leak detection. This meter is reliable and provides an alternative to the use of of gas detection tubes. Three interchangeable sensor modules are required for use with this meter:

00-1032 PH3 Sensor 500/2000 PPB
00-1033 PH3 Sensor 10/200 PPM
00-1034 PH3 Sensor 200/2000 PPM

Analytical Technology Inc
680 Hollow Road
Box 879
Oaks, PA 19456
800 959 0299
www.analyticaltechnology.com or

ATI (UK) Limited
First Floor
237-239 Oldham Rd
OL4 4QR
0044 161 624 0200
email: sales@atiuk.com

The Bedfont Scientific EC80 battery operated phosphine monitor is not recommended for use with tobacco fumigations.

2.2.3 Gas Sample Lines and Tobacco Probes

2mm internal diameter (i.d.) nylon or hard plastic gas sample lines should be used (nylon sample lines are available from Bedfont*). Probes for insertion into the tobacco bales can be constructed of locally available materials. The following design has been found to be successful in use:

A maximum of 8mm external diameter, 4mm internal diameter steel tubing. Care should be taken to ensure the end of the sample probe does not become blocked with tobacco. This can be achieved by first inserting a solid metal rod into the probe so that the tip of the rod extends just past the tip of the sample probe. Insert the tube to the bale centre and remove the metal rod and attach the gas sample lines.

The total length of the probe can also be designed with a 'stop' included as a handle such that insertion in the tobacco bale to the handle ensures that the gas sample holes are exactly at the bale centre without the need for detailed measurements.

If cardboard leaf cases are to be sampled the card can be punctured with a sharp object before insertion of the bale probe. On no account must a drill be used and do not make a pilot hole in the tobacco prior to insertion of the sampling probe.

* Bedfont Scientific
Bedfont House
Holywell Lane
Upchurch
Kent ME9 7HN
United Kingdom
Telephone +44 1634 375614
Fax +44 1634 378980

FUMIGATION REQUIREMENT

BRITISH AMERICAN TOBACCO

Best Practice

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

3. FUMIGATION REQUIREMENTS

3.1 AMBIENT TEMPERATURES FOR FUMIGATION

3.2 CALCULATING THE AMOUNT OF FUMIGANT REQUIRED.

Calculate the volume of the space to be fumigated. This should include the total volume of the fumigation area including the space occupied by the tobacco. **Sufficient metal phosphide preparation will have to be applied to achieve a successful fumigation and the initial dose must comply with the fumigant manufacturers label instructions.**

Every 3 grams of aluminium or magnesium phosphide preparation will react with atmospheric moisture to give 1 gram of phosphine gas. Do not calculate the dose of fumigant on the basis of tobacco tonnage.

3.3 SEALING STRUCTURES

If fumigating the whole of a warehouse, check the building for potential areas from which the gas might leak and seal as necessary. Examine the roof area from inside during daylight in order to identify holes and cracks. Use heavy masking tape at least 5cm wide or 150µm thick (600 gauge) polyethylene tape and sheets of 150µm thick polyethylene sheeting for sealing areas such as windows. For sealing building gaps e.g. wall ceiling joints, use a synthetic mastic filler. Roofs made from overlapping sheet materials will not be gas tight and will probably require sheeting over with polyethylene sheeting. Please note that insulating foam will not prevent fumigant from escaping from a fumigation space.

For fumigation under sheeting, cover over with 150µm thick polyethylene sheet or specialist gas impermeable fumigation sheeting. If more than 1 sheet is needed, overlap by at least 30cm and roll and clamp the joint. The sheets should be 'sealed'/anchored to the ground e.g. using overlapping sand snakes of minimum diameter 150mm. **DO NOT** use water snakes or rigid

objects. If the floor surface is poor choose another site or use a polythene ground sheet and seal the oversheet to it.

Shipping containers may be fumigated as sealed units or sheeted over as for conventional fumigation under sheeting. If fumigated as a sealed unit, pay attention to the condition of the floor before filling the container, if holes are apparent in any part of the structure reject the container. Many containers have wooden floors and phosphine is known to easily penetrate wood, avoid using these for fumigations if possible. Inspect the seals of the doors and seal any vents with tape. The rubber door seal may not be sufficient alone and may need taping. Containers are notoriously difficult to seal to ensure a successful fumigation as the quality varies from container to container. They are perhaps most successful if sheeted over and fumigant applied as for a sheeted fumigation.

British American Tobacco requires that shipping containers must not be fumigated whilst in transit.

Once the structures are sealed place warning notices on the fumigation see UK Health and Safety Executive Guidance note CS22 "Fumigation" .

3.4 GAS LINES FOR PHOSPHINE MONITORING

Before commencing the fumigation, preparation must be made to sample the levels of phosphine gas achieved inside the fumigation area. This is carried out as follows:

Use the 2mm i.d. gas sample tubing attached to the steel sample probe. Sample from the centre of a representative case or bale. Include a further line to sample the general atmosphere around the bales, but 1 metre above floor level. Take the sampling tubing outside the fumigation area, plug the end and seal the point of exit from the building, stack or container.

If there are any joints to be made in the gas sample lines or at the point of attachment to the bale probe or to the measuring instrument, **do not use sticky tape**. Rather have available a range of stretchable silicone tubings with different diameter bore by which the various pieces can be joined. It is most important that these joints do not leak as incorrect readings will be produced if leaks occur.

3.5 APPLYING FUMIGANT

To commence the fumigation the metal phosphide preparation should be distributed inside the stack, warehouse or container in accordance with the manufacturers instructions and recommended safety practices. Specifically, for the preparation in tablet form, trays of heavy

gauge paper or other suitable material should be used . **Do not place fumigant directly on or in tobacco cases or bales or heap the fumigant preparation in one place .**

It may also be worthwhile placing the fumigant slightly off the ground in order to reduce the risk of fire in the event of the warehouse flooding. Fumigation fires have been reported in warehouses where flashflooding has resulted in water seeping into the fumigation area causing a fire on contact with the fumigant. The fumigation risk assessment (carried it prior to the start of the fumigation) must take into account issues such as this risk of flooding and appropriate preventive measures must be taken.

If registered for use in the country concerned, magnesium phosphide plates are recommended. Where aluminium phosphide is used, a packaged i.e. contained formulation e.g. bags / sachets is required, USE OF PELLETS OR TABLETS SHOULD BE AVOIDED.

Once the fumigation has commenced place barriers with warning notices attached to keep personnel away fron the fumigation stacks. These should at minimum be at a distance that will exclude personnel from any area (risk area) where the phosphine concentration is likely to exceed 0.1ppm. Staff should not be permitted to work in the aisle adjacent to a fumigation stack. Ideally, for stack fumigations in warehouses, staff should not remain in the warehouse which should be locked, the outside of the warehouse forming the boundary of the risk area. In some countries this is a statutory requirement.

3.6 SAFETY MONITORING

The fumigation area should then be secured and safety monitoring in accordance with recommended fumigation safety practices carried out, see UK Health and Safety Executive Guidance note CS22 "Fumigation" ISBN 0-7176-1218-X published 1996. Sample the atmosphere around the fumigation each day after the start of the fumigation. Especially, check that the concentration at the risk area barriers do not exceed the 0.1ppm and if necessary resite the barriers to satisfy this criteria.

3.7 PHOSPHINE MONITORING FOR EFFICACY

In addition to sampling phosphine gas concentrations to ensure external safety considerations are met, sampling must also be carried out to ensure that the fumigation is effective. However, under some conditions penetration to the centre of a case may take longer and it is recommended that the phosphine monitoring data is used to establish the necessary fumigation time before aeration of the structure is commenced.

The phosphine gas concentration must be measured in every separate area to be fumigated and on each occasion this is carried out. Sealing of fumigations will vary from fumigation to fumigation. It should not be assumed that because one fumigation was well sealed that subsequent fumigations will be equally well sealed: phosphine gas monitoring is the only way to confirm an effective fumigation on each occasion.

Before taking any sample for measurement, remove the gas from the dead space of the line using the sampling pump. If available, an electric pump of low flow rate can also be used to do this. This is known as purging the gas sample lines.

Sample the atmosphere in the test bale and in the general airspace of the fumigation chamber each day after the start of the fumigation. Test and record the phosphine level reached on the fumigation certificate attached.

3.8 VENTING THE FUMIGATION

Providing that the target concentration of phosphine at the centre of the tobacco bale has been reached and held for the required time, the fumigation may be vented. A reappraisal of safety in accordance with recommended safety practices e.g. HSE guidance note CS22 should be carried out at this point of the fumigation. It may be necessary to increase the size of the risk area to ensure no personnel are exposed to concentrations of phosphine above the occupational exposure level. Where possible this process will be arranged so that the first day of venting commences on a non-working day for the site i.e. the number of staff on site is minimal and therefore those at potential risk are reduced. This practice should however, be commensurate with maintaining sufficient staff on site to cover the required safety aspects.

Ensure that personnel not wearing RPE are excluded from the increased risk area. Wearing RPE, unsheet the fumigation stack and open the warehouse doors, switch on ventilation fans if available. For containers, open the doors. Use the low level Drager gas detection tubes to measure atmospheric levels of phosphine and place barriers equipped with warning notices to exclude personnel from areas where the concentration exceeds 0.1ppm. **Continue the ventilation process until the concentration adjacent to the fumigated tobacco has gone below 0.1ppm or until 48 hours has elapsed whichever is longest.** If the fumigation site is within 100m of non British American Tobacco property outside the site boundary measure the concentration at the boundary to ensure this does not exceed 0.1ppm.

One hour after commencing venting, staff wearing protective equipment including RPE should gather the spent fumigant, for aluminium phosphide dust do not collect more than 2kg together in an open container. Add this material slowly to a 2% solution of detergent in water such that a maximum residue of 20kg of powder is added to 70 litres of water. Leave this mixture to stand with occasional stirring for 48 hours to ensure complete deactivation. At the end of this period the water may be poured to drain and the slurry buried unless national regulations require an

alternative process. For magnesium phosphide plates these should be placed in a wire basket with a lid before immersion in water to prevent them floating..

Once the phosphine concentration in the fumigation area has gone below 0.1ppm or 48 hours have elapsed, whichever is longest, a clearance certificate may be issued and access by personnel may be permitted, see UK Health and Safety Executive Guidance note CS22 "Fumigation" .

PLEASE NOTE – traces of gas can remain within the leaf tobacco for some time after the completion of fumigation aeration and these will air off very slowly, presenting no risk provided that the area is well ventilated. If however the fumigation area is re-sealed after the aeration period then there is the potential for concentrations to build up above the occupational exposure standard and a further airing period will be necessary before safe re-entry.

TROUBLESHOOTING

BRITISH AMERICAN TOBACCO

Best Practice

REQUIREMENTS (PROTOCOL) FOR PHOSPHINE FUMIGATIONS

4. TROUBLESHOOTING

If tests show that effective concentrations are not achieved and held, check thoroughly to identify the cause:

Check that the correct amount of fumigant for the calculated air space was used. The dose of fumigant applied should **not** be based upon the tonnage of tobacco being treated.

Check the calculation of the volume of space being treated.

Examine the physical structure - vents, doors, etc. for possible source of leaks, the low level Drager gas detection tubes should be used for this task. If treated under sheeting, examine carefully the sheeting for damage and effective sealing to the ground.

If no reason for the failure is found, consider a trial fumigation of the fumigant releasing product under gas proof sheeting, to check the performance of the fumigant. Aluminium or

magnesium phosphide will generate phosphine gas in atmospheres of relative humidity down to 15%.

NOTE: ANY CHECKS MADE MUST CONFORM TO THE ESTABLISHED SAFE WORKING CONDITIONS TO BE FOLLOWED WITH PHOSPHINE FUMIGATIONS. ON NO ACCOUNT SHOULD THERE BE ANY ATTEMPT AT INTERFERING WITH THE FUMIGATION ITSELF.

UK HEALTH AND SAFETY EXECUTIVE GUIDANCE NOTE CS22 FUMIGATION

BRITISH AMERICAN TOBACCO

Best Practice

UK HEALTH AND SAFETY EXECUTIVE GUIDANCE NOTE CS22 FUMIGATION

This document is available direct from UK Health and Safety Executive:

ISBN 0-7176-1218-X

General Website - **www.hse.gov.uk**

Telephone	0044 (0)1787 881165
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Email	hsebooks@prolog.uk.com
Website	www.hsebooks.co.uk
Post	HSE Books PO Box 1999 Sudbury Suffolk CO10 2WA

EXAMPLE SAFETY DATA SHEETS FOR METAL PHOSPHIDE PREPARATIONS

MAG.doc

(Please not that these are examples only and that it is the responsibility of the fumigator in charge to have up to date versions of these documents

MATERIAL SAFETY DATA SHEET: MAGNESIUM PHOSPHIDE-MAGTOXIN® SPOT FUMIGANT, FUMI-CEL®, FUMI-STRIP®

PROPER DOT SHIPPING NAME: MAGNESIUM PHOSPHIDE, CL 4.3, UN2011, PG I, DANGEROUS WHEN WET, POISON LABELS APPLY

SECTION I - PRODUCT INFORMATION

Manufacturer:

DEGESCH America, Inc.
275 Triangle Dr.
P. O. Box 116
Weyers Cave, VA 24486 USA

Telephone: (540) 234-9281
Telefax: (540) 234-8225
Internet address: http://www.degeschamerica.com

EMERGENCY TELEPHONE NOS.:

Emergency - Chemtrec (800) 424-9300
Emergency and Information - DEGESCH America, Inc. (540) 234-9281

Packaging: Magtoxin is available in porous blister packs called the Magtoxin Prepac Spot Fumigant. Fumi-Cel is produced by impregnating magnesium phosphide into polyethylene in the form of a 117g plate, each plate liberating 33g of hydrogen phosphide. The Fumi-Strip is formed by attaching together, end-to-end, 20 of the Fumi-Cel plates. Fumi-Cel and Fumi-Strip do not liberate carbon dioxide and ammonia. All metal phosphide products are packed in gas-tight containers.

Date of Revision: January 1997

SECTION II - HAZARDOUS INGREDIENTS INFORMATION

Identity:

Magtoxin Spot Fumigant, Fumi-Cel, Fumi-Strip, Magnesium Phosphide, Mg_3P_2 - Reacts with water to produce phosphine, hydrogen phosphide, PH_3 as shown in Equation 1. Magtoxin is formulated with 66% magnesium phosphide and also contains ammonium carbamate and inert ingredients. Ammonium carbamate releases ammonia and carbon dioxide as shown in Equation 2.

1) $Mg_3P_2 + 6H_2O \rightarrow 3Mg(OH)_2 + 2PH_3$

Mg_3P_2	CAS No. 12057-74-8
PH_3	CAS No. 7803-51-2

2) $NH_2COONH_4 \rightarrow 2NH_3 + CO_2$

NH_2COONH_4	CAS No. 1111-78-0
NH_3	CAS No. 7664-41-7
CO_2	CAS No. 124-38-9

NFPA Chemical Hazard Ratings:
Flammability Hazard 4
Health Hazard 4
Reactivity Hazard 2
Special Hazard W

SARA Physical and Health Hazards:
Fire
Reactivity
Immediate (Acute)

Inhalation Exposure Limits:

Component	OSHA PEL TWA (ppm)	ACGIH TLV TWA (ppm)	ACGIH TLV STEL (ppm)	NIOSH IDLH (ppm)
Hydrogen Phosphide*	0.3	0.3	1.0	50
Ammonia	50	25	35	300
Carbon Dioxide	5,000	5,000	30,000	40,000

*EPA limits are 0.3 ppm TWA during fumigation and 0.3 ppm ceiling at all other times.

SECTION III - PHYSICAL CHARACTERISTICS

Boiling Point:

Mg_3P_2	>1000^oC
PH_3	-87.7^oC

Specific Gravity of Vapors (Air = 1):

Mg_3P_2	N/A
PH_3	1.17

Vapor Pressure:

Mg_3P_2	0mm Hg
PH_3	40mm Hg @-129.4^oC

Solubility in Water:

Mg_3P_2	Insoluble, reacts
PH_3	26cc in 100 ml water at 17^oC

Appearance and Odor:
Magtoxin and magnesium phosphide are a dark charcoal gray. The paper covering the polyethylene matrix of the Fumi-Cel and Fumi-Strip is yellow-orange in color. The hydrogen phosphide (phosphine, PH_3) gas produced by these products has an odor described as similar to garlic, carbide or decaying fish.

Specific Gravity:

Mg_3P_2	2.06

Melting Point:

AlP	>1000^oC
PH_3	-133.5^oC

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point:
Magnesium phosphide and Magtoxin are not themselves flammable. However, they react readily with water to produce hydrogen phosphide (phosphine, PH_3) gas which may ignite spontaneously in air at concentrations above its LEL of 1.8% v/v. UEL of hydrogen phosphide is not known.

Extinguishing Media:
Suffocate flames with sand, carbon dioxide or dry extinguishing chemicals.

Special Fire Fighting Procedures:
Do not use water on metal phosphide fires.

Respiratory Protection:
Wear NIOSH/MSHA approved SCBA or equivalent respiratory protection.

Protective Clothing:
Wear gloves when handling Magtoxin.

Unusual Fire and Explosion Hazards:
Hydrogen phosphide-air mixtures at concentrations above the lower flammable limit of 1.8% v/v, PH_3 may ignite spontaneously. Ignition of high concentrations of hydrogen phosphide can produce a very energetic reaction. Explosions can occur under these conditions and may cause severe personal injury. Never allow the buildup of hydrogen phosphide to exceed explosive concentrations. Open containers of metal phosphides in open air only and never in a flammable atmosphere. Do not confine spent or partially spent dust from metal phosphide fumigants as the slow release of hydrogen phosphide from these materials may result in the formation of an explosive atmosphere. Spontaneous ignition may occur if large quantities of magnesium phosphide or aluminum phosphide are piled in contact with liquid water. This is particularly

true if quantities of these materials are placed in moist or spoiled grain which can provide partial confinement of the hydrogen phosphide gas liberated by hydrolysis.

Fires containing hydrogen phosphide or metal phosphides will produce phosphoric acid by the following reaction:

$2PH_3 + 4O_2 \text{ ---> } 3H_2O + P_2O_5 \text{ ---> } 2H_3PO_4$

SECTION V - REACTIVITY DATA

Stability:
Magnesium phosphide is stable to most chemical reactions, except for hydrolysis. Magtoxin, Fumi-Cel and Fumi-Strip will react with moist air, liquid water, acids and some other liquids to produce toxic and flammable hydrogen phosphide gas. Magnesium phosphide is more reactive than aluminum phosphide and will liberate hydrogen phosphide more rapidly and more completely at lower temperatures and humidities.

Incompatibility:
Avoid contact with water and oxidizing agents.

Corrosion:
Hydrogen phosphide gas may react with certain metals and cause corrosion, especially at higher temperatures and relative humidities. Metals such as copper, brass and other copper alloys, and precious metals such as gold and silver are susceptible to corrosion by phosphine. Small electric motors, smoke detectors, brass sprinkler heads, batteries and battery chargers, fork lifts, temperature monitoring systems, switching gears, communication devices, computers, calculators and other electrical equipment may be damaged by this gas. Hydrogen phosphide will also react with certain metallic salts and, therefore, sensitive items such as photographic film, some inorganic pigments, etc., should not be exposed.

Hazardous Polymerization:
Will not occur.

SECTION VI - HEALTH HAZARD INFORMATION

Routes of Entry:
Magnesium phosphide and hydrogen phosphide gas from these fumigants are not absorbed dermally. Primary routes of exposure are inhalation and ingestion.

Acute and Chronic Health Hazards:
Magnesium phosphide is a highly acute toxic substance. Hydrogen phosphide gas LC_{50} is about 190 ppm for a one-hour inhalation exposure. The acute oral toxicity of the Magtoxin formulation was found to be 9.1 mg/kg of body weight. Magnesium phosphide is not known to cause chronic poisoning.

Carcinogenicity:
Magnesium phosphide is not known to be carcinogenic and is not listed as such by NTP, IARC or OSHA.

Signs and Symptoms of Exposure:
Magnesium phosphide fumigant products react with moisture from the air, acids and many other liquids to release hydrogen phosphide (phosphine, PH_3) gas. Mild exposure by inhalation causes malaise (indefinite feeling of sickness), ringing in the ears, fatigue, nausea and pressure in the chest which is relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, pain just about the stomach, chest pain, diarrhea and dyspnea (difficulty in breathing). Symptoms of severe poisoning may occur within a few hours to several days resulting in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin color), unconsciousness, and death.

Emergency and First Aid Procedures:
Symptoms of overexposure are headache, dizziness, nausea, difficult breathing, vomiting, and diarrhea. In all cases of overexposure get medical attention immediately. Take victim to a doctor or emergency treatment facility.

<u>If the gas or dust from magnesium phosphide is inhaled:</u>

Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.
<u>If magnesium phosphide pellets or powder are swallowed:</u>

Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.

If powder or granules of magnesium phosphide get on skin or clothing:

Brush or shake material off clothes in a well ventilated area. Allow clothes to aerate in a ventilated area prior to laundering. Do not leave contaminated clothing in occupied and/or confined areas such as automobiles, vans, motel rooms, etc. Wash contaminated skin thoroughly with soap and water.

If dust from pellets or tablets gets in eyes:

Flush with plenty of water. Get medical attention.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING

Spill Cleanup Procedures:

If possible, dispose of spilled Magtoxin, Fumi-Cel or Fumi-Strip by use according to label instructions. Freshly spilled material which has not been contaminated by water or foreign matter may be replaced into original containers. Punctured flasks, pouches or containers may be temporarily repaired using aluminum tape. If the age of the spill is unknown or if the product has been contaminated with soil, debris, water, etc., gather up the spillage in small open buckets having a capacity no larger than about 1 gallon. Do not add more than about 0.5kg (l lb.) to a bucket. If on-site wet deactivation is not feasible, transport the uncovered buckets in open vehicles to a suitable area. Wear gloves when handling Magtoxin, Fumi-Cel or Fumi-Strip.

Respiratory protection will most likely be required during cleanup of spilled magnesium phosphide fumigants. If the concentration of hydrogen phosphide is unknown, NIOSH/MSHA approved SCBA or its equivalent must be worn.

Small amounts of spillage, from about 2 to 4 kg (4 to 9 lbs.) may be spread out over the ground in an open area to be deactivated by atmospheric moisture. Alternatively, spilled magnesium phosphide fumigants may be deactivated by the wet method as described in the following.

Wet Deactivation of Spilled Magnesium Phosphide Products:

1. Spilled magnesium phosphide fumigants, Magtoxin, Fumi-Cel and Fumi-Strip, may be deactivated with water. Do not use detergent for the deactivation of these products. Fill the container in which the deactivation is to be performed with water to within a few inches of the top.

2. The spilled material is added slowly to the water. Magtoxin Prepacs, Fumi-Cel or Fumi-Strips may ignite during wet deactivation if they are allowed to float to the surface. Add weights or otherwise ensure that they stay submerged until deactivation is complete. At no time should the deactivation container be covered.

3. Due to the reactivity of magnesium phosphide, additions of spilled product to the water should be made slowly and carefully. This should be done in open air and respiratory protection will probably be required.

4. Allow the mixture to stand, with occasional stirring, for about 24 hours. Do not cover the container. The mixture will then be safe for disposal.

5. Dispose of the deactivated material, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, the deactivation water containing spent dust may be poured into a storm sewer or out onto the ground.

For Assistance:
Contact - DEGESCH America, Inc.
Telephone: (540) 234-9281
Fax: (540) 234-8225
Internet address: http://www.degeschamerica.com
or
Chemtrec: (800) 424-9300

Disposal of Spent Magtoxin, Prepacs, Fumi-Cel and Fumi-Strip:

When being disposed of, spilled or partially reacted magnesium phosphide fumigants are considered hazardous wastes under existing Federal Regulations. If properly exposed, the grayish-white residual dust from Magtoxin and spent Fumi-Cel or Fumi-Strip will not be a hazardous waste and normally contains only a very small amount of unreacted magnesium phosphide. This waste will be safe for disposal. However, the residuals from incompletely exposed magnesium phosphide fumigants may require special care.

Triple rinse pouches, tins and pails. Tins and pails may then be offered for recycling or reconditioning, or punctured and disposed of in a sanitary landfill, or by other procedures approved by state and local authorities. Rinsate may be disposed of in a storm sewer, sanitary landfill or by other approved procedures. Or, it is permissible to remove lids and expose empty pails, tins or pouches to atmospheric conditions until the residue is reacted. Then puncture and dispose of in a sanitary landfill or other approved site, or by other procedures approved by state and local authorities.

Some local and state waste disposal regulations may vary from the following recommendations. Disposal procedures should be reviewed with appropriate authorities to ensure compliance with local regulations. Contact your State Pesticide or Environmental Control Agency or Hazardous Waste Specialist at the nearest EPA Regional Office for guidance.

1. Confinement of partially spent fumigant or residual dust, as in a closed container, or collection and storage of large quantities of fumigant may result in a fire or explosion hazard. Small amounts of hydrogen phosphide may be given off from unreacted magnesium phosphide, and confinement of the gas may result in a flash.

2. In open areas, small amounts of spent residual dust may be disposed of on site by burial or by spreading over the land surface away from inhabited buildings.

3. Residuals from magnesium phosphide fumigants may also be collected and disposed of at a sanitary landfill, incinerator or other approved sites or by other procedures approved by Federal, State or Local authorities.

4. From 1 to 2 kg (2 to 4 lbs.) of spent fumigant may be collected for disposal in an open 1-gallon bucket. **Caution:** Do not collect dust in large drum, dumpsters, plastic bags or other containers where confinement may occur. Transport the buckets in an open vehicle for disposal or deactivation.

Deactivation of Partially Spent Magtoxin, Fumi-Cel and Fumi-Strip:

Magtoxin Prepacs, Fumi-Cels or Fumi-Strips which are only partially spent may be rendered inactive by either a "dry" or "wet" deactivation method. The "dry" method entails holding the Prepacs, Cels or Strips out of doors in locked, 30-gallon wire baskets which are available from DEGESCH America, Inc., or your supplier. Protect the partially spent magnesium phosphide fumigants from rain. The deactivated products may then be taken to an approved site for incineration or burial at periodic intervals or whenever the wire container is full. **Caution:** Storage of partially spent magnesium phosphide in closed containers may result in a fire hazard.

Alternatively, partially spent Prepacs, Fumi-Cels and Fumi-Strips may be treated by the "wet" deactivation method as follows:

1. Fill the container in which the deactivation is to be performed with water to within a few inches of the top. Detergent is not necessary for the deactivation of spent magnesium phosphide fumigants.

2. The spent material is added slowly to the water. Magtoxin Prepacs, Fumi-Cels or Fumi-Strips may ignite during wet deactivation if they are allowed to float to the surface. Add weights or otherwise ensure that they stay submerged until deactivation is complete.

3. Partially spent Magtoxin Prepacs, Fumi-Cels or Fumi-Strips may react quite vigorously during wet deactivation if they were exposed under cold and/or dry conditions or if the fumigation period was shortened. It is suggested that a small portion of the product be tested prior to immersing large amounts of material in water if it is suspected that the product contains considerable unreacted magnesium phosphide.

4. Due to the reactivity of magnesium phosphide, additions to the water should be made slowly and carefully. Deactivation should be carried out in open air and respiratory protection may be required.

5. Allow the mixture to stand with occasional stirring. Do not cover the container.

6. Dispose of the deactivated material, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, deactivation water containing spent dust may be poured into a storm sewer or out onto the ground.

Precautions to be Taken in Handling and Storage:

Store Magtoxin, Fumi-Cel and Fumi-Strip products in a locked, dry, well-ventilated area away from heat. Post as a pesticide storage area. Do not store in buildings inhabited by humans or domestic animals.

Other Precautions:

1. Do not allow water or other liquids to contact magnesium phosphide fumigants.

2. Do not pile up large quantities of magnesium phosphide products during fumigation or disposal.

3. Once exposed, do not confine the fumigant or otherwise allow hydrogen phosphide concentration to exceed the LEL.

4. Open containers of Magtoxin, Fumi-Cel or Fumi-Strip only in open air. Do not open in a flammable atmosphere. Hydrogen phosphide in the head space of containers may flash upon exposure to atmospheric oxygen.

5. See EPA approved labeling for additional precautions and directions for use.

6. Magtoxin, Fumi-Cel and Fumi-Strip are restricted use pesticides due to acute inhalation toxicity of highly toxic hydrogen phosphide (phosphine, PH_3) gas. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified Applicator's Certification.

SECTION VIII - CONTROL MEASURES

Respiratory Protection:

NIOSH/MSHA approved full-face mask with approved canister for phosphine (hydrogen phosphide, PH_3) may be worn at concentrations up to 15 ppm. At levels above this or when the hydrogen phosphide concentration is unknown, NIOSH/MSHA approved SCBA or equivalent must be worn.

Protective Clothing:

Wear gloves when contact with magnesium phosphide is likely to occur.

Eye Protection:

None required.

Ventilation:

Local ventilation is generally adequate to reduce hydrogen phosphide levels in fumigated areas to below the TLV/TWA. Exhaust fans may be used to speed the aeration of silos, warehouses, shipholds, containers, etc.

We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind, expressed or implied, and we assume no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use.

SAFETY DATA SHEETS FOR METAL PHOSPHIDE PREPARATIONS

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MATERIAL SAFETY DATA SHEET: ALUMINUM PHOSPHIDE, PHOSTOXIN®

PROPER DOT SHIPPING NAME: ALUMINUM PHOSPHIDE, CL 4.3, UN1397, PG I, DANGEROUS WHEN WET, POISON LABELS APPLY

SECTION I - PRODUCT INFORMATION

Manufacturer:

DEGESCH America, Inc.
275 Triangle Dr.
P. O. Box 116
Weyers Cave, VA 24486 USA

Telephone: (540) 234-9281
Telefax: (540) 234-8225
Internet Address: http://www.degeschamerica.com

EMERGENCY TELEPHONE NOS.:

Emergency - Chemtrec (800) 424-9300
Emergency and Information - DEGESCH America, Inc. (540) 234-9281

Phostoxin is available as 0.6g pellets and 3.0g tablets. Tabletized Phostoxin is also available in gas permeable packages called Prepacs and Ropes. Products are packed in gas-tight containers.

Date of Revision: November 1996

SECTION II - HAZARDOUS INGREDIENTS INFORMATION

Identity:

Phostoxin, Aluminum Phosphide, AlP - reacts with water to produce phosphine, hydrogen phosphide, PH_3 as shown in Equation 1. Phostoxin is formulated with 55% aluminum phosphide and also contains ammonium carbamate and inert ingredients. Ammonium carbamate releases ammonia and carbon dioxide as shown in Equation 2.

1) $AlP + 3H_2O \rightarrow Al(OH)_3 + PH_3$

AlP	CAS No. 20859-73-8
PH_3	CAS No. 7803-51-2

2) $NH_2COONH_4 \rightarrow 2NH_3 + CO_2$

NH_2COONH_4	CAS No. 1111-78-0
NH_3	CAS No. 7664-41-7
CO_2	CAS No. 124-38-9

NFPA Chemical Hazard Ratings:
Flammability Hazard 4
Health Hazard 4
Reactivity Hazard 2
Special Hazard W

SARA Physical and Health Hazards:
Fire
Reactivity
Immediate (Acute)

Inhalation Exposure Limits:

Component	OSHA PEL TWA (ppm)	ACGIH TLV TWA (ppm)	ACGIH TLV STEL (ppm)	NIOSH IDLH (ppm)
Hydrogen Phosphide*	0.3	0.3	1.0	50
Ammonia	50	25	35	300
Carbon Dioxide	5,000	5,000	30,000	40,000

*EPA limits are 0.3 ppm TWA during fumigation and 0.3 ppm ceiling at all other times.

SECTION III - PHYSICAL CHARACTERISTICS

Boiling Point:

AlP	>1000^{o}C
PH_3	-87.7^{o}C

Specific Gravity of Vapors (Air = 1):

AlP	N/A
PH_3	1.17

Vapor Pressure:

AlP	0mm Hg
PH_3	40mm Hg @-129.4^{o}C

Solubility in Water:

AlP	Insoluble, reacts
PH_3	26cc in 100 ml water at 17^{o}C

Appearance and Odor:
Phostoxin and aluminum phosphide have a greenish-gray color and the hydrogen phosphide (phosphine, PH_3) gas produced by these chemicals has an odor described as similar to garlic, carbide or decaying fish.

Specific Gravity:

AlP	2.85

Melting Point:

AlP	>1000^{o}C
PH_3	-133.5^{o}C

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point:
Aluminum phosphide and Phostoxin are not themselves flammable. However, they react readily with water to produce hydrogen phosphide (phosphine, PH_3) gas which may ignite spontaneously in air at concentrations above its LEL of 1.8% v/v. UEL of hydrogen phosphide is not known.

Extinguishing Media:
Suffocate flames with sand, carbon dioxide or dry extinguishing chemicals.

Special Fire Fighting Procedures:
Do not use water on metal phosphide fires.

Respiratory Protection:
Wear NIOSH/MSHA approved SCBA or equivalent respiratory protection.

Protective Clothing:
Wear gloves when handling Phostoxin tablets, pellets or dust.

Unusual Fire and Explosion Hazards:
Hydrogen phosphide-air mixtures at concentrations above the lower flammable limit of 1.8% v/v, PH_3 may ignite spontaneously. Ignition of high concentrations of hydrogen phosphide can produce a very energetic reaction. Explosions can occur under these conditions and may cause severe personal injury. Never allow the buildup of hydrogen phosphide to exceed explosive concentrations. Open containers of metal phosphides in open air only and never in a flammable atmosphere. Do not confine spent or partially spent dust from metal phosphide fumigants as the slow release of hydrogen phosphide from these materials may result in the formation of an explosive atmosphere. Spontaneous ignition may occur if large quantities of aluminum phosphide or magnesium phosphide are piled in contact with liquid water. This is particularly true if quantities of these materials are placed in moist or spoiled grain which can provide partial confinement of the hydrogen phosphide gas liberated by hydrolysis.

Fires containing hydrogen phosphide or metal phosphides will produce phosphoric acid by the following reaction:

$2PH_3 + 4O_2 \text{ ---> } 3H_2O + P_2O_5 \text{ ---> } 2H_3PO_4$

SECTION V - REACTIVITY DATA

Stability:
Phostoxin and aluminum phosphide are stable to most chemical reactions, except for hydrolysis. They will react with moist air, liquid water, acids and some other liquids to produce toxic and flammable hydrogen phosphide gas. Hydrogen phosphide may react vigorously with oxygen and other oxidizing agents.

Incompatibility:
Avoid contact with water and oxidizing agents.

Corrosion:
Hydrogen phosphide gas may react with certain metals and cause corrosion, especially at higher temperatures and relative humidities. Metals such as copper, brass and other copper alloys, and precious metals such as gold and silver are susceptible to corrosion by phosphine. Small electric motors, smoke detectors, brass sprinkler heads, batteries and battery chargers, fork lifts, temperature monitoring systems, switching gears, communication devices, computers, calculators and other electrical equipment may be damaged by this gas. Hydrogen phosphide will also react with certain metallic salts and, therefore, sensitive items such as photographic film, some inorganic pigments, etc., should not be exposed.

Hazardous Polymerization:
Will not occur.

SECTION VI - HEALTH HAZARD INFORMATION

Routes of Entry:
Aluminum phosphide and hydrogen phosphide gas from Phostoxin are not absorbed dermally. Primary routes of exposure are inhalation and ingestion.

Acute and Chronic Health Hazards:
Phostoxin is a highly acute toxic substance. The LC_{50} for hydrogen phosphide gas is about 190 ppm for a one-hour inhalation exposure. The acute oral toxicity of the Phostoxin formulation was found to be 11.5 mg/kg of body weight. Phostoxin is not known to cause chronic poisoning.

Carcinogenicity:
Phostoxin is not known to be carcinogenic and is not listed as such by NTP, IARC or OSHA.

Signs and Symptoms of Exposure:
Aluminum phosphide tablets, pellets and dust react with moisture from the air, acids and many other liquids to release hydrogen phosphide (phosphine, PH_3) gas. Mild exposure by inhalation causes malaise (indefinite feeling of sickness), ringing in the ears, fatigue, nausea and pressure in the chest which is relieved by removal to fresh air. Moderate poisoning causes weakness, vomiting, pain just about the stomach, chest pain, diarrhea and dyspnea (difficulty in breathing). Symptoms of severe poisoning may occur within a few hours to several days resulting in pulmonary edema (fluid in lungs) and may lead to dizziness, cyanosis (blue or purple skin color), unconsciousness, and death.

Emergency and First Aid Procedures:
Symptoms of overexposure are headache, dizziness, nausea, difficult breathing, vomiting, and diarrhea. In all cases of overexposure get medical attention immediately. Take victim to a doctor or emergency treatment facility.

<u>If the gas or dust from aluminum phosphide is inhaled:</u>

Get exposed person to fresh air. Keep warm and make sure person can breathe freely. If breathing has stopped, give artificial respiration by mouth-to-mouth or other means of resuscitation. Do not give anything by mouth to an unconscious person.

<u>If aluminum phosphide pellets, tablets or powder are swallowed:</u>

Drink or administer one or two glasses of water and induce vomiting by touching back of throat with finger, or if available, syrup of ipecac. Do not give anything by mouth if victim is unconscious or not alert.

<u>If powder or granules of aluminum phosphide get on skin or clothing:</u>

Brush or shake material off clothes in a well ventilated area. Allow clothes to aerate in a ventilated area prior to laundering. Do not leave contaminated clothing in occupied and/or confined areas such as automobiles, vans, motel rooms, etc. Wash contaminated skin thoroughly with soap and water.

<u>If dust from pellets or tablets gets in eyes:</u>

Flush with plenty of water. Get medical attention.

SECTION VII - PRECAUTIONS FOR SAFE HANDLING

Spill Cleanup Procedures:
If possible, dispose of spilled Phostoxin by use according to label instructions. Freshly spilled material which has not been contaminated by water or foreign matter may be replaced into original containers. Punctured flasks or containers may be temporarily repaired using aluminum tape. If the age of the spill is unknown or if the Phostoxin has been contaminated with soil, debris, water, etc., gather up the spillage in small open buckets having a capacity no larger than about 1 gallon. Do not add more than about 1 to 1.5kg (2 to 3 lbs.) to a bucket. If on-site wet deactivation is not feasible, transport the uncovered buckets in open vehicles to a suitable area. Wear gloves when handling Phostoxin.

Respiratory protection may be required during cleanup of spilled material. If the concentration of hydrogen phosphide is unknown, NIOSH/MSHA approved SCBA or its equivalent must be worn.

Small amounts of spillage, from about 4 to 8 kg (9 to 18 lbs.) may be spread out over the ground in an open area to be deactivated by atmospheric moisture. Alternatively, spilled Phostoxin may be deactivated by the wet method as described in the following.

Wet Deactivation of Spilled Phostoxin:

1. Deactivating solution is prepared by adding the appropriate amount of low sudsing detergent to water in a drum or other suitable container. A 2% solution or 4 cups of detergent in 30 gallons is suggested. The container should be filled with deactivating solution to within a few inches of the top.

2. The material is added slowly to the deactivating solution and stirred so as to thoroughly wet all of the Phostoxin. This should be carried out in open air and respiratory protection may be required. At no time should the deactivation drum be covered.

3. No more than about 45 to 50 lbs. of Phostoxin should be added to 15 gallons of water-detergent mixture. Prepacs and Ropes may ignite during wet deactivation if they are allowed to float to the surface. Add weights or otherwise ensure that Prepacs and Ropes stay submerged until deactivation is completed.

4. Allow the mixture to stand, with occasional stirring, for about 36 hours. The resultant slurry will then be safe for disposal.

5. Dispose of the slurry of deactivated material, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, this slurry may be poured into a storm sewer or out onto the ground.

For Assistance:
Contact - DEGESCH America, Inc.
Telephone: (540) 234-9281
Telefax: (540) 234-8225
Internet address: http://www.degeschamerica.com
or
Chemtrec: (800) 424-9300

Disposal of Spent Phostoxin:
When being disposed of, spilled or partially reacted Phostoxin is considered a hazardous waste under existing Federal Regulations. If properly exposed, the grayish-white residual dust after a fumigation will not be a hazardous waste and normally contains only a very small amount of unreacted aluminum phosphide. This waste will be safe for disposal. However, the spent residual dust from incompletely exposed Phostoxin may require special care.

Triple rinse flasks and stoppers with water. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by other procedures approved by state and local authorities. Rinsate may be disposed of in a storm sewer, sanitary landfill or by other approved procedures. Or, it is permissible to remove lids and expose empty flasks to atmospheric conditions until the residue in the flasks is reacted. Then puncture and dispose of in a sanitary landfill or other approved site, or by other procedures approved by state and local authorities.

Some local and state waste disposal regulations may vary from the following recommendations. Disposal procedures should be reviewed with appropriate authorities to ensure compliance with local regulations. Contact your State Pesticide or Environmental Control Agency or Hazardous Waste Specialist at the nearest EPA Regional Office for guidance.

1. Confinement of partially spent residual dust, as in a closed container, or collection and storage of large quantities of dust may result in a fire or explosion hazard. Small amounts of hydrogen phosphide may be given off from unreacted aluminum phosphide, and confinement of the gas may result in a flash.

2. In open areas, small amounts of spent residual dust may be disposed of on site by burial or by spreading over the land surface away from inhabited buildings.

3. Residual dust from Phostoxin may also be collected and disposed of at a sanitary landfill, incinerator or other approved sites or by other procedures approved by Federal, State or Local authorities.

4. From 2 to 3 kg (4 to 7 lbs.) of spent dust from 2 to 3 flasks of Phostoxin may be collected for disposal in a 1-gallon bucket. Larger amounts, up to about one-half case, may be collected in burlap, cotton or other types of porous cloth bags for transportation in an open vehicle to the disposal site. Do not collect dust from more than 7 flasks of tablets or 10 flasks of pellets (about 11 kg or 25 lbs.) in a single bag. Do not pile cloth bags together. Do not use this method for partially spent or "green" dust. Caution: Do not collect dust in large drum, dumpsters, plastic bags or other containers where confinement may occur.

Deactivation of Partially Spent Phostoxin Prepacs and Ropes:
Phostoxin Prepacs and Ropes which are only partially spent may be rendered inactive by either a "dry" or "wet" deactivation method. The "dry" method entails holding the Prepacs and Ropes out of doors in locked, 30-gallon wire baskets which are available from DEGESCH America, Inc., or your supplier. Protect the partially spent Phostoxin from rain. The deactivated Prepacs and Ropes may then be taken to an approved site for incineration or burial at periodic intervals or whenever the wire container is full. Caution: Storage of partially spent Prepacs and Ropes in closed containers may result in a fire hazard.

Alternatively, partially spent Prepacs and Ropes and residual dust from Phostoxin fumigation may be treated by the "wet" deactivation method as follows:

1. Deactivating solution is prepared by adding the appropriate amount of low sudsing detergent or surface active agent to water in a drum or other suitable container. A 2% solution or 4 cups of detergent in 30 gallons is suggested. The container should be filled with deactivating solution to within a few inches of the top.

2. Immerse spent Prepacs and Ropes or slowly pour residual dust into the deactivating solution while stirring so as to thoroughly wet all of the spent Phostoxin. This should be done in the open air and not in the fumigated structure. Dust from Phostoxin tablets or pellets should be mixed into no less than about 10 gallons of water-detergent solution for each case of spent material.

3. Dispose of the deactivated Prepacs and Ropes or dust-water suspension, with or without preliminary decanting, at a sanitary landfill or other suitable site approved by local authorities. Where permissible, the slurry may be poured into a storm sewer or out onto the ground.

4. Caution: Respiratory protection may be required during wet deactivation. Do not cover the container at any time. Do not dispose of dust in a toilet. Do not allow quantities of dry, spent dust from Phostoxin to be collected or stored without deactivation.

Precautions to be Taken in Handling and Storage:
Store Phostoxin products in a locked, dry, well-ventilated area away from heat. Post as a pesticide storage area. Do not store in buildings inhabited by humans or domestic animals.

Other Precautions:

1. Do not allow water or other liquids to contact Phostoxin.

2. Do not pile up large quantities of Phostoxin during fumigation or disposal.

3. Once exposed, do not confine Phostoxin or otherwise allow hydrogen phosphide concentration to exceed the LEL.

4. Open containers of Phostoxin only in open air. Do not open in a flammable atmosphere. Hydrogen phosphide in the head space of containers may flash upon exposure to atmospheric oxygen.

5. Phostoxin is a restricted use pesticide due to acute inhalation toxicity of highly toxic hydrogen phosphide (phosphine, PH_3) gas. For retail sale to and use only by certified applicators or persons under their direct supervision and only for those uses covered by the certified applicator's certification.

6. See EPA approved labeling for additional precautions and directions for use.

SECTION VIII - CONTROL MEASURES

Respiratory Protection:
NIOSH/MSHA approved full-face mask with approved canister for phosphine (hydrogen phosphide, PH_3) may be worn at concentrations up to 15 ppm. At levels above this or when the hydrogen phosphide concentration is unknown, NIOSH/MSHA approved SCBA or equivalent must be worn.

Protective Clothing:
Wear gloves when handling aluminum phosphide tablets, pellets or dust.

Eye Protection:
None required.

Ventilation:
Local ventilation is generally adequate to reduce hydrogen phosphide levels in fumigated areas to below the TLV/TWA. Exhaust fans may be used to speed the aeration of silos, warehouses, shipholds, containers, etc.

We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind, expressed or implied, and we assume no responsibility for any loss, damage, or expense, direct or consequential, arising out of their use.

SPECIFICATION OF POLY-LINERS

BRITISH AMERICAN TOBACCO

Best Practice

SPECIFICATION OF POLY - LINERS

The recommended poly-liner suitable for successful fumigations is as follows:

Material

- Linear low density polyethylene suitable for direct contact with food i.e. food grade. If in doubt concerning suitability contact the appropriate Company Additives and Materials Guidance panel.

Thickness

- 0.08 to 0.13mm

Perforations

- 0.05mm holes (final diameter) to be applied in a grid pattern over the entire surface of the liner at 50mm intervals.

INSECTICIDAL AGENTS APPROVED FOR USE IN INFESTATION CONTROL

Insecticidal Agents Approved for Use in Infestation Control

A. PYRETHROIDS

ACTIVE AGENT	TRADE NAMES (Examples)	INSECTICIDAL PROPERTIES	MAMMALIAN TOXICITY	
Pyrethrum an extract of natural pyrethrin usually mixed with piperonyl butoxide	Aqua Py Pybuthrin 2/16 ULV spray Pybuthrin 33 fogging spray Pybuthrin 5/50 ULV spray Turbocide	Contact insecticide with knockdown action. Little residual effect, active principle rapidly lost through air exposure and action of light. Normally formulated as mixture with piperonyl butoxide to enhance stability and as synergist.	Classified as Moderately hazardous (WHO) or Harmful (EC). Commercial preparations generally of low acute toxicity, but manufacturer's formulation data must be examined. Dermatitis can be caused in sensitised persons. Slight eye and skin irritant. OEL, 8h TWA 5 mg m^{-3} 10 min. STEL 10 mg m^{-3} (UK)	

ACTIVE AGENT	TRADE NAMES (Examples)	INSECTICIDAL PROPERTIES	MAMMALIAN TOXICITY	
Permethrin	Reslin 25 SE spray fog WP surface spray Coopex	Contact insecticide with residual action. Relatively stable to light and elevated temperature.	Acute toxicity very low - "slightly hazardous" by WHO and not defined by the 3 EC categories.	
Phenothrin	Sumithrin	Contact insecticide with rapid knockdown action.	Very low acute toxicity (as for Permethrin).	

Tetramethrin	Py-kill Neo-Pynamin	Rapid knockdown contact insecticide. Normally used in mixed formulations.	Very low acute toxicity (as for Permethrin). Not irritant to skin.	
Deltamethrin	Decis Cislin Crackdown	Contact insecticide with rapid action. Very stable in air and retains long residual action on hard surfaces protected from sunlight. Used specifically for hard surface treatment.	Classified as "highly hazardous" (WHO), "toxic" (EC. Manufacturer's formulation data must be examined. Mild eye irritant.	

EC - European Economic Community
OEL - Occupational Exposure Limit
STEL - Short Term Exposure Limit (10 minutes)
TWA - Time-Weighted Average (8 hours)
UK - United Kingdom
WHO - World Health Organisation

B. INSECT GROWTH REGULATORS

Methoprene	Dianex	Does not kill the insect, but prevents development of the larval to the adult form Dianex is applied to control the environment by selective use in and around machinery, or as a space spray or fog. Very specific in action but useful for moth as well as beetle control.	Very low mammalian toxicity.

EC - European Economic Community
OEL - Occupational Exposure Limit
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FREEZING RECOMMENDATIONS USED FOR KILL CIGARETTE BEETLE

Best Practice

FREEZING RECOMMENDATIONS USED TO KILL CIGARETTE BEETLE

In order to ensure that the freezing treatment is effective, all parts of the tobacco concerned must reach the desired temperatures and then be held at the following designated temperatures for the minimum times:

Table 1

British American Tobacco Recommended minimum times:

Temperature	Time
Minus 25^{O}C	18 hours
Minus 20^{O}C	48 hours
Minus 18^{O}C	5 days (120 hours)

To these times must be added the period required to achieve the set temperature which will depend on cooling capacity, type of package and volumes involved. It is important not to use the temperature gauges mounted in or on cold stores or cold chambers, these measure only the temperature of the cold store not the temperature of the tobacco inside.

If available use automatic temperature recording devices (ATRD's) inserted in the centre of tobacco cases/cartons to ensure that the tobacco consignment has reached the required temperatures for the minimum required time.

However, automated reading devices type units do not provide a direct readout to determine if the tobacco has reached the desired temperature. They are removed from the tobacco after the freezing cycle and the temperature the tobacco reached confirmed following down loading of the data to a personal computer.

As real time readings, and if ATRD's are not available, thermocouple probes must be used to confirm that the tobacco itself has reached the required temperature but are limited in that temperatures could alter 'between readings' which would not be apparent.

Method

1. Nominate a suitably qualified individual who can take responsibility for ensuring that the following procedure is adhered to.

2. Specify tobacco consignment or part consignment to be frozen, recording case/operation/consignment numbers as appropriate to clearly identify cases frozen.

3. Stack cases/cartons on 'dunnage' in freezing chamber taking care to ensure at least 100mm of free air space on 5 sides of all cartons.

4. Place ARTD's in the tobacco at geometric centres of randomly selected cartons. ATRD's should be assigned to the load at a ratio of 1 unit per ton of tobacco or a minimum of 3 units per total consignment.

N.B. Clearly mark cartons containing ATRD's to facilitate simple retrieval.

5. Commence freezing and leave for at least 24 hours.

6. Using a temperature probe of sufficient length to reach the centre of a case/carton, take temperature readings at random (at a ratio of one reading per ton of tobacco) and record results. If **any** of the probe temperatures are above the stated minimum, leave consignment in freezer for 24 hours and retest. Continue procedure until desired temperatures are attained.

   When **all** probe readings indicate that the minimum temperatures required have been achieved, leave consignment in freezer for the length of time corresponding to the temperature attained (Table 1).

7. Retrieve ATRD's.

8. 'Read' ATRD's and printout results. Check that all the graphs prove that the total consignment has reached the desired temperature and has been held at these for the minimum times (Table 1).

Should any of the 'readouts' show the required temperatures have not been reached, the freezing operation **must** be repeated until **all** readouts demonstrate that the required temperatures and times have been achieved.

HYGIENE REQUIREMENTS FOR TOBACCO PREMISES

BRITISH AMERICAN TOBACCO

Best Practice

HYGIENE REQUIREMENTS FOR TOBACCO PREMISES

The planning, construction materials, detailed design and layout of tobacco premises, including storages, should take account of the principles of hygiene, to ensure that the premises and equipment can be maintained in a high state of cleanliness and that contamination of the product, including material in process, can be avoided. The requirements are similar to those required for food manufacturing and storage premises.

The following should be observed:

1. **Materials of Construction (Walls, Floors, Ceilings)**

   The materials used should result in a high standard of surface finish. Surfaces should be continuous, with a minimum of joins or gaps where debris can accumulate. The surface finish of floors and walls should be hard, impervious and non-dusting. Joins between floors and walls should be contoured for ease of cleaning.

   The construction material for floors should be appropriate to anticipated wear. If multi-layered materials are employed, all edges should be sealed and enclosed.

   Heavy metals (e.g. Lead, Cadmium) or toxic metals (e.g. Arsenic) or their compounds should not be used as either fillers or pigments in wall or floor components or finishes.

   Asbestos or asbestos cement should not be used for any purpose.

Fibrous or other insulating materials, whether for walls or ceilings, should be enclosed in sealed elements to avoid potential for shedding of fibres or particles into the factory atmosphere and be fully protected against mechanical damage or disruption.

The use of false ceilings should be avoided.

2. Doors, Windows, Ventilators, Inspection Points

Where practical all doors, windows and other access points should be fully screened and have effective seals to prevent ingress and movement of pests. For opening windows this may require externally-mounted wire screens (20 mesh per inch, 8 mesh per cm.) to prevent insects entering. Sills and ledges, especially where high-up on walls, should be flush with walls for ease of cleaning. Window frames should be sealed to walls, if not integral with them. If access is required on a regular basis consider automatic doors or plastic strip 'doors' are known to exclude insects.

3. Internal Supports (Pillars, Girders etc.)

Floor mounted pillars should be sealed to the floor without gaps or crevices. Hollow-section pillars or girders should be capped and finished to prevent dust accumulation within. Panelling of pillars etc. should be avoided unless it is completely sealed and protected against mechanical damage. Bumper bars may be required round both pillars and door areas where traffic flow is heavy. Overhead beams are sources of dust accumulation and should be minimised and shaped to avoid dust accumulation I and H shaped beams should be avoided, round beams are the most appropriate shape. Joins etc. should be sealed for ease of cleaning.

4. Trunking, Ducting, Conduits, Cable Trays

All offer potential for dust and debris accumulation, vermin and other pests to enter premises and as internal infestation sources. Larger ducts and trunking should be provided with inspection hatches and be screened at external discharge points if appropriate. Conduits should be sealed at entry/exit points to buildings and through walls within buildings. Conduit and trunking within buildings should be effectively sealed against dust ingress.

All insulation of pipework and trunking should be effectively sealed to protect against damage and shedding of dust and particles and to prevent it being a harbourage for pests.

Air ducts should be sited to avoid condensation and either run-back or accumulation of condensation within.

Sealed or covered cable trays are not recommended. These should be of the ladder type with sufficient space to allow 10mm between individual cables.

5. Paint and Finishes

The following should not be used in coatings, finishes or paints on floors, walls, ceilings, supports or equipment.

Asbestos in any form, glass or other material fibres, PTFE, PVC, PVdC, Polyurethane, Lead, Cadmium, Chrome, Mercury, Arsenic, Antimony or their compounds.

6. Drains

Equipment and floor drains should be screened to prevent solid debris entering the trade waste sewer and should be covered both within and outside buildings to avoid odours and pests. All above-ground discharge points from buildings should be screened on the outside to prevent entry of pests. Areas round cylinders should incorporate provision for wash-down.

7. Control Panels and Boxes

Whatever mounded on walls, the boards should not be sealed to the wall, but have a 150mm gap to the wall or have sufficient free space to allow inspection for debris and its removal. They should not be placed in corners of rooms where access for removal of debris will be limited. In leaf warehouses where fumigations may take place, the phosphine fumigant will corrode electrical equipment, consequently it may be appropriate to seal sensitive electrical components.

8. Equipment Mounting

Placement of all equipment should allow safe access for examination and cleaning round it. Items should have a minimum of 100mm to 150mm of free-space from either walls or floor. Equipment e.g. cigarette makers should **NOT** be sealed to the floor. Permanently mounted access ladders and walkways with guard rails should be provided to cylinders and other equipment at high level for inspection, maintenance and cleaning. Wherever equipment is a source of heat and/or steam, adequate head-space to the ceiling should be present to avoid condensation.

9. Water and Plumbing

Process water and steam must be from a source defined as meeting the basic requirements for drinking water, e.g. EU standards for drinking water, in relation to:

Microbiological quality
Chemical quality
Freedom from odour

PTFE valves, fittings and tapes must not be used in water or steam lines serving the production areas.

All jointing compounds, gaskets, elastromeric and plastic materials should be of the quality approved for drinking water supply.

10. Air-flows

Air movement through process areas and tobacco stores should take account of the need to avoid cold-spots and condensation on walls, floors and ceilings. In RH- and temperature-controlled areas such as cut tobacco stores an even flow of circulated air is required throughout.

11. Leaf Storages

If leaf storages are to be subject to fumigation, all electrical fittings must be of a type appropriate for use where phosphine may be present. Fans, ventilators and windows should be designed to permit gas-tight closure and remote operation for venting after fumigation. Vents should be directed into the site unless the stores are remote from boundaries. Access points to leaf stores should avoid any possibility of storm water entry. The siting of leaf stores for fumigations should meet the British American Tobacco Guidelines for boundary conditions for phosphine levels during fumigation and ventilation and be at an appropriate distance from the boundary fence to minimise all risk.

12. Proprietary Materials, Composites

It is impossible to predict the acceptability, properties or potential interactions, (including with cleaning materials) of formulated proprietary products and composites from trade names or simple descriptions. To reduce the risk of untoward subsequent effects, it is recommended that the advice of the appropriate Company Additives and Materials Guidance Panel is sought at an early stage whenever it is proposed to use proprietary floorings, coatings and sealants in the construction of a processing factory.

FUMIGATION CERTIFICATE

Double click on the icon below to see a copy of a fumigation certificate which may be used or modified.

"BAT FUMIGATION CERT (New2).xls"