

Royal Thai Government
Ministry of Agriculture and Cooperatives

Thailand Methyl Bromide Phase-out Project

Pest Management Plan

Prepared By
The Project Management Unit
Office of Agricultural Regulation
Department of Agriculture
Ministry of Agriculture and Cooperatives

Submitted for Compliance with World Bank Operational Policy on Pest
Management (OP 4.09)

TABLE OF CONTENT

Pest Management Plan (PMP) for Methyl Bromide

Executive Summary

I. Introduction

II. Pest Management Plan (PMP) for Methyl Bromide

II.1 Pest Management Approaches

II.1.1 Current and anticipated problems, relevant to the use of fumigant

II.1.2 Current and proposed pest management practices

II.1.3 Relevant IPM experience within project area, country, region

II.1.4 Recommendation for adjustment of proposed pest management approaches where necessary

II.2 Pesticide Use and Management

II.2.1 Present, proposed and/ or envisage pesticide use

II.2.2 Type and quantity of pesticides envisaged to be financed by the project:

II.2.3 Circumstance of pesticide use and the ability of end – users to handle products within acceptable risk margin: the end-user of pesticides may be divided into three groups

II.2.4 Assessment of risk

II.2.5 Pre-requisites and/ or measures required to reduce specific risks associated with envisaged pesticide use under the project

II.3 Policy, Regulatory Framework and Institutional Capacity

II.3.1 Policy on pesticides and fumigant

II.3.2 Country's regulatory framework for control of the distribution and use of pesticide

II.3.3 Describe and assess all policy related to the restrictions of MB

II.3.4 Institutional capacity for implementing IPM

II.4. Strengthening of National Capacities

II.5. Monitoring and Evaluation

II.6. Public Consultation and Disclosure -

LIST OF ANNEXES
Pest Management Plan (PMP) for Methyl Bromide

- Annex 1 Management Plan
- 1-A. Mitigation
 - 1-B. Monitoring
 - 1-C. Institutional Strengthening and Training for Implementation
 - 1-D. Scheduling and Reporting
- Annex 2 Code of Good Practice for Fumigation with Phosphine
- 2-A. **Contents List for the “Code of Good Practice for Fumigation with Phosphine” (translated)**
 - 2-B. Best Practice for Fumigation with Phosphine
 - 2-C. Safety Rules for Fumigators Using Phosphine
- Annex 3 Relevant Legal Documents
- 3-A. Hazardous Substances Act B.E. 2535
 - 3-B. Notification of Ministry of Agriculture and Cooperatives On the Determination of Criteria, Procedures and Conditions For Manufacturing, Importation, Exportation and Having in Possession of Hazardous Substance under the Responsibility of the Department of Agriculture B.E. 2547 (2004)
 - 3-C. Notification of Ministry of Agriculture and Cooperatives Entitled Registration, Issuance and Extension of Hazardous Substance Registration Certificate Under Responsibility of Department of Agriculture B.E. 2551(2008)
 - 3-D. Notification of the Ministry of Interior - Re: Working Safety in Respect to Environmental Condition (Chemical)*
- Annex 4 Emergency Response Plan
- Annex 5: Public Consultation and Disclosure

Executive Summary

Thailand is a Party to the Montreal Protocol and is obliged to phase-out consumption of ozone depleting substances (ODS). Major ODSs used in Thailand are CFCs, which are used in manufacturing industries and serving of equipment such as refrigeration and air-conditioning. In addition to CFCs, ODS namely “methyl bromide (MB)” has been used in agricultural sector to control insects in the storage and soil fumigation. According to the Montreal Protocol, Thailand must phase-out consumption of MB for non-quarantine and pre-shipment (non-QPS) applications by the end of 2014.

To enable Thailand to phase-out MB, the Royal Thai Government (RTG) received a grant of US\$ 2,901,600 from the Multilateral Fund through the World Bank to completely phase out consumption of MB in all non-QPS applications under the project called National Methyl Bromide Phase-out Plan (NMBPP). The implementation of NMBPP would enable Thailand to accelerate the phase-out of MB by the end of 2012, which is earlier than the original deadline. The NMBPP is a part of the ODS Phase-out project, Ozone Project Trust Fund (OTF-21926-TH). The Department of Agriculture (DoA) is a national implementing agency for the NMBPP.

Given that phosphine is commercially available alternative to MB in Thailand, the NMBPP is promoting its use to replace MB. However, phosphine is a hazardous chemical, of which the use must be handled properly to ensure efficacy to prevent insect resistance, ensure safety of the workers, and to protect environment. In addition, the Integrated Pest Management (IPM) technique will be introduced to reduce the dependence on chemical and to promote hygienic standard for commodity management. The NMBPP will not finance the cost of phosphine, but will finance the capacity building activities of government and enterprise and the capital cost required to acquire the enterprises with equipment for fumigation and IPM in effective and safe manner.

This PMP document specifies detail assessment of risks, recommendations to reduce risks, and actions taken by the government to ensure the safe and effective application of phosphine. Actions taken by the government can be classified into 3 categories i.e (i) regulatory, (ii) capacity building for DoA and users, and (iii) acquisition of equipment. The regulatory component is mainly governed by the Hazardous Substances Act 1992 to manage licensing system of fumigants and also certification system for users. The capacity building component, which aims to strengthen capacity of users to perform fumigation effectively and safely as well as educating users on IPM program, will be implemented through a series of training workshops nation-wide. DoA has developed training modules and VDO documentary on good practices for fumigation, which have been distributed to the users. In addition, DoA has established the insect resistance control unit to monitor potential resistance to phosphine. The last component assists owners of storage facilities and fumigation service providers through the sub-project to acquire fumigation and safety equipment including IPM equipment.

This PMP has been prepared and incorporated all aspects that need to be taken into account for the effective and safe fumigation. This is to ensure that the phase-out of MB consumption in Thailand would be accomplished in the sustainable manner.

Pest Management Plan (PMP) for Methyl Bromide

I. Introduction: Despite Methyl Bromide (MB) is an Ozone Depleting substance (ODS) controlled under Annex E of the Montreal Protocol, it has been contributing to the protection against many pests including insects, weeds, bacteria, nematodes, and etc. To assist the Royal Thai Government (RTG) to completely phase out its consumption of methyl bromide in all non-QPS applications in accordance with the phase – out schedule stipulated in the Montreal Protocol, the World Bank agreed to assist Thailand to implement its MB Phase-out Plan with financial support of US\$ 2,901,600 provided by the Multilateral Fund for Implementation of the Montreal Protocol. Since MB is highly effective in controlling pests, proposed alternatives need to be very effective to enable the achievement of MB phase-out objectives without compromising pest control standards in Thailand. To address this concern, the RTG will need to find alternative pest control measures that are effective, practically feasible, economically affordable and environmentally sound. These alternative pest control measures will need to be in compliance with the World Bank Operational Policies on Environmental Assessment (OP 4.01) and on Pest Management (OP 4.09 and BP 4.01 Annex C).

To meet the safeguard requirements of the Bank, the project is preparing a Pest Management Plan (PMP) to meet OP 4.09 Policy Objectives. This comprehensive PMP outlines various elements and actions to be taken in order to adequately address the above concerns during the project implementation.

II. Pest Management Plan (PMP) for Methyl Bromide: The PMP includes 5 major sections: (1) pest management approaches; (2) pesticide use and management; (3) policy, regulatory framework and institutional capacity; (4) monitoring and evaluation; and (5) cost estimates

II.1. Pest Management Approaches

II.1.1. Current and anticipated problems, relevant to the use of fumigant

Fumigation in Thailand could be classified in three major applications: (i) post-harvest applications (stack fumigation and silo fumigation); (ii) structural fumigation; and (iii) Quarantine and Pre-Shipment applications. At the moment, two available fumigants that have been registered with the Department of Agriculture through the Hazardous Substances Act 1992 in Thailand are Methyl Bromide and Phosphine. Given that the NMBPP focuses on only non-QPS applications, the PMP therefore does not address any methyl bromide use and its alternative for QPS applications.

i. Problems related to Post-Harvest applications of MB and Phosphine

Users of MB in non-QPS applications are divided into two groups (i) by enterprises doing their own fumigations, with in-house capacity to use MB and (ii) by fumigation servicing companies that are outsourced by enterprises to do their fumigation needs. Normally, companies with in-house capacity to do their own fumigation were large and medium size MB users, while the remaining enterprises outsourced fumigation servicing companies as previously mentioned. Fumigation servicing companies are one of the primary MB user group in Thailand. In addition to its ozone depleting property, improper practice of MB fumigation can lead to occupational health and safety.

Similar to MB, phosphine is used by two groups of stakeholder (i) the enterprise with in-house fumigation team, and (ii) fumigation servicing companies. In the past, due to the ease of phosphine utilization, it was found that a number of enterprises do fumigation with phosphine on their own without proper fumigation practice. The improper practice has several adverse impacts to environment, workers, and fumigation effectiveness. Firstly, improper practice may harm occupational health of the workers. Secondly, improper practice can lead to insect resistance to phosphine, which undermines the phase-out of MB in Thailand.

In Thailand, phosphine is the solely alternative to MB for the post-harvest applications. Strategies under NMBPP to phase-out MB will comprise of adoption of phosphine as alternative to MB and other non-chemical approaches such as Integrated Pest Management (IPM), Nitrogen treatment technology, etc.

The uses of MB and phosphine in Thailand are in rice, maize, cassava, rice flour, coffee, bean, pea, sorghum and animal feed. Those commodities may be stored in bulks, in silos of various sizes, or in bags. The storage time is generally about 3-6 months depending on the products. At present, there are 20 major species of stored pests detected in Thailand. These species are shown in Table 1 below. Although the damage caused by storage insects is considerable, there has been a little systematic surveillance in loss of each commodity. It is estimated that about 20% product loss due to damage of insect is incurred during storage on an annual basis.

Table 1. List of storage insect pests permanently causing damage related to MB use at post harvest

ID	Species
1	<i>Lasioderma sericeum</i>
2	<i>Stegobium paniceum</i>
3	<i>Rhyzopertha dominica</i>
4	<i>Cryptolestes pusillus</i>
5	<i>Sitophilus zeamais</i>
6	<i>S. oryzae</i>
7	<i>Ahasverus advena</i>
8	<i>Oryzaephilus surinamensis</i>
9	<i>O. mercator</i>
10	<i>Cryptolestes pusillus</i>

ID	Species
11	<i>Latheticus oryzae</i>
12	<i>Tribolium cataneum</i>
13	<i>Lophocaters pusillus</i>
14	<i>Liposcelis spp</i>
15	<i>Callosobruchus maculatus</i>
16	<i>C. chinensis</i>
17	<i>Areacerus fasciculatus</i>
18	<i>Dermestes spp.</i>
19	<i>Sitotroga cereallela</i>
20	<i>Corcyra cephalonica</i>

ii. Problems related to structural fumigation with MB.

Structural fumigation is fumigation of building or empty silos/bins prior to loading the stored products. In Thailand, such the fumigation uses only MB as fumigant and the fumigation is seldom conducted given that the enterprise has to shut down the processing plant. Quantity of MB used can be varied depending on the size of the plant. However, it is estimated that average annual share of structural fumigation is about 1-2% of total fumigation. The adoption of IPM and heat treatment are alternatives to MB structural fumigation.

iii. Potential change in pest problems that can be anticipated as a result of the project's activities

In Thailand, MB and phosphine are effective fumigants that have been adopted by the enterprises and fumigation servicing companies. As aforementioned, the ease of phosphine utilization has led to the fact that a number of enterprises including small enterprises do fumigation with phosphine on their own without proper fumigation practice. However, given that phosphine is the only alternative fumigant to MB at the moment. The NMBPP therefore proposes to convert to phosphine with an integration of pest management approaches.

The potential problem that could be anticipated from the implementation of NMBPP is insect pest resistance. This is unlikely for MB fumigation. For phosphine fumigation, poor practice leads to insect resistance problem, which is caused by leakage of phosphine gas so that concentration of phosphine does not meet the effective dose, As a result, all stages of insect pest are not killed and the resistance starts to develop.

Therefore, the NMBPP will address this potential problem by strengthening capacity of enterprises and fumigation servicing companies through the training program and acquisition of fumigation equipment to ensure that phosphine fumigation is carried out effectively and to promote best fumigation practices. In addition, insect resistance control unit is established to monitor the level of phosphine resistance across the country and to develop effective strategies to combat resistance. The NMBPP will adopt a uniform phosphine resistance management plan that will prevent the onset of resistance by reducing the selection pressure i.e. (i) monitoring of insect resistance to phosphine and the recommended dosage of phosphine by the Post Harvest Research and Development Office, (ii) suggestion on minimum insect population that need fumigation, (iii) the promotion of IPM to reduce the reliance on phosphine for disinfections, (iv) the promotion of Good Manufacturing Practice (GMP) and Hazardous Analysis and Critical Control Point (HACCP), and (v) the Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities.

With regard to safety concern, the NMBPP also provides the enterprises with safety equipment such as faced gas mask, phosphine monitoring device, and provide safety training..

II.1.2. Current and Proposed Pest Management Practices:

i. Post-Harvest Applications

a. Current practices: The existing practices for post-harvest application are chemical approach and non-chemical approach. The chemical approach is a practice that uses pesticides for disinfections of insect pests. At the moment, there are two groups of chemicals used for insect control in storage in Thailand. They are: (1) chemicals for spraying such as: Malathion, Sumithion, Actellic which are applied to the structure such as wall, floor of the building and (2) Fumigants including MB and Phosphine. Due to its penetration property, fumigants are used when there is need to disinfest insect pests living in the commodities before delivery to the customers to reduce complaints.

The non-chemical approach is used to minimize the density and damage of storage insects including: (1) storage hygiene before being filled with commodities by physical treatment; (2) regular surveillance for monitoring purposes; (3) controlled atmosphere: cold treatment, heat disinfection treatment, adjusting CO₂ concentration; and (4) Insect removal during the processing. Due to the concern on residues that may contaminate in the products, the non-chemical approach has been widely used in Thailand.

Carbon dioxide fumigation: Carbon dioxide (CO₂) has been used to disinfest stacks of processed grain in Thailand. This process takes 7 to 21 days on average, but it is difficult to achieve high mortality under the best conditions. CO₂ is potentially more dangerous to use and requires specialized equipment for detection and monitoring. Special nylon sheeting and sealing technique is required to hold the inert gas during the long fumigation periods.

Carbon dioxide a level of 380 ppm is listed as an approved organic technique for fumigating bagged commodities. Carbon dioxide has a specific gravity of 44, which means it is light and can penetrate readily into a mass of commodity like bagged grain. It is highly toxic at concentrations of 40-60% (400,000 - 600,000 ppm). CO₂ dehydrates insects and causes death by desiccation.

Cost of proposed practices for store treatment: The cost for current storage treatment practices depends on technologies. Excluding carbon dioxide, it may range from 15-30 / m³ as summarized in Table 2.

Environmental impacts: The most important impact of current practices is ozone layer depletion caused by MB. For phosphine, no evidence of impact, except the trouble when collecting phosphine tablets that are not completely decomposed since it is easy to generate flames and potentially explosions. Moreover, Phosphine may corrode copper and electronic equipments and cause pest resistance (Table 2).

Table 2: Summary of current pest management practices

Measure	Cost (Baht)	Advantages and disadvantages	Negative impacts to environment
Store Treatment			
Temperature Adjustment	Higher cost than MB use	To preserve quality of products and to inhibit insect development.	None
Fumigation with Phosphine	15-22 Baht/ m ³ depending on source of Phosphine	High efficacy to control pests for durable commodities. Need longer exposure period and may cause resistance of insects if not properly done.	No evident, but may cause spontaneous combustion if the concentration exceeds the flammable limit
Fumigation with MB	25-30 Baht/ m ³	High efficacy to control pests for durable commodities	Depleting ozone layer
Carbon dioxide fumigation	12,500 Baht / 21 tones (servicing fee)	High efficacy to control pests during living period for durable commodities	None
Structure Treatment			
Store hygiene with systemic chemical pesticides	N/A	Routine process and low cost. Can be widely applied for any store before filling product	Insignificant due to infrequent application such as Malathion, Sumithion, and Actellic
Fumigation construction with MB	25-30 Baht/ m ³ of structure	High efficacy and broad spectrum	Depleting ozone layer

b. Proposed practices: For alternative of MB use, a series of techniques including current and new ones have been determined. They include: Aluminum phosphide fumigation with recirculation system; Magnesium phosphide fumigation with recirculation system, Carbon dioxide fumigation; nitrogen treatment and integrated pest management.

Generally, cost of magnesium phosphide fumigation is much higher than aluminium phosphine fumigation. The Carbon dioxide fumigation is also costly comparing with aluminium phosphine fumigation and need longer fumigation period. Nitrogen treatment has comparative advantage for fumigation of premium products as this is chemical-free treatment. Therefore, the most appropriate method is aluminum phosphide fumigation and nitrogen treatment.

Aluminum/magnesium phosphide fumigation with recirculation system: Given that the recirculation system has not been widely used in the current practice for phosphine fumigation, the NMBPP aims to improve efficacy and safety of phosphine fumigation through the installation of recirculation system. This is to ensure that phosphine will be well penetrated through commodity, evenly distributed in the enclosure, and to ensure that phosphine concentration will not exceed the explosion level.

Nitrogen treatment: Nitrogen treatment is a method to control insects in all stages of development in post harvest commodities without using toxic chemicals and without negative effect on the quality of the products. Nitrogen treatment is based on the establishment of a low-oxygen environment which kills insects by means of establishing a nitrogen generator. The low-oxygen atmosphere is applied in airtight environments which range from 1 to 1000 m³ or in climate controlled rooms. The nitrogen treatment takes 3-5 days depending on the type of product and type of insect. With the nitrogen treatment, there will be no need for the enterprise to fumigate with MB or phosphine. As a result, this treatment will be able to reduce the reliance on the use of fumigation through both MB and phosphine.

Environment impacts: The impacts of proposed practices are referred in Table 3. Except impacts of phosphine as mentioned above, there are no impacts caused by other proposed practices to environment.

Table 3: Summary of proposed practices

Measure	Cost (Baht)	Advantages and disadvantages	Negative impacts to environment
Store Treatment			
Aluminum phosphide fumigation with recirculation system	15-22 Baht/ m ³ depending on source of Phosphine	High efficacy to control pests for durable commodities. Need longer exposure period and may cause resistance of insects if not properly done.	No evident, but may cause spontaneous combustion if the concentration exceeds the flammable limit.
Magnesium phosphide fumigation with recirculation system	25 Baht/ m ³	As above	As above
Nitrogen treatment	High capital cost, but low operating cost	Nitrogen treatment has comparative advantage for fumigation of premium products as this is chemical-free treatment.	None
Integrated pest management (IPM) package ¹	Higher cost compared to MB	Can be used alternatively with fumigation method in case of necessary/ or losing of efficacy	None
Structure Treatment			
Heat treatment	More expensive than combined heat-phosphine fumigation due	Safe. Less sealing is needed. Resistance is not a problem. Insect are susceptible to extreme temperatures.	None

¹ Including screens, insect trapping, rodent and bird control, vacuuming, insect resistance monitoring, residual insecticide application and inspection

Measure	Cost (Baht)	Advantages and disadvantages	Negative impacts to environment
	to the need to reach higher temperature		
Combined heat-phosphine fumigation	Typically 0.5-0.7 USD/m ³	High efficacy to control insects. Can be widely applied for any store before filling product but need to control resistance.	No evident, but may cause spontaneous combustion if the concentration exceeds the flammable limit.

ii. Pest Control for Structure

a. Current practices: The practices of pest management for structure are chemical approach and non-chemical approach. The chemical approach is a practice that uses pesticides for disinfestations of insect pests. At the moment, there are two groups of chemicals used for insect control in stores in Thailand. They are: (1) chemicals for spraying such as: Malathion, Sumithion, Actellic which are applied to the structure such as wall, floor of the building and (2) Fumigants with MB. The non-chemical approach is used to minimize the density and damage of storage insects including: (1) storage hygiene before being filled with commodities by physical treatment and inventory management and (2) regular surveillance for monitoring purposes.

Cost of current practices: The cost of current practices is highly dependent on the treatment materials and sites as summarized in table 2.

Environmental impacts: Both MB and chemicals used for structure treatment may cause negative impact to environment. The impact of MB has been referred to before. For other treatment with pesticides, beside the consequence of pest resistance, pesticides may all cause pollution and contamination if it is leached. However, given that (i) all of operators normally follow recommendations (dosage, procedure, safety) from the manufacturer, (ii) the frequency of treatment with pesticide is low (2 times a year) and (iii) it is the spot treatment inside the structure, it is anticipated that the impact is not significant.

b. Proposed practices: The project proposes to replace the use of MB in structural fumigation with either heat treatment or the combined heat-phosphine fumigation method. Experimental and full-scale fumigations of flour mills and food processing plants have shown this method to be highly effective against all stages of insect life.

iii. National service aimed at providing fumigation management advices/ service:

a. Hazardous Substances Act 1992

Fumigation takes an important role especially in storage and structural treatment. To undertake this action, the Hazardous Substances Act 1992 has been used to control import, export, and having in possession of MB in Thailand (see Annex 3-A). The Pesticide Regulatory Subdivision is assigned by DoA to manage licensing system of MB import and also certification system for MB users. To facilitate and manage the activities, various regulations and legal documents have been promulgated such as the Notification of Ministry of Agriculture and

Cooperatives on the Determination of Criteria, Procedures, and Conditions for Manufacturing, Importation, Exportation and Having in Possession of Hazardous Substances under the Responsibility of DoA (see Annex 3-B), and the Notification of Ministry of Agriculture and Cooperatives Entitled Registration, Issuance and Extension of Hazardous substances Registration Certificate under the Responsibility of DoA (see Annex 3-C).

To date, there are 7 importers of MB namely Kemfac, Muroh International, OMIC, Asia Pest Control and Inspection, M C Solvent, SGS (Thailand), and Ampa Intertrade. These importers then sell MB to MB users. At present, there are about 70 companies registered with DoA as having MB in possession, of which 22 companies are fumigation servicing companies. All 22 fumigation servicing companies can supply any fumigation service. The rest are in-house fumigation enterprises, who use MB to meet their own disinfestation need.

b. Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities

In addition, DoA has issued a Notification regarding Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities in March 2008. The Notification does not recommend the use of fumigants (including methyl bromide) in processed commodities comprised of: (i) flour, starch and their by-products such as rice paper, tapioca pearl; (ii) dehydrated fruits; (iii) foodstuffs, and food ingredients; and (iv) manufactured agricultural commodities such as natural rubber, wood base and engineered wood base products. Frozen fruits and vegetables are also included in this Notification as they are free from pests. Wood packaging material under International Standard on Phytosanitary Measures No. 15 (ISPM15) is not included in this Notification.

Given that there is a very low risk that these processed commodities have any pests given that pests would be eliminated during manufacturing process. Following Good Manufacturing Practice (GMP) and Hazardous Analysis and Critical Control Point (HACCP) would result in processed commodities that are pest-free, according to DOA requirements. In this regard, GMP and HACCP are used for issuance phytosanitary certification of these commodities when exported to other countries. In addition, an accreditation scheme for manufacturing process of these commodities is an incentive for exporters to obtain phytosanitary certificates, without the need for individual inspection and evaluation of treatment by DOA officers. Interested manufacturers of these processed commodities can apply for this accreditation scheme. The working groups established by the Office of Agricultural Regulation will inspect and evaluate the manufacturer qualifications and methodology. If requirements are fulfilled, a two-year certificate will be issued to the enterprise. Periodically random inspections will be made to ensure the good manufacturing process throughout the validity of certificate. When requested from exporters, DOA would issue phytosanitary certificate for said exported commodity that was produced by manufacturer holding valid certificate without the need to re-conduct inspection and evaluation. With the regulation, considerable quantity of fumigant can be reduced.

c. Working Safety in Respect to Environmental Condition

The Ministry of Interior has issued the Notification regarding working safety in respect to environmental condition from chemical, which prescribes welfare on health and safety of the

employees. Working safety from the use of MB and phosphine are also included in the Notification (see Annex 3-D).

For MB, the Notification requires that the average quantity of MB density in the atmosphere shall not exceed 20 ppm (80 mg/m^3) throughout normal working period within the place of operation where the employee works. For phosphine, the Notification specifies that, no matter at any time of the normal working period, the employer shall not let the employee work in the place where the phosphine density in the atmosphere exceeds 0.3 ppm(0.4 mg/m^3).

The Notification also requires that, within the place of operation where chemicals specified in the Notification are used, and the conditions of use may be harmful to the user or to those nearby, the employer shall prepare a specific room or building for the use of such chemicals. Air filter to cover the nose and mouth to protect against chemical shall be capable of reducing the density of chemical not to exceed the specified level accordingly (see Annex). In addition, the regulation also requires that the respirator used to protect against fume, gas or chemical vapor shall be the full-face type which is self-contained with air cylinder, or be the type which the air hose is connected from other source of supply

II.1.3. Relevant IPM experience within project area, country, region:

IPM program was introduced into Thailand through the implementation of Demonstration Project, which was approved by the Multilateral Fund in 1998 and implemented through the UNIDO. Normally, the beneficiaries under the NMBPP are enterprise related to the processing and manufacturing of foods for human and animal feeds, which have to be certified to the Good Manufacturing Practice (GMP), Hazardous Analysis and Critical Control Point (HACCP), and ISO standard. Under this certification, the principle similar to IPM has been adopted as part of the certification process. Therefore, these enterprises would be able to adopt IPM technique to reduce the loss by insect pests under the NMBPP.

II.1.4. Recommendation for adjustment of proposed pest management approaches where necessary

It is believed that techniques selected as alternatives, have been successfully applied in Thailand or other countries, the predictable risks of pest control is only in cases pests resistance to phosphine. To avoid this problem, the project has proposed to provide training and proper fumigation equipment with phosphine. The training will be organized by the authorized training centers of DoA located across the country, which have been established under the NMBPP. The objective of the training is to strengthen capacity of the enterprise in how to fumigate with phosphine effectively and safely and how to integrate the IPM concept for their pest management program to reduce the reliance on fumigation. Equipment provided to the enterprise would enable them to monitor concentration of the phosphine during the fumigation period to ensure that concentration is maintained at appropriate level (250 ppm) and there is no leakage of phosphine throughout the fumigation period. The effective fumigation can prevent insect resistance to phosphine.

In addition, the NMBPP has established an insect resistance control unit within DoA, which will be responsible for monitoring situation of insect resistance to phosphine across the country. Roles and responsibility of the insect resistance control unit is to (i) periodically collect insect

sampling from all locations across the country and test for resistance in the laboratory, (ii) conduct an experiment to determine recommended dose that could effectively kill each insect at all stages. In case of any suspicious on the insect resistance to phosphine, the enterprise can also notify the insect resistance control unit to collect sample of suspected insect and test in the laboratory. The insect resistance control unit is critical component for the sustainable phase-out of MB and adoption of alternative. If any potential insect resistance is detected, the insect resistance control unit will recommend action to address the issue, which would be disseminated to key stakeholders to prevent further development of resistance.

II.2. Pesticide Use and Management

II.2.1. Present, proposed and/ or envisage pesticide use

There are various methods of pests control for post harvest and structure treatment, which can be classified into 2 main categories that are chemical approach and non-chemical approach. Under the NMBPP, the following alternatives are proposed:

- **For storage treatment:** For post-harvest application, fumigation is still considered as the most widely used method by the enterprises due to the ease and effectiveness of applications in killing insect pests. The project proposes to replace MB in storage fumigation with phosphine (aluminum phosphide or magnesium phosphide) or nitrogen treatment. In addition, IPM program will be integrated in the pest management under the NMBPP.
- **For structure treatment:** Pesticides are mainly used for store hygiene before storing commodities. In this case, it is often integrated with other methods such as physical cleaning, screening or ventilation. The use of MB for structural fumigation in Thailand is low (only 1-2%). The project proposed to replace MB structural fumigation with heat treatment or combined heat-phosphine fumigation.

Table 4: Proposed Alternatives to MB

Applications	Technique
Storage Fumigation	Aluminum Phosphide / Magnesium Phosphine
	Nitrogen Treatment
	IPM
Structural Fumigation	Heat Treatment
	Combined heat-phosphine fumigation

For the conversion associating with phosphine, the NMBPP will finance the enterprise to acquire fumigation equipment and safety equipment, which can be varied from one enterprise to another depending on their baseline. These equipment are (i) phosphine monitoring device (low range and high range), (ii) faced gas mask and canister, (iii) explosion-proof portable ventilator, and (iv) fumigation sheet.

For the conversion associating with nitrogen treatment, the NMBPP will finance some enterprises with in-house fumigation team to acquire nitrogen generating system as one of alternatives. IPM is an approach that can help to reduce the reliance on fumigants, which can avoid risks associated with occupational health of the workers during the operation. NMBPP has incorporated IPM component to minimize the use of fumigations (MB and phosphine). Activities under IPM include storage hygiene, monitoring of the warehouse, and physical control. Training on IPM and basic equipment for IPM will be provided to all enterprises as part of the assistance.

It is, however, noted that the enterprise will receive funding up to the maximum funding level established for the enterprise classified in each type. The rest will be borne by the enterprise as counterpart funding.

II.2.2. Type and quantity of pesticides envisaged to be financed by the project:

The NMBPP aims to phase-out consumption of MB for non-QPS application in 2002, which was about 403 tons (241.8 ODP tons), through the phased reduction and will completely phase-out consumption of MB by 2015. As mentioned earlier, about 98-99% of total consumption of MB is used for post-harvest application in stack fumigation and silo/bin fumigation. Only 1-2% is used for the structure fumigation. Therefore, about 398 tons of MB was used in post-harvest application and the remaining 5 tons was used for structural fumigation. With an average dosage of MB 32 gram/m³ of fumigated product, 398 tons of MB in 2002 was used for fumigation of 12,437,500 m³ of products annually. With the dosage rate of phosphine of 1 gram/m³ of fumigated product, about 12,437.5 kg (12.4 tones) of phosphine is needed. Nitrogen is not applicable in this case as it is not the pesticide.

The NMBPP will not finance the cost of phosphine, but will finance the capacity building activities of government and enterprise and the capital cost required to acquire the enterprises with equipment for fumigation and IPM in effective and safe manner.

II.2.3. Circumstance of pesticide use and the ability of end – users to handle products within acceptable risk margin: the end-user of pesticides may be divided into three groups:

- **Fumigation servicing companies and in-house fumigation enterprises:** In accordance with requirement of DoA, all workers from 70 companies registered with DoA as having MB in possession (of which 22 companies are fumigation servicing companies) have been trained with fumigation techniques. With regard to phosphine, the training provided under the NMBPP would enable these stakeholders to properly utilize phosphine as alternative to MB. The financial assistance under NMBPP for acquisition of fumigation equipment (type I for in-house fumigation enterprises and type 3 for fumigation servicing companies) would supplement these enterprises to apply fumigants in accordance with the required safety measures during treatment of store commodity and structure.
- **Pesticides suppliers:** This group may access with pesticide through commercial process. This activity now is under strict control of the Office of Agricultural Regulation of DoA. According to the regulation, suppliers of pesticides must undergo training provided by the Office of Agricultural Regulation on how to handling, store and use protective gears when contact with pesticides. In addition, the pesticide suppliers have been regularly

monitored through mechanism conducted by the Agricultural Inspection Officer. Therefore, there will be almost no risk with this group during accessing and purchasing pesticides.

- **Farmers and small end-users:** Through IPM and other training program provided by pesticide companies on proper and safe use of pesticide, knowledge of farmers and small end-users on safe use of pesticides has been improved. Thus they can handle and use pesticides with minimum risk to their health and environment. Under the NMBPP, these stakeholders are considered as type 2 beneficiaries and will be trained on the use of phosphine through the nation-wide training. Basic equipment for phosphine fumigation and IPM (including insecticide application) will be provided to the enterprises that have participated in the project.

II.2.4. Assessment of risk:

The actual potential risk of alternatives may come from storage, transportation and usage of all chemical pesticides, including phosphine. It should carefully select the suitable equipment for transportation, storage, and avoid or protect the equipment contained copper to expose to phosphine when conducting fumigation. The risk of using phosphine for fumigation can be classified into 4 stages from start to the end as follows:

- Phosphine is also a flammable and explosion fumigant if concentration exceeds flammable limit, it is essential that the enterprises carefully inspect conditions of area to be fumigated prior to the commencement of phosphine fumigation. In addition, after applying phosphine to the product, it is essential that the enterprises monitor concentration of phosphine gas in the enclosure for the efficacy and not to exceed the flammable limit.
- Another potential risk of phosphine fumigation is gas leakage from the enclosure. Normally, enclosure must be completely sealed in order to prevent leakage of phosphine gas throughout the fumigation period. However, if the fumigation sheet is worn out or not properly enclosed or the silo/bin is not airtight, the workers may expose themselves to the phosphine gas.
- Phosphine fumigation needs ventilation of phosphine gas from the enclosure and silo/bin at the end of the process. During the ventilation, the concentration of phosphine released to the adjacent area may exceed the Threshold Limit Value designated by the Ministry of Interior (0.3 ppm.) if there is no equipment to draw phosphine gas from the enclosure. The phosphine gas will slowly release around the risk area and can harm the workers. In addition, equipment to draw must be explosion-proof to ensure that there will be no electricity spark during the ventilation of phosphine gas from the enclosure.
- The collection and disposal of residual after fumigation also need to be carefully done to avoid fire potential. However, this potential risk is applicable only when the chemical reaction between the phosphine tablet and moisture in the air is incomplete. In addition, the residual must be properly disposed of in open and well ventilated waste bin or according to the manufacturer recommendation to avoid environmental pollution.

II.2.5. Pre-requisites and/ or measures required to reduce specific risks associated with envisaged pesticide use under the project:

In order to reduce specific risk associated with envisaged pesticide use under the project as mentioned above, a detailed training program has been designed under the NMBPP to improve capacity of phosphine end-users at all levels (in-house fumigation enterprises, fumigation servicing companies, and small enterprises). The potential risks as mentioned above will be addressed during the training under the NMBPP. Scope of training will cover both efficiency and safety aspects to ensure that there is no adverse impact from the use of phosphine to replace MB and that the phase-out of MB can be achieved in the sustained manner. The IPM program has been proposed under the NMBPP to reduce reliance on fumigant. Scope of training would comprise of, but not limit to, the followings:

- Knowledge about regulations related to fumigation;
- Code of good practice for phosphine fumigations (fumigation techniques and safe use of pesticide);
- Fumigation and personal protective equipment
- Symptoms and Poisoning caused by fumigants
- Emergency and first aid treatments.

The training will be conducted by the authorized training centers of DoA and comprise of theoretical and practical training. Fumigation and personal protective equipment will be demonstrated to the participants during the training to ensure that the enterprises have understanding on the use of equipment effectively and safely.

The Project Management Unit has developed several training manual as follows:

- Training on MB alternatives. Content of the training manual are similar to the scope of training as mentioned above plus IPM program;
- Code of good practice for MB and phosphine fumigation: The manual focus on the fumigation technique as well as precaution and safety.
- VDO documentary: This tool demonstrates how to conduct fumigation with phosphine.

Apart from the training, the financial assistance through the sub-projects for acquisition of fumigation and safety equipment would assist the enterprises to properly follow the code of good practice for fumigation, which can reduce adverse impacts from the use of phosphine as follows.

- In case of silo fumigation, the NMBPP will assist the enterprise to identify potential leakage of fumigant from the silo that may be found in the joints. If need be, the modification to fix the leakage of silo bins will be incorporated in the sub-project.
- Phosphine monitoring device will be used to examine that concentration of phosphine in the enclosure are not less than 250 ppm and are not over the flammable limit throughout the fumigation period.

- Phosphine monitoring device will be used for monitoring any leakage of phosphine gas in the working area. If so, evacuation of the workers from the contaminated area is essential and immediate actions should be made to dilute concentration of the phosphine gas to the safety level and to fix the contaminated area.
- At the end of fumigation process, phosphine gas will be ventilated using explosion-proof portable ventilator. The explosion-proof ventilator would draw phosphine gas from enclosure/silo to the well ventilated area through flexible duct. The enterprise will also use phosphine monitoring device to monitor concentration at the working area and ventilated area to check whether it exceeds the Threshold Limit Value designated by the Ministry of Interior. The use of such device would enable fumigators / workers to access to and work in a safety manner.
- During the operation, the enterprise will use faced gas mask with proper canister, which can prevent fumigators / workers to inhale toxic fumigant gas during the working time including time necessary to enter the contaminated area if an emergency situation develops in which worker may be exposed.

A Code of Good Practice for phosphine fumigation has been prepared by DoA (in Thai) and it will be published in November 2010. Personal protection and safety regulations for phosphine fumigation are an important part of the Code of Good Practice (see a translated List of Contents for the Code of Good Practice in Annex 2-A).

The Best Practices for Phosphine Fumigation and Safety Rules for Fumigators Using Phosphine for phosphine fumigation is the basis for developing the Code of Good Practice for Fumigation (in Thai) is shown in Annex 2-B and Annex 2-C respectively.

II.3. Policy, regulatory framework and institutional capacity

II.3.1. Policy on pesticides and fumigant:

In Thailand, MB and phosphine, and pesticide are strictly controlled and regulated by the DoA under the Hazardous Substances Act 1992. Under the Hazardous Substance Act 1992, MB and phosphine are classified as type III hazardous substances. Pesticides are classified as either hazardous substances type III or type IV depending on the chemical. If the pesticide is classified as type III, the same provisions with MB and phosphine are applied. If the pesticide is classified as type IV substances, it cannot be produced, imported, exported or having in possession in Thailand.

The Hazardous Substances Act 1992 requires that any production, import, export and having in possession of type III hazardous substances are controlled by the designated authority. For MB, phosphine and pesticides, Pesticide Regulatory Sub-division, the Office of Agricultural Regulation, DoA is assigned as authority to responsible for the requirement according to the Hazardous Substances Act 1992. **Registration of Pesticides and Fumigants**

Any pesticides to be introduced in Thailand must seek approval from DoA through the registration with the Pesticide Regulatory Sub-division. As part of the registration process,

efficacy data, analysis procedures and safety issues of the active ingredient must be approved by the Toxicological Working Group. Once the registration process is completed, that chemical would be able to be marketed in Thailand. Registration Certificates for hazardous substances are valid for 6 years.

Import/Export of Pesticides and Fumigants

According to the Hazardous Substances Act 1992, DoA has established a licensing system for import and export of MB, phosphine, and pesticide. Any enterprises wishing to import or export the pesticide and fumigants need to obtain import/export license from the Pesticide Regulatory Sub-division. The import/export license is mandatory for importer/exporter to furnish to the Customs Department in clearing the shipment entering to Thailand or leaving from Thailand.

Having in Possession Pesticides and Fumigants

In addition, according to the current legislation, fumigation servicing companies and in-house fumigation enterprises must register with the Pesticide Regulatory Sub-division for their MB usages. According to the Regulation of the Ministry of Agriculture, it is mandatory for any parties having MB in possession to be licensed by the DoA. The enterprise must designate at least one employee to be trained by DoA. Training to be provided to the enterprise comprising of i) knowledge about regulations related to MB and fumigation; ii) Stored Product Pests: iii) Fumigation Techniques and safe use of pesticide; iv) personal protective equipment such as face gas mask with the right type of canister, self-contained breathing apparatus. v) Symptoms and Poisoning caused by fumigants; and vi) First Aid Treatments.

It is noted that the above provisions are applied to the case of having pesticide in possession. Any parties having pesticide in possession must be licensed by the DoA. The enterprise must designate at least one employee to be trained by DoA. The certificate of training is valid for 5 years. The license of possession will be given to enterprise fulfilling DoA requirement and is valid for 1 years. However, license must be extended on the annual basis and the enterprise must fulfill the conditions set forth in the procedure for the extension. Site inspection at the premises to inspect all the safety is mandatory to get the license.

II.3.2. Country's regulatory framework for control of the distribution and use of pesticide:

1. *Availability of trained inspector for pesticide control:* To enforce the Hazardous Substances Act 1992, the Office of Agricultural Regulation has established its inspection network from the center to locals. The inspection officer are responsible for undertaking regular and extraordinary inspection of the conditions of production facilities and the whole processes related to production, formulation, distribution and usage to ensure pesticide quality and proper use. To undertake this task, these inspectors have been well trained on knowledge of professional inspection. During the inspection, inspectors may take samples for quality check which will be done by the Office of Agricultural Production, Science Research and Development.
2. *Control of pesticide package and label:* The Hazardous Substances Act 1992 empowered the Minister to define quantity, composition, qualifications and mixtures, containers, methods of examining and testing the containers, labels, productions, imports, exports,

sales, transports, storage, disposals, destruction and treatment of hazardous substance containers. Notification of Ministry of Agriculture and Cooperatives on the Determination of Criteria, Procedures, and Conditions for Manufacturing, Importation, Exportation and Having in Possession of Hazardous Substances stipulates that the manufacturer of hazardous substance shall provide label which is large enough attached to the package for transportation with the statement identifying common name of hazardous substance, the quantity of main ingredients or the rates of main ingredients, hazardous substance symbols such as corrosive substance, flammable substance and toxic substance, etc., and the warning signs, for example, no tossing and no hooking, such mark and letter must be obviously clear. The format and content of label is also controlled by DoA and must be in Thai. Therefore, all pesticides are properly packaged and labeled before and during distribution to the market.

3. *List of Controlled Pesticides and Fumigants:* The list of pesticides and fumigant permitted for production, import, export and having in possession in Thailand is reviewed and revised periodically by the Hazardous Substances Committee, which is chaired by the Permanent Secretary of the Ministry of Industry.
4. *Quality Control:* To strengthen capacities for enabling the monitoring of pesticide quality, the Agricultural Production Sciences Research and Development Office of DoA has established the laboratory as the facility for pesticide testing. The inspection officers can send sample of suspected pesticide collected during the monitoring process to the laboratory for examining its composition.
5. *Capacity of medical staff to recognize and treat pesticide poisoning:* According to the labeling requirement of pesticide, it is mandatory that the guideline on first aid of pesticide poisoning is presented on the pesticide label. Training provided to stakeholders having in possession of pesticides and fumigants as part of certification process includes a session related to first aid of pesticide poisoning. The NMBPP reiterates this issue by including the first aide treatment in the training agenda. For further information, the stakeholders are advised to contact the Toxicology Center of Mahidol University.
6. *Disposal of Unwanted Hazardous Substances:* Disposal of hazardous substances must follow guidelines of the Notification of Ministry of Agriculture and Cooperatives on the Determination of Criteria, Procedures, and Conditions for Manufacturing, Importation, Exportation and Having in Possession of Hazardous Substances. The Notification stipulated that segregation of the disposal of toxic substance and containers out of the general containers is needed prior to destruction under the special incinerator with the temperature over 1,000 degrees Celsius or delivery for destruction at the incinerator of the industrial estate or the custom-hired company of such disposal.

II.3.3. Describe and assess all policy related to the restrictions of MB

MB is classified as hazardous substances type III under the Hazardous Substances Act 1992. The regulation regarding registration, importation and having in possession of MB has been described earlier. Other policies related to restriction of MB are elaborated below:

MB Quota for non-QPS Application

Licenses Certificates for importing of the hazardous substances are valid for three years. However, License Certificates for importing MB are considered special cases among Type III substances, and they are valid for two months after being issued. This expiration deadline has been effective since the beginning of the year 2005. Each license can be used for only one shipment (one 20 feet container or 16 metric tonnes). In addition, import of MB against issued licenses must be done in that calendar year and cannot be carried over to be imported in the next year.

At present, there are 7 importers of MB in Thailand. Given that MB is controlled substances under the Montreal Protocol whose non-QPS consumption must be gradually reduced, the DoA has set up the quota system to importers of MB. The quota allocated to each importer is based on quota given in the previous year taking into account reduction schedule of the year that the quota is issued. Total quota issued to all importers must not exceed allowable consumption as allowed under the agreement between the ExCom and the RTG.

It is, however, noted that quota means the amount of MB that has been used for non-QPS applications. There is no restriction on the import of MB that has been used for OPS application, which is currently exempted under the Montreal Protocol. During the application of new import license, the importers of MB must submit a report of MB usage of the previous shipment to the Pesticide Regulatory Sub-division. The report contains information regarding type of product for MB application, date of application, quantity, and importing countries. The Pesticide Regulatory Sub-division will then review the report and calculate the amount of MB in the previous shipment that has been used for non-QPS applications. Such the amount will be deducted from the quota allocated to that particular importer.

Management Information System (MIS)

To ensure that MB that have been claimed against QPS applications are in line with the QPS definition under the Montreal Protocol, the DoA has set up the Management Information System (MIS) as part of the NMBPP. The MIS includes information regarding NMBPP-related information, registration, licensing, imports, consumption, monitoring and enforcement. This database will also contain names of users, importers, quantities of MB used for QPS and non-QPS consumption.

MIS is a decentralized design that will allow related users of the MIS (Plant Quarantine Stations across Thailand) to enter information into the database from various points (multiple information-entry points). With security system, related users of MIS will have different accessibility to the MIS to ensure that confidential information is not accessed by unauthorized parties.

According to the MIS design, the Phytosanitary Certificate Issuance Offices, the Office of Agricultural Regulation will enter related information of fumigation (i.e. name of exporters, type and amount of product, amount of MB used, date of fumigation, country of destination etc.) into the MIS database. Plant Quarantine Stations throughout the country will access such database

and enter information to confirm that the commodity has been already treated and exported from Thailand.

In the meantime, importers of methyl bromide will also be required to enter information regarding MB used for QPS and non-QPS applications of each import license into the MIS database. Information to be entered includes type and amount of product, amount of methyl bromide used, date of fumigation, country of destination, name of exporters/enterprises etc. Prior to issuing a new import license, the Pesticide Regulatory Sub-division would access information entered by the Plant Quarantine Stations and by that particular importer. Information from two sources will be verified for any consistencies and investigated, if any. In addition, the Pesticide Regulatory Sub-division will also verify information entered by importer as to whether it fulfills definitions of QPS as defined under the Montreal Protocol in order to determine the amount of methyl bromide used for QPS and non-QPS applications for previous import license.

The MIS has been fully in operation since 2009 and regularly monitored by the Project Management Unit of the NMBPP.

II.3.4. Institutional capacity for implementing IPM:

Normally, the beneficiaries under the NMBPP are enterprise related to the processing and manufacturing of foods for human and animal feeds, which have to be certified to the Good Manufacturing Practice (GMP), Hazardous Analysis and Critical Control Point (HACCP), and ISO standard. Under this certification, the principle similar to IPM has been adopted as part of the certification process. Therefore, these enterprises would be able to adopt IPM technique for prevention of insect pests under the NMBPP.

With regard to the institutional capacity, the NMBPP has included IPM program as an alternative to MB. IPM program is the component that encourages owners of storage facilities to adopt hygiene sanitation technique to avoid insect infestation and therefore alleviate the need for chemical dosing to destroy them. Hygiene sanitation technique includes screening, insect trapping, rodent and bird control, vacuuming, insect resistance monitoring, residual insecticide application, inventory management (first-in first-out) and inspection. Under the NMBPP, the IPM program will be taught to end-users of fumigants during the training workshops to be organized by the authorized training centers. The authorized training centers have capacity to undertake the nation-wide training workshop as they are attached to the Office of Agricultural Research and Development (OARD) located across Thailand and to the Port of Bangkok Plant Quarantine Station.

II.4. Strengthening of national capacities: All activities and components requiring funding from the project are delineated in the project proposal. However, for a successful and sustainable deployment of feasible MB alternatives, the project will need a strong support and commitment of Government to keep developing more effective and environmentally sound IPM technologies through research projects. This may be the best way to ensure the future success in phasing out MB beyond this project. Moreover, it is also necessary to facilitate pesticide and fumigation companies/ enterprises adopting new advance technologies for alternative of MB by giving them priority during accessing registration procedure and through financial encouragement policy (lower or free of tax etc.).

II.5. Monitoring and evaluation:

Monitoring and evaluation is shown in Annex 1-B of the PMP.

II.6 Public Consultation and Disclosure:

Public consultations have been held during the past three years through a series of six workshops (see details in Annex 5) which have addressed the key issues in the use of Methyl Bromide and its alternatives (principally Phosphine) as a fumigant. The workshops provided training and discussion forums to consult with owner of storage facilities, fumigation servicing companies, concerned government agencies and associations, importers, and suppliers and trainers to consult and discuss the Training Manual produced by the ODS project team and published as an official Department of Agriculture document. The issues addressed included the use of Methyl Bromide and Phosphine, testing for leaks, associated safeguards, health considerations, IPM alternatives, etc. A video was also produced on DVD in mid-2009 to accompany the Training Manual and illustrate the typical equipment and procedures involved with fumigation as well as the proper handling and use of fumigation chemicals. This is a summary of the consultation workshops conducted so far where the Manuals and DVD are provided to all participants. More consultation and training events are currently being planned for early-2011:

- **December 2007** - Consultation on finalization of the Training Manual with stakeholders which used the feedback to improve the text. The revised version of the “Training Manual on the Methodology for Methyl Bromide and its Alternatives” was published early in 2008 and officially endorsed by DOA. In addition to fumigation practices for insect control, it also includes sections on IPM, Rodent and Bird Control, Safety and Safeguards and Health.
- **13-14 May 2008** - Train-the-Trainers Workshop by the project PMU in DOA for 35 people to discuss the preparation of training modules based on the MeBr Training Manual.
- **11-12 March 2009** - Brain Storming consultation session on the Fumigation Publication for 172 people. The first day was a broad presentation, the second day was a technical discussion on best practice and procedures for 30 government and industry specialists.
- **6 May 2009** - Training Workshop for Fumigators for 70 people, representing 30 fumigation servicing companies and DoA to discuss techniques for phosphine fumigation and first aid for patient exposing to phosphine, etc.
- **16 September 2009** - Training Workshop for Fumigators as the follow-up workshop to the workshop in May 2009 with the focus on practical session. There were 50 people representing 20 fumigation servicing companies and DoA to discuss and undergo practical training on code of good practice for fumigation and use of fumigation and safety equipment.
- **4 February 2010** - Training Workshop on the safe use of Fumigation Equipment, repeated due to high demand. There were 35 people representing 14 fumigation servicing companies and DoA to discuss and undergo practical training on code of good practice for fumigation and use of fumigation and safety equipment.
- **Future** – Alternatives to the MeBr controlled atmosphere approach.

As a result of these consultation events, the DOA has developed a set of solid training materials and has succeeded in disseminating details of fumigation procedures, best practice, licensing issues, alternatives and safeguards to all of the major actors in the industry in Thailand.

Annex 1
Management Plan

1-A. Mitigation

Project Activity	Potential Environmental and Health Impacts	Proposed Mitigation Measure(s) (incl. legislation & regulations)	Institutional Responsibilities (incl. enforcement & coordination)	Cost Estimates (USD)	Remarks
<i>Regulations</i>	Improve efficiency of fumigation and worker safety	Development of pest control standards for storage facilities	PMU	55,000	Goods
	Reduce the reliance on MB use	Development and implementation of accreditation program for storage facilities (through the Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities)	PMU	55,000	Workshop IOC
<i>Capacity Building</i>	Strengthen capacity of DOA officers related to MB and alternatives	Local and oversea training of DOA officers that are not the trainers of authorized training centers (ATC) (7 activities carried out up to date)	PMU, DOA officers, physicians	42,900	Training Workshop IOC
	Improve efficiency of fumigation and worker safety	Development of training modules	PMU, DOA officers, Toxicology Center of Ramathibodi, DIW	5,500	Goods
	Monitor insect resistance to phosphine	Building Capacity on Insect Resistance Control <ul style="list-style-type: none"> • Insect Resistance Control unit costs for 8 years • Laboratory unit and equipment • Insect bioassays for research for 8 years • Training of staff at international centers • Domestic travel costs for collecting samples 	PMU, the Post Harvest Technology Research and Development Office,	99,000 43,000 17,600 17,600 34,000	Goods, Workshop, Training, IOC
<i>Conversion Sub-project</i>	Strengthen capacity of enterprise to adopt alternatives to MB in an efficient and safe	Type 1: Enterprise with in-house fumigation team <ul style="list-style-type: none"> • Modification of fumigation enclosure • Acquisition of fumigation and safety 	PMU, the Government Saving Banks, type 1 enterprises, 8 ATCs	603,720	1. Sub-project 2. Enterprise's counterpart funding to cover capital cost that are

Project Activity	Potential Environmental and Health Impacts	Proposed Mitigation Measure(s) (incl. legislation & regulations)	Institutional Responsibilities (incl. enforcement & coordination)	Cost Estimates (USD)	Remarks
	manner	<ul style="list-style-type: none"> equipment comprising of <ul style="list-style-type: none"> ○ Phosphine monitoring device ○ Explosion-proof portable ventilator / blower ○ Faced gas mask and phosphine canister ○ Nitrogen generating system ● Acquisition of IPM comprising of <ul style="list-style-type: none"> ○ Light trap ○ Industrial vacuum cleaner ○ Insecticide knapsack sprayer ● Training to enterprise conducted by ATCs 			<p>not financed by the sub-project (at least. 20%).</p> <p>3. Operation and maintenance cost of equipment and storage facility to be borne by enterprise</p>
		<p>Type 2: Enterprise without in-house fumigation team</p> <ul style="list-style-type: none"> ● Acquisition of fumigation and safety equipment comprising of <ul style="list-style-type: none"> ○ Monitoring pump and consumable tubes (high and low range) ○ Faced gas mask with replacement canisters ● Acquisition of IPM comprising of <ul style="list-style-type: none"> ○ Light trap ○ Industrial vacuum cleaner ○ Insecticide knapsack sprayer ● Training to enterprise conducted by ATC 	PMU, the Government Saving Banks, type 2 enterprises, 8 ATCs	375,925	<p>1. Sub-project</p> <p>2. Enterprise's counterpart funding to cover capital cost that are not financed by the sub-project (at least 20%).</p> <p>3. Operation and maintenance cost of equipment and storage facility to be borne by enterprise</p>
		<p>Type 3: Fumigation Servicing Companies</p> <ul style="list-style-type: none"> ● Acquisition of fumigation and safety equipment comprising of 	PMU, the Government Saving Banks, type 3 enterprises, ATC	102,260	<p>1. Sub-project</p> <p>2. Enterprise's counterpart funding to cover capital cost that are</p>

Project Activity	Potential Environmental and Health Impacts	Proposed Mitigation Measure(s) (incl. legislation & regulations)	Institutional Responsibilities (incl. enforcement & coordination)	Cost Estimates (USD)	Remarks
		<ul style="list-style-type: none"> ○ Phosphine monitoring device ○ Faced gas mask and phosphine canister ● Training to enterprise conducted by ATC 			<p>not financed by the sub-project (at least 20%).</p> <p>3. Operation and maintenance cost of equipment to be borne by enterprise</p>
<i>Technical Assistance and Training</i>	1. Establish 8 ATCs fully equipped with training equipment for fumigation and IPM 2. Strengthen capacity of DOA trainers	<p><i>Train-the-trainer Program</i></p> <ul style="list-style-type: none"> ● Development of training modules <ul style="list-style-type: none"> ○ Training on MB alternatives ○ Code of good practice for MB fumigation ○ Code of good practice for phosphine fumigation ○ VDO documentary: ● Training of trainers Workshop ● Equipment package for 8 ATCs, each package comprising of <ul style="list-style-type: none"> ○ Electronic Phosphine Monitoring Device and Aspirating Pump and Detector Tube ○ Explosion-proof Portable Ventilator and Industrial Fan ○ Self-contained Breathing Apparatus (SCBA), Faced Gas Mask, Personal Protection Device ○ Phosphine Generator ○ Grain Probe ○ Fumigation Sheet and Sand Snake and Fumigation Accessories ○ Vacuum Cleaner ○ Light Trap and Rodent Trap 	PMU, trainers from 8 ATCs, Toxicology Center of Ramathibodi, Vibhavadi Hospital, DIW	259,826	Goods, Workshop, IOC
	Strengthen capacity of enterprise to adopt alternatives to MB in	<p><i>Training of MB Users and Training Updates</i></p> <ul style="list-style-type: none"> ● Train-the-trainer workshop 	PMU, type 1, 2, and 3 enterprises, 8 ATCs	321,984	Workshop IOC

Project Activity	Potential Environmental and Health Impacts	Proposed Mitigation Measure(s) (incl. legislation & regulations)	Institutional Responsibilities (incl. enforcement & coordination)	Cost Estimates (USD)	Remarks
	an efficient and safe manner				
			Total	2,033,315	

Pest Management Plan

1-B. Monitoring

Proposed Mitigation Measure	Parameters To be Monitored	Location	Data and/or Measurements (incl. methods & equipment)	Frequency of Measurement	Responsibilities (incl. review and reporting)	Cost (Equipment & Labor)
Regulation						
Pest control standards for storage facilities	Number of COP published and distributed	Thailand	Review record of distribution	Annually	PMU	5,500 USD
Capacity Building						
Local and oversea training of DOA	No. of training	Thailand and oversea	-	In 2008, 2010 and 2012	PMU	Under PMU budget
Development of training modules	Training module published and distributed	Thailand	Review record of distribution	Annually	PMU	5,500 USD
Building Capacity on Insect Resistance Control	1. Insect Resistance Control Unit established and fully equipped with laboratory equipment 2. Number of domestic travelling to collect insect 3. Result of testing for insect resistance to phosphine	<ul style="list-style-type: none"> • Post Harvest Technology Research and Development Office • Warehouses throughout Thailand 	Result of the testing	Parameter 1: One time Parameter 2 and 3: Annually	PMU and Post Harvest Technology Research and Development Office	193,600 USD
Conversion Sub-project						
Type I Sub-project	1. Number of participating enterprises 2. Use of equipment 3. Quantity of MB and phosphine used by the enterprise (QPS and non-	Thailand	Site visit and data reporting from questionnaire	Annually	PMU and GSB: Parameter 1-3 Pesticide Regulatory Sub-division: Parameter 3	5,000 USD

Proposed Mitigation Measure	Parameters To be Monitored	Location	Data and/or Measurements (incl. methods & equipment)	Frequency of Measurement	Responsibilities (incl. review and reporting)	Cost (Equipment & Labor)
	QPS)					
Type II Sub-project	1. Number of participating enterprises 2. Use of equipment 3. Quantity of phosphine used by the enterprise	Thailand	Site visit and data reporting from questionnaire	Annually	PMU, GSB, and Group Coordinator	25,000 USD
Type III Sub-project	1. Number of participating enterprises 2. Use of equipment 3. Quantity of MB and phosphine used by the enterprise (QPS and non-QPS)	Thailand	Site visit and data reporting from questionnaire	Annually	PMU and GSB: Parameter 1-3 Pesticide Regulatory Sub-division: Parameter 3	5,000 USD
						239,600 USD

Pest Management Plan

1-C. Institutional Strengthening and Training for Implementation

Institutional Strengthening Activity	Position(s)	Scheduling	Responsibility(ies)	Cost Estimates (USD)	
	(Institutions, PIUs, contractors, construction supervision consultants)				
Mitigation	PIU	2007 - 2013	PMU, Plant Quarantine Station, Pesticide Regulatory Subdivision, physicians, Toxicology Center of Ramathibodi, DIW, the Post Harvest Technology Research and Development Office, the Government Saving Banks, enterprises type 1-3, 8 ATCs	2,033,315	
Monitoring (incl. compliance)	PIU	2007 onwards	PMU, OARD, Pesticide Regulatory Subdivision, 10 Plant Quarantine Stations, Post Harvest Technology Research and Development Office, GSB, and Group Coordinator	239,600	

Training Activity	Participants	Types of Training	Content (modules, etc.)	Scheduling	Cost Estimates
Training on regulation to control MB and adoption of phosphine	DOA officers	Training Workshop	<ul style="list-style-type: none"> • Montreal Protocol and MB phase-out obligation • Government policy to phase-out MB • Existing licensing system related to MB • Alternative to MB • Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities • NMBPP and status update 	Once a year in 2008, 2010 and 2012	9,900 USD

Training Activity	Participants	Types of Training	Content (modules, etc.)	Scheduling	Cost Estimates
Oversea Training on fumigation	DOA officers	Study visit	<ul style="list-style-type: none"> • Fumigation technique • Recapture technique • Control of MB • Export phytosanitary certification system • Safeguard of MB use • Heat treatment • Phosphine fumigation in kiwi fruit 	2010 and 2011	33,000 USD
Training on insect resistance control unit	Post Harvest Technology Research and Development Office	Oversea Training	<ul style="list-style-type: none"> • Phosphine assay • Assessment of resistance insect • Insect receivable culturing • Insect resist control • Dosing technique • Statistical analysis 	2008 and 2009	17,600 USD
Train-the-trainer Program	Trainers of ATCs	Training Workshop	<ul style="list-style-type: none"> • Montreal Protocol and MB phase-out obligation • Government policy to phase-out MB • Knowledge about regulations related to fumigation; • Code of good practice for phosphine fumigations (fumigation techniques and safe use of pesticide); • Fumigation and personal protective equipment • IPM program • Symptoms and Poisoning caused by fumigants and first aid treatments. 	2008	5,500 USD

Training Activity	Participants	Types of Training	Content (modules, etc.)	Scheduling	Cost Estimates
Training of MB Users@8 ATCs	Users of MB	Training Workshop	<ul style="list-style-type: none"> • Montreal Protocol and MB phase-out obligation • Government policy to phase-out MB • Knowledge about regulations related to fumigation; • Code of good practice for phosphine fumigations (fumigation techniques and safe use of pesticide); • Fumigation and personal protective equipment • IPM program • Symptoms and Poisoning caused by fumigants and first aid treatments. 	2009-2012	321,984 USD

Pest Management Plan

1-D. Scheduling and Reporting

Activities	2010				2011				2012			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mitigation Measure												
Regulation												
Development of Management Information System (MIS)			X									
Development of pest control standards for storage facilities	X	X	X									
Development and implementation of accreditation program for storage facilities	X				X				X			
Capacity Building												
Local and oversea training of DOA officers					X							X
Development of training modules												
Building Capacity on Insect Resistance Control	X	X	X	X	X	X	X	X	X	X	X	X
Conversion Sub-project												
Type I Sub-project	X	X	X	X	X	X	X	X				
Type II Sub-project					X	X	X	X	X	X	X	X
Type III Sub-project	X	X	X									
Technical Assistance and Training												
Train-the-trainer Program	X	X	X	X								
Training of MB Users and Training Updates					X		X		X		X	X
Project Implementation Support												
Establishment of PMU												
Project Support	X	X	X	X	X	X	X	X	X	X	X	X
Outreach Program	X		X		X		X		X		X	
Monitoring				X				X				X
Monitoring												

Activities	2010				2011				2012			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Regulation												
Management information system (MIS)		X	X	X	X	X	X	X	X	X	X	X
Pest control standards for storage facilities					X				X			
Accreditation program for storage facilities					X				X			X
Capacity Building												
Local and oversea training of DOA					X							X
Development of training modules					X				X			X
Building Capacity on Insect Resistance Control					X				X			X
Conversion Sub-project												
Type I Sub-project					X				X			X
Type II Sub-project									X			X
Type III Sub-project					X				X			X
Technical Assistance and Training												
Train-the-trainer Program					X	X						
Training of MB Users and Training Updates					X				X			X
Project Implementation Support												
Project Support					X				X			X
Outreach Program					X				X			X
Monitoring					X				X			X
Institutional Strengthening												
Mitigation Measure												
Monitoring												
Training												
Training on regulation to control MB and adoption of phosphine					X							X
Oversea Training on fumigation		X							X			
Training on insect resistance control unit												
Train-the-trainer Program												
Training of MB Users@8 ATCs					X		X		X		X	X

Annex 2
Code of Good Practice for Fumigation with Phosphine
Annex 2-A

Contents List for the “Code of Good Practice for Fumigation with Phosphine” (translated)

- | | |
|---|--|
| 1. บทนำ | 1. Introduction |
| 2. วัตถุประสงค์ และ ข้อควรปฏิบัติทั่วไป | 2. Objectives and General Requirements |
| 3. สารเคมีฟอสฟิน | 3. Phosphine as a Fumigant |
| 3.1 คุณสมบัติทั่วไป | 3.1 General Characteristics, Chemical and Warning Properties |
| 3.2 ผลกระทบของฟอสฟินต่อมนุษย์ | 3.2 Adverse Effects on People |
| 3.3 ผลกระทบของฟอสฟินต่อลินิน | 3.3 Adverse Effects on Commodities |
| 3.4 การวัดความเข้มข้นของฟอสฟิน | 3.4 Detection and Measurement |
| 3.4.1 การตรวจโดยการรับรู้กลิ่น | 3.4.1 Detection by smell |
| 4. อุปกรณ์ป้องกันอันตรายล้วนๆ | 4. Personal Protection |
| 4.1 อุปกรณ์ป้องรับหายใจ | 4.1 Respiratory Protection |
| 4.1.1 ตัวสูบกรองแก๊สฟอสฟิน | 4.1.1 Canister Respirators |
| 4.1.2 ชุดอุปกรณ์ปักป้องระบบหายใจชนิดที่มีสัมภาระติดตัว | 4.1.2 Self-contained Breathing Apparatus (SCBA) |
| 4.2 การป้องกันการได้รับสารทางผิวน้ำ | 4.2 Skin Protection |
| 5. บุคลากรที่ปฏิบัติภาระ | 5. Fumigation Personnel |
| 5.1 จำนวนบุคลากรที่เนื้อที่สุดในการปฏิบัติงาน | 5.1 Minimum Number of Persons |
| 5.2 คุณสมบัติของบุคลากรในการปฏิบัติภาระ | 5.2 Qualifications of Personnel |
| 5.2.1 การปฐมนิเทศยา | 5.2.1 First Aid Qualifications |
| 5.3 การเฝ้าระวังทางสุขภาพของผู้ที่ปฏิบัติงานรวมถึงศัลศรีพัช | 5.3 Monitoring of Health of Fumigation Staff |
| 6. การปฏิบัติภาระ | 6. Fumigation Practice |
| 6.1 สูตรของสารเคมี | 6.1 Formulations |
| 6.1.1 โลหะฟอสไฟด์ | 6.1.1 Metal Phosphides |
| 6.1.2 ฟอสฟินแก๊สที่บรรจุในห่อภายในห่อภายนอกได้ความดัน | 6.1.2 Cylinders of Compressed Gas |
| 6.1.3 ฟอสฟินจากเครื่องกำเนิดแก๊สฟอสฟิน | 6.1.3 Phosphine Generators. |
| 6.2 การเก็บรักษา และการเคลื่อนย้าย | 6.2 Storage and Handling of Formulations |
| 6.2.1 การเก็บรักษาโลหะฟอสไฟด์ | 6.2.1 Metal Phosphides |
| 6.2.2 ฟอสฟินแก๊สในภาชนะบรรจุภายนอกได้ความดัน | 6.2.2 Cylinders of Compressed Gas |
| 6.3 การเตรียมการก่อนภาระ | 6.3 Preparation for Fumigation |
| 6.3.1 การวางแผนการปฏิบัติงาน | 6.3.1 Planning |
| 6.3.2 การแจ้งผู้ที่เกี่ยวข้องกับภาระ | 6.3.2 Notice of Intention to Fumigate |
| 6.3.3 คำจำกัดความของ ผู้ที่เสีย□ | 6.3.3 Definition of Risk Area |
| 6.3.4 การตุมกองลินินเพื่อภาระ | 6.3.4 Sealing of Fumigation Enclosures |
| 6.3.5 การระบายน้ำสารเคมีจากโครงสร้างเพื่อภาระ | 6.3.5 Provision for Ventilation of Fumigation Enclosures |
| 6.3.6 การระบายน้ำสารเคมีและที่น้ำที่ข้างเคียง | 6.3.6 Ventilation of Adjacent Areas |
| 6.3.7 ป้ายเตือนอันตราย | 6.3.7 Warning Signs |

- 6.3.8 การตรวจสอบความปลอดภัยขั้นสุดท้าย
- 6.4 การเตรียมการเพื่อใส่โลหะฟอฟไไฟด์เข้าในโครงสร้างเพื่อการรرم
 - 6.4.1 การใส่โลหะฟอฟไไฟด์เข้าในกองลินค่าที่เป็นกรงสอน หรือ ถุงลินค่าที่ใช้ผ้าคลุมการรرم
- 6.5 วัตราช และระยะเวลาของการรرم
 - 6.5.1 ปัจจัยที่มีผลต่อวัตราชของสารรرم และ ระยะเวลาของการรرم
 - 6.5.2 วัตราชของสารรرم
 - 6.5.3 ชนิดของสารที่ให้แก่ฟอฟไฟน
 - 6.5.4 การเลือกใช้วัตราชของสารรرم
- 6.6 การระบายน้ำออกจากกองลินค่าหางจากครบรยะเวลาในการรرم
 - 6.6.1 การเปิดโครงสร้างที่รرمเพื่อการระบายน้ำรرم
 - 6.6.2 ระยะเวลาในการระบายน้ำรرم
 - 6.6.3 การตรวจสอบความปลอดภัยหลังการระบายน้ำรرمเมื่อเข้าไปปฏิบัติงาน
- 6.7 การปฏิบัติหลังการรرم
- 6.8 การเก็บข้อมูล รวมทั้งการประเมินประสิทธิภาพของการรرم
- 6.9 ความล้มเหลวของการรرمกำจัดศัตรูพืช
 - 6.9.1 เหตุผลบางประการที่ทำให้การรرمล้มเหลว

- 6.3.8 Final Safety Checks
- 6.4 Application of Metal Phosphide Preparations
 - 6.4.1 Application to sheeted Containers or Bagged Commodities under Gasproof Sheets
- 6.5 Dosage Rates and Exposure Periods
 - 6.5.1 Factors Governing Dosage Rates and Exposure Periods
 - 6.5.2 Units of Dosage
 - 6.5.3 Phosphine produced by aluminium phosphide products
 - 6.5.4 Choosing the correct dosage
- 6.6 Clearing the Fumigant on Completion of the Exposure Period
 - 6.6.1 Opening the Fumigation Enclosure
 - 6.6.2 Ventilation Periods
 - 6.6.3 Testing Fumigant Clearance
- 6.7 Post-Treatment Action
- 6.8 Record Keeping, Including Assessment of Effectiveness of Fumigation
- 6.9 Fumigation Failure
 - 6.9.1 Some reasons why phosphine fumigations of containers or stacks fail.

Annex 2-B

Best Practice for Fumigation with Phosphine

BEST PRACTICE FOR FUMIGATION WITH PHOSPHINE

Best fumigation practice is the result of a practical combination of all procedures required during a fumigation treatment to ensure that:

- the people doing the fumigation remain safe and are not harmed
- all people in the area around the fumigation treatment area remain safe and are not harmed
- the environment is not harmed
- all life stages of all target pests are killed to prevent the development of resistance
- the commodity, or product, or equipment being treated inside the fumigation enclosure is not damaged in any way.

Each of these five goals that make up a successful fumigation *will be* reached when best fumigation practice is followed.

Best fumigation practice as described in this here may ask for conditions, requirements and resources that may be unavailable to the fumigator.

Even so, in some cases, it may still be possible for a fumigator to do a fumigation.

However, as the technique moves further away from best fumigation practice:

- ✖ the risk of harming people **increases**
 - ✖ the chances of killing target pests **decreases**
 - ✖ until, at a certain **minimum point**
 - ✖ fumigation is **worthless**
 - ✖ BECAUSE IT WILL FAIL

The risk of failure is greatly increased because very many fumigators consider fumigation with phosphine to be easy - because:

- phosphine is generated from solid metal phosphide preparations (pellets, tablets, plates, sachets, chains blankets etc.)
- these preparations are easy to introduce into an enclosure.

Fumigators must not be misled by the apparent simplicity of this process. In fact, the requirements for doing a fully successful fumigation with phosphine are very much more demanding than those for methyl bromide.

The extra demands of phosphine fumigation arise because (in most cases) the applied concentrations when used with short exposures mainly kill the larval and adult life stages of insects. These stages are called the 'susceptible life stages'.

The eggs and pupae are not killed. These are called the 'tolerant life stages'. Increasing the dosage will **not** kill these life stages. These life stages can only be killed by allowing them to grow and develop into the next susceptible life stage - eggs to larvae, and pupae to adults - while they are inside the fumigation enclosure.

This is why long exposure periods extending up to 7 days or more are required when fumigation treatments are done with phosphine.

In fumigation practice this means that:

- the concentration of phosphine inside the enclosure must be held at a poisonous level long enough to allow eggs and pupae to develop through to larvae and adults
- enclosures made with fumigation sheets must be sufficiently gastight to allow phosphine to be held at these concentrations for up to 8 days at 25C – *and even longer with resistant strains of insects*
- fumigation treatments where most gas is lost by about the fifth day will fail, leaving some live tolerant stages.

Repeated fumigation failures (treatments where eggs and pupae have not been killed) have already led to the development of resistance to phosphine in some insects, in some countries.

There is a very real likelihood that this could lead to loss of phosphine as an effective fumigant if this process continues.

When fumigations that do not follow best fumigation practice are done repeatedly, there is an unacceptable likelihood:

- of harming people in and around the fumigation area
- that insects will develop resistance to the fumigant used in such treatments.

This is because core parts of the fumigation technique essential for a successful result are not applied.

The table below lists some examples of conditions for best fumigation practice and those which are essential for safety during a fumigation.

If any of the conditions essential for safety cannot be met then fumigators and other people will be endangered.

	Conditions for best practice	Essential conditions for safety
Trained personnel available (licensed or registered where required)	✓	✓
Enclosure can be made gastight	✓	✓
Personal protection equipment available	✓	✓
Availability of equipment for accurately measuring the concentration of phosphine inside: • the enclosure • the workspace concentration	✓ ✓	✓ ✓
People can be excluded from area close to fumigation	✓	✓
No connection (pipes, drains, ducts) between fumigation enclosure and a non-target area	✓	✓
Sufficient time available for both the • exposure period • post-exposure ventilation	✓	✓
Fumigant allowed under local legislation	✓	—
Fumigant acceptable to product end user	✓	—
Commodity not damaged by fumigant	✓	—
Adequate supply of fumigant available	✓	—
For phosphine: temperatures above 15 °C.	✓	—
Meteorological conditions acceptable e.g. minimal wind	✓	—

There are many conditions that make up best fumigation practice for phosphine and it is not possible to list them all in the table above. However, if any of the points listed are not met, then the fumigation will not reach the highest standards of efficacy and may not kill all life stages of all target pests. This in turn can encourage development of resistance.

Many of the requirements of best fumigation practice for phosphine result from the ‘science behind fumigation’.

However, there is also a very practical aspect to best fumigation practice that applies to the materials, equipment, and tools that fumigators use during a fumigation treatment.

Fumigators must remember that they are working with poisonous gases. This means that they have a duty of care.

For this reason they must always make sure that they are properly equipped. Fumigators must:

- have proper respiratory protective equipment available, either (i) self-contained breathing apparatus, or (ii) a respirator with filter canisters appropriate for the fumigant being applied
- always maintain fumigation monitoring equipment in good-as new condition, because if you fail to have gas-monitoring equipment calibrated regularly (and in accordance with the manufacturer's instructions) this may be the cause of (i) a fumigation failure or (ii) a fatal accident.
- never make a temporary repair, because it will almost always continue to be used, and could be a cause of reduced standards in your fumigation work.

Annex 2-C

Safety Rules for Fumigators Using Phosphine

SAFETY RULES FOR FUMIGATORS USING PHOSPHINE

Fumigation with phosphine is a precise operation requiring considerable expertise, and cannot be undertaken without proper preparation. It is important that management and their Fumigators-in-Charge understand this, and ensure that proper planning is carried out before a fumigation treatment is done.

1. Are you allowed to do a fumigation with phosphine in your country?

Have you been trained to do fumigations with phosphine?

Can you recognise a fumigation failure?

Do you have the practical experience needed to do a treatment without supervision?

2. Check *all* national and local government rules and regulations telling you *how to do fumigations in your country*. Make sure you understand them.
3. Check *all* national and local government rules and regulations about *use of phosphine in your country*. Make sure you understand them.
4. Do you know and understand when to apply the dosage rates for phosphine recommended in your country?
5. Can you recognise the symptoms of phosphine poisoning?
6. Check all equipment before you use it. Make sure it is all in good working condition.

Examine all gas proof sheets by suspending them over a lighted doorway. Repair even the smallest holes that could cause gas leaks, since these leaks could result in human injury or insufficient gas concentration to control the target pest.

Make sure you have enough phosphine generating product to do the treatment.

Make sure there are enough sand snakes to seal the enclosure. There must be enough to go around the enclosure twice.

Make sure enough trays are available to put tablets (or pellets) on.

Make sure a fully equipped tool kit is available.

7. Go and inspect the place where the fumigation will be done.

Is the stack sheltered from strong wind? If not, can it be moved and rebuilt?

Is the stack built on a gas proof floor?

Are you sure there is no drain under the stack?

Can the enclosure be sealed properly?

Has the stack been built around a pillar? If so, rebuild the stack.

Is there enough space between the stack and the walls?

Are there any connecting godowns?

Identify all houses around the danger area where people live. Will the people who live in them be safe during the exposure period?

Identify any items that could be damaged by phosphine and make sure they are removed before the fumigation starts.

8. If it is possible to do a fumigation:

is there enough time to do the fumigation properly?

can the fumigation be done at a time when workers are not present?

can the enclosure be aerated at a time when workers are not present?

is it possible to close off the danger area?

is it possible to safely aerate the enclosure at the end of the exposure period?

is electricity available so that fans can be used to aerate the enclosure at the end of the exposure period? - If not, a portable generator will be required.

9. Emergency Actions

Look for and identify all safe ways to get out of the fumigation area in an emergency.

Identify emergency doors, connecting godowns, a water supply,

Identify the nearest telephone, the nearest hospital, the nearest doctor, the nearest fire brigade.

Find the quickest way to the nearest hospital.

Make sure two trained persons are present at all times during the fumigation.

10. Develop a Fumigation plan.

Tell all fumigation staff:

how the fumigation will be done

how to leave the fumigation area *safely* in case of emergency

what to do if any person breathes in phosphine gas

what to do if any person breathes in or comes into contact with dust produced by phosphine-generating product

who will monitor gas concentrations in the workspace.

All people involved with the fumigation must be shown around the fumigation site. If there is a safer way to do anything, revise the fumigation plan.

11. Make sure all fumigation staff:

know what first aid action to take in case anyone is injured

are equipped with, and know how to use personal-protection equipment appropriate for fumigation with phosphine (self-contained breathing apparatus, gas masks)

understand that *gloves must be worn while i) opening and handling containers of generating product, and ii) dispensing the product by hand.*

12. *Before a fumigation is started*, be sure that the nearest doctor (or hospital) has instructions on how to treat injuries caused by phosphine.

13. Where necessary, the fumigator-in-charge must make sure that all national and local government agencies (for example, the police, the fire brigade, the nearest hospital, etc.) that might be involved with the fumigation treatment, have been told where and when the fumigation treatment will be done.
14. Check weather conditions before fumigation.

If it is possible that wind will damage fumigation sheets, delay the fumigation until the treatment can be done safely or take other precautions.
15. Fumigators must not consume alcohol less than 24 hours before the start of a fumigation treatment.
16. Warning signs

Always put warning signs (in appropriate languages) around the danger area at a fumigation site.
Include an emergency phone contact number on the signs.

The signs must be at places where people are most likely to see them.

Guards must be used if required by government (or other) regulation.
17. Containers (tins, canisters) of phosphine generating products must always be opened in the open air because concentrations of gas may build up in them.

To avoid inhaling the gas, fumigators must make sure that containers are pointed away from them when they open such containers.
18. *Do not eat, drink or smoke at any time when doing a fumigation with phosphine, especially while handling and distributing phosphine-generating products.*
19. To prevent spontaneous ignition of phosphine-generating products (tablets, pellets, sachets, etc.):

do not place phosphine-generating products on wet grain
do not place phosphine-generating products on wet surfaces or surfaces that may get wet
do not heap tablets or pellets when distributing them for a fumigation.
20. To prevent contamination:

do not allow phosphine generating products or their breakdown products (spent residues) to come into contact with any food or feed commodity.
21. Monitoring

Always use leak detection equipment to check that the workspace is safe and the enclosure is well-sealed.
22. Repeated small exposures to phosphine can be dangerous. Always plan ways to *minimise unprotected exposure to phosphine.*
23. If anyone gets sick during fumigation, with symptoms of or similar to phosphine poisoning, don't take chances. Take the person to a doctor and let the doctor decide the cause of the illness.
24. Clothing.

After a fumigation, fumigators must wash thoroughly and change their clothes immediately.

Clothing contaminated with dust produced by generating compounds must be aired in a open area before they are washed.

Do not leave contaminated clothing, shoes and other equipment in confined areas, such as motor cars, cupboards or rooms.

Dirty clothing worn by fumigators must be washed separately from other clothes, especially infants clothes.

25. Aeration

Aeration must be done in stages to avoid sudden release of large amounts of fumigant.

26. Disposal of spent residues.

Spent residues must be disposed of according to local regulations in your country or, in the absence of such regulations, in accordance with the manufacturers instructions.

Do not flush residues into sewers or septic tanks.

27. Disposal of empty containers.

Containers in which phosphine-generating products are supplied must be disposed of so that they cannot be re-used. This must be done in accordance with local regulations in your country or, in their absence, in accordance with the manufacturers instructions.

28. Clearance

Clearance after aeration must be issued only when monitoring instruments show that gas concentrations have fallen to, or are below, the TLV set for phosphine in your country.

29. The fumigator-in-charge must make sure that all national and local government agencies (for example, the police, the fire brigade, the nearest hospital, etc.), that might be involved with the fumigation treatment, have been told that the fumigation has ended.

30. Warning signs.

After clearance has been given at the end of the aeration period, *remove all warning signs.*

If signs are not removed, people will ignore them during the next fumigation.

31. Promptly return all empty phosphine cylinders to the supplier.

NEVER GIVE OR SELL PHOSPHINE PREPARATIONS TO UNTRAINED PERSONS

Annex 3

Relevant Legal Documents

Annex 3-A

HAZARDOUS SUBSTANCE ACT B.E. 2535 (Unofficial English Translation)

**BHUMIBHOL ADULYADEJ REX.
Given on the 29th day of March, B.E. 2535;
Being the 47th year of the Present Reign.**

His Majesty King Bhumibhol Adulyadej has been graciously pleased to Proclaim that:

Whereas it is expedient to revise the law on hazardous substances.

BE IT THEREFORE ENACTED BY THE KING, by and with the advice and consent of the National

Legislative Assembly acting as the Parliament, as follows:

Section 1 This Act shall be called the “Hazardous Substance Act, B.E. 2535”

Section 2 This Act shall come into force as from the day following the date of its publication in the Government Gazette.

Section 3 The following Acts shall be repealed:

- (1) The Toxic Substance Act, B.E. 2510.
- (2) The Toxic Substance Act (No. 2), B.E. 2510.

Section 4 In this Act,

“Hazardous Substance” means the following substance.

- (1) Explosives.
- (2) Flammable substance.
- (3) Oxidizing agent and peroxide.
- (4) Toxic substance.
- (5) Substance causing diseases.
- (6) Radioactive substance.
- (7) Mutant causing substance.
- (8) Corrosive substance.
- (9) Irritating substance.
- (10) Other substance either chemicals or otherwise which may cause injury to the persons, animals, plants, property, or environments.

“Produce” means to make, culture, blend, mix, alter, modify, contain separately or contain collectively.

“Import” means to bring or order into the Kingdom or to transit.

“Export” means to send or undertake to send out of the Kingdom.

“Sale” means a disposal, dispensation, or distribution for commercial purposes and also includes having in possession for sale.

“Having in possession” means having in possession whether for oneself or for others and regardless of whether having in possession for sale, for transport or for use or for other purposes and also includes leaving or existing in the area under possession.

“Label” means a picture, logo, or any statement shown on the hazardous substance, containers, or packages, or inserted or included in the hazardous substance or containers, or packages and also included a document or manual for the hazardous substance.

“Committee” means the Committee on Hazardous Substance.

“Authority” means a person appointed by the Responsible Minister for the execution of this Act.

“Responsible Minister” means the line Minister of any agency assigned to take charge of the control of hazardous substance under Section 19.

Section 5 The Minister of Defence, the Minister Of Agriculture and Cooperatives, the Minister of Interior, the Minister of Public Health, the Minister of Science, Technology and Environment, and the Minister of Industry shall control, promote, and oversee the work of the Secretary and the Assistant Secretaries of the Committee on Hazardous Substance for the execution of this.

The Minister of Industry shall have the power to prescribe the ministerial rules fixing the fees of not higher than the rates attached herewith and exempting the fees as well as adopting other requirements and to prescribe the announcements for the execution of this Act.

The Responsible Minister shall have the power to appoint the authorities and to prescribe the announcements for the execution of this Act.

Such ministerial rules or announcements, upon publication in the Government Gazette, shall become enforceable.

Chapter I **Committee on Hazardous Substance**

Section 6 There shall be the Committee on Hazardous Substance consisting of the Permanent Secretary of the Ministry of Industry as the chairman, the Director-General of the Department of Internal Trade, the Director-General of the Department of Medical Service, the Director-General of the Department of Public Works, the Director-General of the Police Department, the Director-General of the Department of Agriculture, the Director-General of the Department of Agricultural Extension, the Secretary-General of the National Environment Board, the Secretary-General of the Food and Drug Administration, the Secretary-General of the Office of Atomic Energy for Peace, the Secretary-General of the Office of Industrial Standards Institute and a representative from the Ministry of Defence and not more than seven scholars appointed by the Cabinet as the members; the Director-General of the Industrial Works Department as a member and the secretary; a representative from the Department of Public Works, a representative from the Department of Industrial Works, a representative from the Department of Agriculture, a representative from the Office of Atomic Energy for Peace and a representative from the Food and Drug Administration as the assistant secretaries.

The member scholars appointed by the Cabinet must be the experts having expertise, works and experiences relating to the branches of chemistry, science, engineering, agricultural science, or law and at least two of them shall be appointed from the scholars working in an organ of public interest for the protection of health or environment.

Section 7 The Committee shall have the following powers and duties.

(1) To give Opinions to the Minister of Industry regarding the prescription of the announcements pursuant to Section 18 paragraph two and Section 36 paragraph one.

(2) To give Opinions to the Responsible Ministers regarding the prescription of the announcements pursuant to Section 20, Section 36 paragraph three, Section 37 paragraph two, Section 44, and Section 47 (5)

(3) To give advice to the authority regarding the registration or revocation of the register of hazardous substance.

(4) To give advice or opinions to the Responsible Minister, the Minister of Industry, responsible agencies and the authority regarding any matter relating to hazardous substance.

(5) To consider the grievances from persons sustaining troubles or injuries for hazardous substance.

(6) To inform of or publicize the information relating to hazardous substance to the public. In this respect, the list of hazardous substance or of relevant persons engaging in a business may be designated.

(7) To oversee, give advice, and expedite the authority, Government bodies or agencies taking charge of various hazardous substance in the exercise of their power and in the performance of their duties as provided by law.

(8) To propose opinions to the Minister of Industry for recommendation to the Cabinet regarding the control of hazardous substance and the protection of and remedies for damage caused by hazardous substance as the operation guidelines for various Government agencies.

(9) To perform such other acts as provided by law to be the powers and duties of the Committee.

Section 8 The member scholars shall remain in their office for a term of two years. Any retiring member scholar may be reappointed.

Section 9 Apart from the vacancy upon expiration of the term of office under Section 8, the member scholars may vacate the office upon:

(1) Death;

(2) resignation;

(3) removal by the Cabinet on account of deficiency, dishonesty to the duties, disgraceful behavior or incapacity;

(4) being a bankrupt;

(5) being incompetent or quasi-incompetent person; or

(6) punishment of imprisonment by a final judgement to that effect except the punishment for an offence committed recklessly or a petty offence.

Section 10 In case where an appointment of a member scholar is made during the term of office of the member scholars already appointed, either as an additional appointment or for filling the vacancy, the person so appointed shall retain his/her office for the term equal to that remaining for the member scholars already appointed.

Section 11 In case where the member scholars have completed their term of office but no new member scholars have been appointed, the retiring member scholars shall, for the time being, perform their duties until new appointment of the member scholar is made.

Section 12 Not less than half of the total number of members must be present at the meeting of the Committee in order to form a quorum. If the chairman is not present at the meeting, the members present shall select one of the members to be the chairman of the meeting.

Decisions of the meeting shall be made by a majority of votes. Each member shall have one vote. In case of an equality of votes, the chairman of the meeting shall have a casting vote. Any member having a private interest in any matter, such member shall have no right to vote on such matter.

Section 13 The Committee shall have the power to appoint a Sub-committee to consider or to perform any act as assigned by the Committee.

The Committee shall fix the quorum and procedures of the Sub-committee as it thinks fit.

Section 14 In performing its duties, the Committee or Sub-committee assigned by the Committee shall have the power to give a written order summoning any person to testify or to submit any document or substance for consideration as is necessary.

Chapter 2 **Control of the Hazardous Substance**

Section 15 In case where there exists the law on any subject having any specific provisions, such provisions of the law shall apply. However, in case where it is appropriate, the Committee, upon approval of the Ministry taking charge of the law on such subject, may adopt a resolution applying the provisions of this Act in addition to or in lieu of the law on such subject provided that any period or condition may be provided in such resolution.

The resolution under paragraph one, upon publication in the Government Gazette by the Minister taking charge of the law on such subject, shall become enforceable.

Section 16 In case of necessity for the prevention of danger to be inflicted upon the persons, animals, plants, property, or environments, a decree may be prescribed designating the area for prohibition of possession, disposal or use of any hazardous substance.

Section 17 The Information Center for Hazardous Substance shall be established in the Ministry of Industry as a coordinating center with respect to information on hazardous substance for various government agencies including private sectors for the collections and services of all kinds of information relating to hazardous substance since their existence in foreign countries, importation or domestic production, moving, uses, destruction, and any other relevant matters.

Section 18 The hazardous substance is classified according to the needs for control as follows:

(1) Type 1 hazardous substance is that of which the production, import, export, or having in possession must comply with the specified criteria and procedures.

(2) Type 2 hazardous substance is that of which the production, import, export, or having in possession must first be notified to the authority and must also comply with the specified criteria and procedures.

(3) Type 3 hazardous substance is that of which the production, import, export, or having in possession must obtain a permit.

(4) Type 4 hazardous substance is that of which the production, import, export, or having in possession is prohibited.

For the purpose of prevention and stop of danger that may be inflicted upon the persons, animals, plants, property, or environments, the Minister of Industry with the opinions of the Committee, shall have the power to publish in the Government Gazette designating the names or qualifications of hazardous substance, types of hazardous substance, period of application and responsible agencies for the control of the said hazardous substance.

Section 19 When any agency of the Ministry or Bureaus of the Central Administration has requested to be the agency responsible for the control of any hazardous substance for the execution of this Act, the

committees shall consider and submit its opinions to the Ministry of Industry in order to prescribe the announcement under Section 18 paragraph two designating such agency as the agency having the powers and duties to execute all part with respect to such hazardous substance provided that specialized expertise, number of personnel, relationship with the principal tasks and work load under its responsibilities shall be primary taken into consideration.

In case where the Committee has viewed otherwise, the Minister of the requesting agency shall be responsible for confirmation to the Committee within thirty days. In this case, it shall be proposed to the Ministry of Industry for submission to the Cabinet for consideration.

Section 20 The responsible Minister, with the opinions of the Committee shall have to publish in the Government Gazette,

(1) adopting the composition, qualifications and mixtures, containers, methods of examining and testing the containers, labels, productions, imports, exports, sales, transports, storage, disposals, destruction, treatments of hazardous substance containers, notification of facts, submission of specimens or any other matters relation, or stop of the substance for the control, prevention, mitigation, or stop of the danger to be inflicted upon the persons, animals, plants, property, or environments by taking into consideration international conventions and covenants,

(2) requiring to have the specialized experts or personnel responsible for any execution under (1),

(3) adopting the error criteria from the required quantity of the essential substance in the hazardous substance,

(4) adopting the procedures for registration of the said hazardous substance,

(5) designating the names and qualifications of the hazardous substance and exemption under Section 36,

Section 21 A producer, importer, exporter or a person having possession of the type 1 hazardous substance must comply with announcements of the Responsible Minister prescribed pursuant to Section 20(1) (2) and (3).

Section 22 Subject to the provisions of Section 36, no person shall be allowed to produce, import, or have in possession the type 2 hazardous substance unless the desire to so undertake has been first notified to the authority.

Upon prescription of an announcement designating any substance to be the type 2 hazardous substance, the producer, importer, exporter, or the person having possession of such substance shall notify the authority of his/her undertaking then within the period specified in the said announcement.

The producer, importer, exporter or the person having possession of the type 2 hazardous substance must also comply with the announcement of the Responsible Minister prescribed pursuant to Section 20(1) (2) and (3).

Section 23 Subject to the provisions of Section 36, no producer shall be allowed to import, export, or have in his/her possession of the type 3 hazardous substance unless permitted by the authority.

The application for permission and the permission thereof shall be in accordance with the criteria and procedures provided for in the ministerial rules, provide that such ministerial rule shall provide as clearly as possible for the cases to be allowed or not to be allowed except in case of an unforeseen necessity and the period for consideration for permission shall also be clearly specified.

The producer, importer or the person having possession of the type 3 hazardous substance must also comply with the announcement of the Responsible Ministry prescribed pursuant to Section 20(1) (2) and (3).

Section 24 Upon prescription of an announcement designating the substance to be the type 3 hazardous substance, the producer, importer, exporter, or the person having possession of such hazardous substance shall apply for a permit under Section 23 within the period specified in the said announcement and during the

said period, such person shall engage in the business for the time being until the authority shall deny the permission as applied.

Section 25 A permit already issued, if subsequently the law or circumstance has changed or there is a substantial ground for the protection of safety, the authority having the power to issue the permits shall have the power to order an amendment of the conditions for permission as is necessary.

Section 26 A permit issued under this Act shall be valid for the period specified therein but shall not exceed three years as from the date of issuance of the permit.

Section 27 The recipient of a permit wishing to renew the permit shall apply therefore before the expiration of the permit. Upon submission of the application, such person shall be deemed as if he/she were the recipient and shall continue the business until the authority shall deny the renewal of such permit. The application for renewal of a permit of a permit and the renewal thereof shall be in accordance with the criteria and procedures provided for in the ministerial rules.

Section 28 In case where the authority denies the issuance or renewal of a permit, the applicant for a permit or a renewal thereof has the right to appeal to the Responsible Minister within thirty days as from the date of receipt of the notice denying the issuance or the renewal of a permit. The decision of the Responsible Minister shall be final.

Section 29 If the authority denies the renewal of the permit of the Responsible Minister orders the dismissal of the appeal for renewal of the permit, the applicant for the renewal of the permit may sell the hazardous substance in his/her possession within the period of three months as from the date of receipt of the order denying the renewal of the permit or of receipt of the order of the Responsible Minister dismissing the appeal as the case may be. Upon expiration of the said period, Section 52 paragraph two, paragraph three and paragraph four shall apply mutatis mutandis.

Section 30 If a permit or a certificate of registration of the hazardous substance is lost, erased or substantially defected, the recipient of the permit shall apply for a substitute of the permit or of the certificate of registration of the hazardous substance to the authority within fifteen days as from the date of knowledge of the loss, erasure or defect.

Section 31 The recipient of a permit which is valid for more than three months must present the permit or the substantially thereof at the open and noticeable place at the place of business specified in the such permit.

Section 32 When it appears to the authority that any recipient of a permit violates or fails to comply with this Act, the authority shall have the power to consider and to order a suspension of the permit for such a period as the authority think fit but shall not exceed one year and if it is a serious case, the authority may order a revocation of the permit.

Section 33 The person whose permit has been suspended or revoked under Section 32 has the right to appeal to the Responsible Minister within thirty days as from the date of receipt the order. The decision of the Responsible Minister shall be final.

The appeal under paragraph one shall not ease the enforcement of the order suspending or revoking the permit.

Section 34 The person whose permit has been suspended or revoked under Section 32 may sell the hazardous substance in his/her possession within the period of three months as from the date of receipt of the order revoking the permit or of receipt of the order of the Responsible Minister dismissing the appeal as the case may be. Upon expiration of the said period, Section 52 paragraph two, paragraph three, and paragraph four shall apply mutatis mutandis.

Section 35 The person whose permit has been revoked may not apply for a new permit until the expiration of five years as from the date of revocation of the permit.

Section 36 The Minister of Industry, with the opinion of the Committee shall publish in the Government Gazette, publicizing clearly the list of hazardous substance in of which its production process and nature are likely to cause injury.

The production, import of type 2 or type 3 hazardous substance excluding from the list in the announcement under paragraph one must be registered first with the authority and upon receipt of the certificate of registration, the production or import shall be undertaken under Section 22 or a permit for production or import under Section 23 shall be issued unless the announcement of the Responsible Minister shall exempt such registration in case where the same hazardous substance have been submitted for registration or otherwise on a reasonable ground.

The application for registration of the hazardous substance and the issuance of a certificate of registration of the hazardous substance shall be in accordance with the criteria and procedures provided for by the Responsible Minister with the opinions of the Committee upon publication in the Government gazette.

Section 37 In case where the registration of the hazardous substance require the production or import of the specimens thereof for registration or there hazardous substance must be imported for use in the production of hazardous substance to be submitted for registration and such hazardous substance are required by law to be produced or imported upon prior permission or registration, the applicant for registration may apply for permission to the authority for the production or import of such hazardous substance under this Act upon exemption from complying with the steps and procedures provided for in the law on such subject.

The production and import under paragraph one must conform to the criteria and procedures provided for by the Responsible Minister with opinions of the Committee upon publication in the Government Gazette.

Section 38 No authority shall register the hazardous substance when the Committee regards that:

(1) the hazardous substance as applied for registration is not reliable as to its benefits as applied or if used is likely to cause injury to the persons, animals, plants, property, or environments without a reasonably normal means for prevention;

(2) the hazardous substance as applied for registration uses the name in such a manner as to show off, to be impolite or likely to create a misrepresentation, or

(3) the hazardous substance as applied for registration is fake or that of which its register has already been revoked by the authority.

The order of the authority denying registration shall be final.

Section 39 For the purpose of protection of the persons, animals, plants, property, or environments, the authority with recommendation of the Committee shall have the power to amend the particulars in the register of hazardous substance as is necessary.

Section 40 For the any hazardous substance already registered which later appears to lack the benefits as registration or if used is likely to cause injury to the persons, animals, plants, property, or environments,

without a reasonably normal means for prevention, the authority with the recommendations of the Committee shall have the power to revoke the register shall be final.

Upon revocation of the register of any hazardous substance, the right of production, import, export, of or having possession of such hazardous substance shall be extinct.

Section 41 The owner of hazardous substance of which its register has been revoked must undertake to destroy or deal with his/her hazardous substance in such a manner as ordered by the authority within the period specified by the authority and Section 52 paragraph two, paragraph three, paragraph four shall apply mutatis mutandis.

Section 42 The producer for commerce, importer for commerce, exporter for commerce, keeper for commerce or seller of type 2 or type 3 hazardous substance must pay the annual fees in accordance with the criteria and procedures provided for in the ministerial rules but the rates of such fees shall not exceed those attached herewith.

Failure to pay the fees within the specified period shall result in an additional payment of five percent per month. In case where the payment of the fees is in arrears without reasonable grounds and if it is the case of a permit for operation, the authority may suspend or revoke the permit as is appropriate.

Section 43 No person shall be allowed to produce, import or have in his/her possession the type 4 hazardous substance.

Upon announcement of the Responsible Minister designating and substance as the type 4 hazardous substance, the producer, importer, person having possession of such substance shall comply with the other of the authority and Section 41 shall apply mutatis mutandis.

Section 44 The Responsible Minister with the opinions of the Committee shall have the power to announce that the following hazardous substance are exempted from complying with this Act wholly or partially as the Responsible Minister think fit.

- (1) The hazardous substance which by its nature or quality may cause minor injury or against which the enforcement of various measures under this Act will incur unreasonable burden.
- (2) The hazardous substance of the ministries, bureaus, departments, local administrations, state enterprises, government agencies, Thai Red Cross Society or other agencies as to be appropriately designated.

Section 45 No person shall be allowed to produce, import, export or have in the possession type 1, type 2, or type 3 hazardous substance as follows:

- (1) Fake hazardous substance.
- (2) Sub-standard hazardous substance.
- (3) Hazardous substance of deteriorating quality.
- (4) Hazardous substance that must be registered but has not been registered.
- (5) Hazardous substance of which its register is revoked.

The having in possession under paragraph one does not include possession for destruction or for submission to the authority or possession for other purposes under the duty provided by law.

Section 46 Any person knowing that the hazardous substance in his/her possession is the hazardous substance under Section 45 must destroy it, must notify the authority or must submit it to the authority in accordance with the criteria and procedures provided for in the announcement prescribed pursuant to Section 20(1).

Section 47 The following hazardous substance or property shall be regarded as the fake hazardous substance.

- (1) Property artificially made to duplicate the genuine hazardous substance either wholly or partially.
- (2) Hazardous substance designated as other hazardous substance or of which their expiry date is exaggerated.
- (3) Hazardous substance of which the illustration of the name or trademark of the producer or the location of the producing place is falsified.
- (4) Hazardous substance represented as the registered hazardous substance, which is falsified.
- (5) Hazardous substance produced with less or more essential substance than the error criteria under Section 20(3) at the level specified by the Responsible Minister with the opinions of the Committee upon publication in the Government Gazette.

Section 48 The following hazardous substance shall be regarded as the Sub-standard hazardous substance.

- (1) Hazardous substance produced with less or more essential substance than the error criteria under Section 20(3) but not reaching the level specified under Section 47(5).
- (2) Hazardous substance produced with the purity, mixtures or other characteristics essential to the quality of hazardous substance different from the criteria specified or registered.

Section 49 The following hazardous substance is regarded as the hazardous substance of deteriorating quality.

- (1) Expiring hazardous substance as shown on the label.
- (2) Hazardous substance so attached as to have the same characteristics as the fake hazardous substance under Section 47(5) or sub-standard importer to disuse the said label or to undertake to correct such label.

Section 50 When the Committee regards any label as incompatible with Section 20(1), the Committee shall have the power to order the producer or importer to disuse the said label or to undertake to correct such label.

Section 51 The control of advertising of the hazardous substance shall be in accordance with the law on consumers protection and for the purpose of the control of advertising, the hazardous substance of which the labels are adopted under Section 20(1) shall be deemed to be the merchandises of which their labels are controlled by the committee on the control of labels under the said law mutatis mutandis.

Section 52 When it appears to the authority that any producer, importer, exporter or any person having the possession of the hazardous substance violates or fails to comply with this Act, the authority shall have the power to order such person to stop the violating acts or to correct or modify or rectify. In this respect, if there is a reasonable ground, the authority may allow such person to export such hazardous substance in order to return the same to the producer or shipper of such hazardous substance or otherwise as the authority deems appropriate by complying with the criteria, procedures and conditions provided for by the authority.

In the case of paragraph one, if it appears that the producer, importer, exporter or the person having the possession of the said hazardous substance cannot rectify whether due to lack of capacity or otherwise, the authority shall have the power to order such person to submit such hazardous substance to the authority at the specified place in order to destroy or deal with it as is appropriate by taking into consideration the dangers to be inflicted by the said hazardous substance.

In case where such hazardous substance may be sold, the authority shall undertake to auction or to sell to the government agencies within three months as from the date of submission. The proceeds after express for storage, sale and relevant charges shall be kept in order to return to the owner but after the expiration of the

said three months, the hazardous substance has not yet been sold, if the authority regards that further extension of the said period shall cause harm or create unreasonable burden, the authority shall have the power to give the order destroying or dealing with it as is appropriate.

In case where the hazardous substance must be destroyed or dealt with as is appropriate, if the expenses are incurred, the owner of hazardous substance shall have the duty to pay or to reimburse to the Government.

Section 53 When it appears that any person has committed an offence under this Act or there is a reasonable ground to suspect that such offence has been committed, the authority shall have the power to arrest such person in order to hand over to the inquiry official for further legal action.

Section 54 In performing the duties, the authority shall have the following powers.

(1) To enter the place engaging in a business relating to the hazardous substance, place of production of the hazardous substance, place of storage of the hazardous substance, or place suspected to be such a place during the period from, sunrise to sunset or during the working hours of the said place or to enter the vehicle carrying the hazardous substance or suspected to carry the hazardous substance in order to inspect the hazardous substance, containers of hazardous substance, book accounts, document or other articles relating to the hazardous substance.

(2) To take the hazardous substance or substance suspected to be the hazardous substance in a reasonable quantity as specimens for inspection.

(3) To search, detain, seize, or attach the hazardous substance, the containers of the hazardous substance, book accounts, documents or any relevant articles in case where there is a reasonable ground to suspect that an offence under this Act has been committed.

(4) To summon in writing any person to testify or to submit any document or substance for consideration.

Section 55 For the hazardous substance, containers of the hazardous substance, book accounts, documents and any article seized or attached under Section 54(3), if the articles seized or attached are perishable or if kept, will be risky of causing injury or harm or the expenses thereof will exceed the value of such articles, the authority shall have the power to destroy or deal with it as is appropriate by taking into consideration the harm that may be caused by the said hazardous substance and Section 52 paragraph three four shall apply mutatis mutandis.

If authority considers that the articles seized or attached are not the property to be forfeited under Section 88 or the Public Prosecutor has the final order not prosecute, the authority shall withdraw the attachment or return the hazardous substance, containers of the hazardous substance, book accounts, documents and such articles to the person deserved of such return immediately.

In case of the return of the articles seized or attached or the proceeds thereof, such return shall be notified by a registered reply mail to the domicile of the person deserved of such return. In case where a person deserved of such return is unknown or if know, his/her domicile is unknown, if publicized in a local newspaper circulated in the areas in which such articles have been seized or attached, or such publicity in a newspaper shall not cover the value of the articles to be returned, if posted at the District Office of such area not less than fifteen days, it shall be deemed to have been notified upon expiration of seven days as from the date of publicity in the newspaper or the expiry date of the period of notice posted at the District Office as the case may be.

A person applying for a return shall be liable to pay the charges of the Government incurred by such publicity in the newspaper together with an additional payment of twenty percent of the said amount.

In case where the return cannot be done because a person deserved of such return is not found, the articles seized or the proceeds to be returned as the case may be shall be kept. If within one year from notification to the person deserved of a return no such person applies thereof, the articles or the proceeds shall devolve on the State.

Section 56 In performing the duties, the authority must present the identify card to the persons involved.

The identity card if the authority shall be in accordance with the form specified by the Responsible Minister.

Chapter 3 **Duties and Civil Liabilities**

Section 57 The provisions in this Chapter shall not abrogate or limit the duties and civil liabilities of a person under the provisions in other chapter or laws.

Section 58 For the purpose of fixing the duties and liabilities under this Chapter, the Minister of Industry shall have the power to publish in the Government Gazette designating the substance to be regarded as the hazardous substance under the provisions in this Chapter.

Section 59 The producer of hazardous substance must be careful in procuring the substance for production, adopting the procedures and reliable steps of production, providing the containers which are strong and safe for uses, moving, transporting, providing the labels showing the hazardous nature of such articles which is adequately distinct, storing properly, and examining the reliability of the person accepting the delivery of hazardous substance from the producer or a person who may be expected to accept delivery of the said hazardous substance.

Section 60 The importer of the hazardous substance must be careful in selecting the producers, examining the quality of hazardous substance, examining the correctness of containers and labels, selecting the modes of transport and carriers, storing properly and examining the reliability of the person accepting the delivery of hazardous substance from the importer or a person who may be expected to accept the delivery of the said hazardous substance.

Section 61 The carrier must be careful in examining the articles used in transportation or vehicles and equipment, correctness of container and labels, propriety of the modes of transport, correctness of loading on the vehicles and reliability of the employees or the persons working for with the carrier.

Section 62 The person having possession of the hazardous substance must be careful in examining the creditability of the producer or importer or supplier of such hazardous substance, correctness of containers and labels, propriety of storage, and reliability of the person accepting the delivery of hazardous substance from him/her or a person who may be expected to accept the delivery of the said hazardous substance.

Section 63 The producer, importer, carrier or the person having possession of the hazardous substance must be liable for injury caused by the hazardous substance is his/her possession unless it is proved that such injury is caused by force majeure or fault of the injured person.

Section 64 The seller or deliverer of hazardous substance to any person must be liable to such person for the injury caused by such hazardous substance unless it is proved that such injury is caused by force majeure or fault of the injured person.

Section 65 The employer, principal, hirer or owner of a business must be jointly liable for the consequence of the wrongful act committed by the persons under Section 63 or Section 64 in the course of their employment for him/her but is entitled to the reimbursement from the said persons unless he/she is also at fault in giving an order, selecting a person, controlling or otherwise which directly results in such wrongful act.

Section 66 The producer, importer, wholesaler, retailer, middle-man and the person taking part in the disposal at every interval from the producer to the person liable while the wrongful acts under Section 63 or Section 64 occur must also be jointly liable for the consequences of the wrongful act.

Section 67 The claim for harms arising out of the hazardous substance under this Act shall be barred by prescription after the expiration of three years as from the date injured person learns of the injury, the state of being the hazardous substance and the person liable or compensation.

If negotiation is undertaken with respect to the compensation to be paid between the person understood to be liable for such compensation and the person entitled thereof, the prescription shall be interrupted until it appears that such negotiation cannot reach settlement.

Section 68 The persons to be liable under Section 63, Section 64, Section 65 or Section 66 who have already paid the compensation to the injured person shall have the right of recourse against a person delivering the hazardous substance to him/her or to a person working for him/her and from person or persons taking part in every stage of delivery of the said hazardous substance up to the producer provided that the right of such recourse shall be exercised within three years as from the date of payment of the compensation. However, if the person exercising the right of a recourse is the person intentionally or negligently committing the wrongful act, such person shall have the right of a recourse only for the part beyond his/her own liability

Section 69 In case where the hazardous substance causes injury to the persons, animals, plant, or environments if the State suffers injury on account of expenses paid in order to rescue, move, treat, mitigate or get rid of the injury and to restore to the original or nearly original condition or if it is the injury to the res nullius, or natural resource, or injury to state property, upon request from the agency assigned to be responsible for the said hazardous substance, the Public Prosecutor shall have the power to institute the claim of compensation for the said injury to the State.

Chapter 4 Penalties

Section 70 Any person failing to testify or to submit any document or object as ordered by the Committee or Sub-Committee under Section 14 or as summoned in writing by the authority under Section 54(4) shall be subject to an imprisonment not exceeding one month or a fine not exceeding ten thousand Baht or both.

Section 71 Any person failing to comply with Section 21, Section 22 paragraph three, Section 41, Section 43 paragraph two shall be subject to an imprisonment not exceeding six months or a fine not exceeding fifty thousand Baht or both.

Section 72 Any person violating Section 22 paragraph one or failing to comply with Section 22 paragraph two or Section 23 paragraph three shall be subject to an imprisonment not exceeding one year or a fine not exceeding one hundred thousand Baht or both.

Section 73 Any person violating Section 23 paragraph one shall be subject to an imprisonment not exceeding two years or a fine not exceeding two hundred thousand Baht or both.

Section 74 Any person violating Section 43 paragraph one shall be subject to an imprisonment not exceeding ten years or a fine not exceeding one million Baht or both.

If the offence under paragraph one is committed recklessly by importer, exporter, the person having possession of the said hazardous substance, such offender shall be subject to a fine not exceeding eight hundred thousand Baht.

Section 75 Any person violating Section 45(1) or Section 45(5) in the case of revocation of the register due to the likelihood to cause injury without any reasonable normal means for prevention, if the offence is committed with respect to type 3 hazardous substance, shall be subject to an imprisonment not exceeding seven year or a fine not exceeding seven hundred thousand Baht or both.

If the offence under paragraph one is committed recklessly by importer, exporter, the person having possession of the said hazardous substance, such offender shall be subject to a fine not exceeding five hundred thousand Baht.

Section 76 Any person violating Section 45(2) or Section 45(5) in the case of revocation of the register due to lack of benefits as registered, if the offence is committed with respect to type 3 hazardous substance, shall be subject to an imprisonment not exceeding five years or a fine not exceeding five hundred thousand Baht or both.

If the offence under paragraph one is committed recklessly by importer, exporter, the person having possession of the said hazardous substance, such offender shall be subject to a fine not exceeding four hundred thousand Baht.

Section 77 Any person violating Section 45(3), if the offence is committed with respect to type 3 hazardous substance, shall be subject to an imprisonment not exceeding one year or a fine not exceeding one hundred thousand Baht or both.

If the offence under paragraph one is committed recklessly, such offender shall be subject to a fine not exceeding eight hundred thousand Baht.

Section 78 Any person violating Section 45(4), if the offence is committed with respect to type 3 hazardous substance, shall be subject to an imprisonment not exceeding three years or a fine not exceeding three hundred thousand Baht or both.

Section 79 If the offence under Section 75, Section 76, Section 77, or Section 78 is committed with respect to type 2 hazardous substance, such offender shall be subject to two-thirds of the penalty provided for in the said Section.

Section 80 If the offence under Section 75, Section 76, Section 77, or Section 78 is committed with respect to type 1 hazardous substance, such offender shall be subject to one-half of the penalty provided for in the said Section.

Section 81 Any recipient of a permit failing to comply with Section 30 or Section 31 shall be subject to a fine not exceeding ten thousand Baht.

Section 82 Any person intentionally creating a misunderstanding with respect to the origin, nature, quality, or other essences relating to the hazardous substance belonging either to such person or to other persons, making or using the labels of false statements or statement known or ought to be known to cause such misunderstandings shall be subject to an imprisonment not exceeding one year or a fine not exceeding one hundred thousand Baht or both.

If the offence under paragraph one repeating the commission of the same offence within six months as from the date of previous commission, such offender shall be subject to an imprisonment not exceeding two years or a fine not exceeding two hundred thousand Baht.

Section 83 Any person selling hazardous substance without a label or if there is a label, such label or representation thereof is not correct or selling the hazardous substance with a label of which its use has been revoked or rectified by the order of the Committee under Section 50 shall be subject to an imprisonment not exceeding six months or a fine not exceeding fifty thousand Baht or both.

If the offence under paragraph one is committed recklessly, such offender shall be subject to a fine not exceeding forty thousand Baht.

If the offence under paragraph one is committed by the producer or importer, such offender shall be subject to an imprisonment not exceeding one year or a fine not exceeding one hundred thousand Baht.

Section 84 Any person intentionally or recklessly rendering a service of making illegal labels or attaching illegal labels or destroying the essential part of legal labels for any of the hazardous substance under the provisions in Chapter 2 shall be subject to an imprisonment not exceeding six months or a fine not exceeding fifty thousand Baht or both.

Section 85 Any person failing to comply with Section 52 paragraph one shall be subject to an imprisonment not exceeding three months or a fine not exceeding thirty thousand Baht or both.

Section 86 Any person failing to facilitate reasonably the authority undertaking the execution of Section 54 shall be subject to an imprisonment not exceeding one month or a fine not exceeding ten thousand Baht.

Section 87 In case where the Court renders a judgement punishing any person for the offence under Section 71 or Section 72 and which is the case where a permit is exempted, if the circumstances indicate that such person may repeat the commission of such offence, the Court may order in the judgement prohibiting the engagement with respect to the hazardous substance for a period not exceeding five years as from the date of passing over of the punishment.

Section 88 The hazardous substance produced, imported, exported or had in possession illegally under this Act, the containers of the said hazardous substance, tools and relevant equipment or any property forfeited

by a judgement of the Court shall be submitted to the agency responsible for the control of the said hazardous substance in order to destroy or deal with it as is appropriate.

In case of the destruction thereof, the Court may also order in the judgement directing the owner to pay for the expense incurred therefrom to the Government.

Section 89 The offence under this Act, which are punishable by an imprisonment not exceeding one year or by a fine only, the Committee or Sub-committee or authority assigned by the Committee shall have the power to effect the fine

In case of the seizure or attachment of the exhibits relating to the commission of an offence under this Act, the person having the power to effect the fine under paragraph one shall effect a fine only when

- (1) in case where the exhibits can be rectified, the offender has agreed and rectified the exhibits;
 - (2) in case where the exhibits cannot be rectified, the offender allows the exhibits seized or attached to devolve on the agency responsible for the control of the said hazardous substance
- In case where the person agreeing to such effect of the fine has rectified the exhibits, the authority shall withdraw the attachment of such exhibits.
- The articles devolved on the agency responsible for the control of the said hazardous substance shall be dealt with in accordance with the regulations prescribed by the Responsible Minister.

Provisional Chapter

Section 90 Any application for permission field in accordance with the law on toxic substance and pending the consideration shall be deemed to be the application for permission under this Act mutatis mutandis. In case where such application has different particulars from those of the application under this Act, the person having the power to grant a permission shall order the modification thereof as is necessary for the compliance with this Act.

Section 91 A permit and certificate of registration issued to any person in accordance with law on toxic substance prior to the date of coming into force of this Act shall remain valid until expiration of the specified period.

Section 92 The substance or any other articles designated by the announcement as ordinary toxic substance and serious toxic substance pursuant to the law on toxic substance shall be revised and the prescription of the announcement designating them as type 1, type 2, type 3, or type 4 hazardous substance shall be completed within six months as from the date of coming into force of this Act.

During the period of unfinished execution under paragraph one, the provisions of the law on toxic substance shall remain in force except that the provisions relating to the Committee on Toxic Substance shall be replaced by the provisions of this Act relating to the Committee on Hazardous Substance and the provisions of this Act shall immediately come into force insofar as they do not conflict or contradict with those of the law on toxic substance.

Section 93 The ministerial rules and announcements prescribed pursuant to the law on toxic substance shall remain in force insofar as they do not conflict or contradict with those of the law on toxic substance.

Countersigned by
Anand Panyarachun
Prime Minister

Rates of Fees

- (1) Certificate of Registration of Hazardous Substance 5,000 Baht each
- (2) Permit for Production of Hazardous Substance 3,000 Baht each.
- (3) Permit for Import of Hazardous Substance 3,000 Baht each.
- (4) Permit for Export of Hazardous Substance 3,000 Baht each.
- (5) Permit for having Possession of Hazardous Substance 3,000 Baht each.
- (6) Permit for Import of Specimens of Hazardous Substance 1,000 Baht each.
- (7) Substitute for a Certificate of Registration of Hazardous Substance 1,000 Baht each.
- (8) Substitute for a Permit 1,000 Baht each.
- (9) Producer of Hazardous Substance 1,000 Baht each annually
- (10) Importer of Hazardous Substance 5,000 Baht each annually
- (11) Exporter of Hazardous Substance 5,000 Baht each annually
- (12) Keeper for Commerce of Hazardous Substance 10,000 Baht each annually
- (13) Seller of Hazardous Substance 10,000 Baht each annually
- (14) Renewal fees of a Permit each time are equal to those fixed for each category of the permits.

N.B. The reason for the proclamation of this Act is that at present a great number of hazardous substance have been used in various business and some of them have caused serious injury to the persons, animals, plants, property, and environments. Although at present there exist some laws which are applicable to the hazardous substance, there are so many of them which are under the powers of several ministries, bureaus, departments as a result of different proclamations made in different periods of time entailing discrepancies and incomprehensive-ness of their provisions, It is therefore expedient to revise the law on toxic substance by expanding the scope of application to cover every kind of hazardous substance as well as to adopt the criteria and procedures for an even more suitable control of the hazardous substance and to agencyize the administrative system to promote coordinations among various agencies involved in the supervision of the said hazardous substance. It is therefore necessary to enact this Act.

(Published in the Government Gazette, Volume 109, Part 39, dated 6th April, B.E. 2535)

Annex 3-B

Unofficial Translation

Notification of Ministry of Agriculture and Cooperatives On the Determination of Criteria, Procedures and Conditions

For Manufacturing, Importation, Exportation and Having in Possession of Hazardous Substance under the Responsibility of the Department of Agriculture

B.E. 2547 (2004)

.....

By virtue of the power vested in accordance with the provisions referred to in Section 5 paragraph 3 and Section 20(1) and (2) of the Hazardous Substance Act B.E. 2535, This Act provides some legislative sections that may limit the constitutional rights and freedom of citizens under Section 29. In conjunction with Section 31, Section 35, Section 48 and Section 50 of the Constitution of the Kingdom of Thailand provide contents to be able to enact under the Constitution. The Minister of the Ministry of Agriculture and Cooperatives hereby with the approval of the Committee on Hazardous Substance promulgates the Notification on the determination of criteria, procedures and condition for manufacturing, importation, exportation and having in possession of hazardous substance as follows:

1. Repeal:

- (1) the Notification of the Ministry of Agriculture and Cooperatives on the determination of criteria, procedures and conditions for manufacturing, importation, exportation and having in possession of hazardous substance overseen by the Responsible Agency of the Department of Agriculture B.E. 2538;
- (2) the Notification of the Ministry of Agriculture and Cooperatives on the approval of place for having in possession of the type-3 hazardous substance overseen by the Responsible Agency of the Department of Agriculture B.E. 2539

2. In this Notification, the hazardous substance means the hazardous substance overseen by the Responsible Agency of the Department of Agriculture issued in accordance with the Notification of the Ministry of Industry referred to in Section 18 paragraph 2 of the Hazardous Substance Act B.E. 2535.

Chapter 1 Application for a Permit

3. The application for a permit of manufacturing, importation, exportation or having in possession of the type-3 hazardous substance, the applicant shall file an application at the Office of Agricultural Regulatory, Department of Agriculture. The application for having in possession of hazardous substance for sale outside the municipal areas of Bangkok, the applicant shall file an application at the Regional Offices of the Office of Agricultural and Development.

4. Necessary documents for each type of hazardous substance regarding to the material safety data sheets must be the requisite qualifications of such hazardous substance and be attached for its consideration of a permit in accordance with the form HS/MOAC 3.

5. The manufacturing location of the type-2 or type-3 hazardous substance must be in the vicinity away from the seacoast or large reservoir at the peak water level in the normal flood season at least 1,000 meters, in exception with the protective measures from the runoff and leak and must not be in the vicinity stipulated

referred to in item 5(1), (2), (3) and (4) of the Ministerial Order (B.E. 2537) issued in accordance with the provisions of the Hazardous Substance Act B.E. 2535.

Chapter 2 **Criteria and Operational Procedures** **Concerning Place of Manufacturing and Storage**

6. In addition to the required course referred to the Ministerial Order (B.E. 2537) issued in accordance with the provisions of the Hazardous Substance Act B.E. 2535, the manufacturer of the type-2 or type-3 hazardous substance must abide by the rules as the following criteria and operational procedures:

- 6.1 Handling tools, appliance, equipment and materials and system as follows:
 - 6.1.1 Must provide protective measures from the leaking of hazardous substance during packaging that may be harmful to the workers;
 - 6.1.2 Must clean tools, appliance, equipment and materials after finishing each of the hazardous substance operation for the protection of contamination or inappropriate chemical reaction and for the purpose of the next hazardous substance manufacturing;
 - 6.1.3 The place of manufacturing, storage and adjacent area in the time of operation, must place a signboard displaying the name of hazardous substance (common name) and warning board that can be clearly seen at the distance of 50 meters with the statements and various kinds of symbols in accordance with the form HS/MOAC 4;
 - 6.1.4 Within the manufacturing building or storage of hazardous substance, must segregate areas between manufacturing and storage of each type of hazardous substance for the protection of contamination among hazardous substance. The qualifications of the floor at the manufacturing section must have the property of not absorbing or holding up any chemical substance. In case where it is necessary to specifically keep some kinds of hazardous substance, such hazardous substance must be separately provided with a special storage room and not place with other hazardous substance;
 - 6.1.5 Place of manufacturing which is not within the scope of factory under the Industry Act must be a substantial and solid building providing with the standard of electrical system inspected and certified by the certified engineer who engages in engineering professional;
 - 6.1.6 Provide adequate light to such working places
 - 6.1.7 The container of hazardous substance must be firm and strong, no leaking sign, convenient to handle and transport, no chemical reaction which is inappropriate to the hazardous substance contained in the container and able to prevent light, heat or moisture, wherever the case may be in accordance with the property of such hazardous substance.
- 6.2 Provide measures and equipment and materials for the safety of workers as follows:
 - 6.2.1 The entrance area of the building or parts of the manufacturing or storage building of hazardous substance shall provide a signboard with the wording “HAZARDOUS SUSTANCE” in red on a white background. The signboard shall have a size of 20x50 centimeters with the thickness of the letter not less than 2 centimeters and the height not less than 15 centimeters;
 - 6.2.2 Provide a signboard with the phase “NO SMOKING, DRINKING, DINING OR KEEPING FOOD IN THE WORKING AREA”;
 - 6.2.3 Provide appropriate equipment and materials for the safety of the workers as follows:
 - (1) work clothes;
 - (2) gloves, shoes and cap;
 - (3) gas mask by type of manufactured hazardous substance;

- (4) protective device from hazardous substance coming in contact with the body;
- (5) glasses wherever it is necessary.
- 6.2.4 Provide place of wash basins for hands and feet before dining, drinking or smoking;
- 6.2.5 Provide dining room or smoking area by separating from the place of working area;
- 6.2.6 Provide training programs to the workers on the understanding of danger from hazardous substance during the work operation, precautionary protective procedures and methods of counteracting the effect of a poison;
- 6.2.7 Provide a health checkup for the workers every six months for the prevention of toxic of hazardous substance accumulated in the body and in case where the work relating to the hazardous substance referred to as organophosphate or carbamate, must have a physical examination check on the level of serumcholinesterase as well, the health checkup shall include the establishment of each of worker health records. In case where the check of hazardous substance accumulated in the body of a worker up to the threshold level, such worker shall be received intention with appropriate treatment or transfer to other appropriate work;
- 6.2.8 Provide periodic training programs on the prevention of emergency response and also provide telephone numbers of the hospital, fire station, site manager or place of manufacturing and security officers at a conspicuous place that can be easily and clearly seen.

6.3 Provide supervisor at all times during manufacturing, the supervisor shall have the qualifications in the degrees of science or engineering or other degrees stipulated by the Minister and promulgated in the Government Gazette;

6.4 Provide record of the manufactured hazardous substance for every manufacturing product, the supervisor shall sign up the record book to certify at least the information on the quantity of production, rates of main ingredients, formulation or qualification of the product, date of manufacturing in accordance with the form HS/MOAC 6 annexed to this Notification. The record must be kept for a period of 2 years subject to be inspected by the official.

The manufacturer shall make a duplicate copy referred to paragraph 1 and send to the official at the end of each month via registered postal delivery and the date stamped by the post office shall be the reference of receipt;

6.5 The manufacturer of hazardous substance shall provide the following matters:

- 6.5.1 Examine on the accuracy of the rate of concentration of main ingredients and other ingredients before packaging, the analytical result shall be kept for a period of two years from the date of manufacturing and subject to be inspected by the official;
- 6.5.2 Examine container to be in good condition for use before and after filling of hazardous substance accordance with item 6.1.7;
- 6.5.3 Examine label to be relevant with each type of manufactured hazardous substance, well-stuck to the immediate container and not easily getting loose from misclassification of label referred to the Notification of the Ministry of Agriculture and Cooperatives on label issued in accordance with Section 20(1) of the Hazardous Substance Act B.E. 2535.

6.6 The manufacturer of hazardous substance shall provide label which is large enough attached to the package for transportation with the statement identifying common name of hazardous substance, the quantity of main ingredients or the rates of main ingredients, hazardous substance symbols such as corrosive substance, flammable substance and toxic substance, etc., and the warning signs, for example, no tossing and no hooking, such mark and letter must be obviously clear;

6.7 Document demonstrated manufacturing procedures includes the following:

- (1) The starting procedure of taking raw materials in the form of concentrated ingredients mixed with ingredients for transforming the composition of such concentrated substance into a usable form;
- (2) Types of ingredients consist of:
 - (2.1) Carrier;
 - (2.2) Diluent;
 - (2.3) Solvent;
 - (2.4) Other ingredients.

6.8 The manufacturer of hazardous substance shall provide the report on used container during the calendar year (January - December) submitted to the official within January of every year. The report shall include the information on type, size, quantity or number of packages, the procedures on delivery, place and method of destruction.

7. The manufacturer shall provide measures on environment protection and sewage management with the following procedures:

7.1 Provide appropriate and enough area for rubbish disposal, the area shall be managed in the orderly manner for the convenience of operation and safety;

7.2 Segregate the disposal of toxic substance and containers out of the general containers prior to destruction under the special incinerator with the temperature over 1,000 degrees Celsius or delivery for destruction at the incinerator of the industrial estate or the custom-hired company of such disposal;

7.3 In case where the manufacturing of hazardous substance is liquid, there shall be a system of elimination of such liquid hazardous substance from leaking or spilling such as the use of saw dust as absorbent then burn or destroy by any appropriate means of destruction;

7.4 Provide a reservoir supplying its water to mop up the floor or sweep away water contaminated with toxic substance with an effective sewage disposal treatment system before draining into a staining pool or a detaining pond and releasing out the treated water. The size of the reservoir must be relevant to the size and place of manufacturing;

7.5 The waste water from washing and taking bath must be treated before draining into a staining pool or a detaining pond;

7.6 In case of the release of treated water to the outside of factory, the manufacturer must examine in accordance with the Notification of the Ministry of Industry on the determination of the qualifications of waste water treatment from draining out of the factory as well;

7.7 The manufacturer must provide a preventive system of waste water leakage within the factory from draining out of the place of manufacturing, for example, ditch around the factory or reservoir for retaining floodwater.

Chapter 3

Criteria and Operational Procedures for Importation

8. The importation of the type-2 or type-3 hazardous substance must import via the office and customs offices of point of entry as follows:

- 8.1 The customs office at Bangkok seaport;
- 8.2 The customs office at Bangkok airport;
- 8.3 The customs postal office;
- 8.4 The customs airport point of entry at Had Yai;
- 8.5 The customs seaport point of entry at Song Kla;
- 8.6 The customs point of entry at Sa Dao;
- 8.7 The customs point of entry at Padangbazar;
- 8.8 The customs office at Lamchabang seaport;
- 8.9 The customs point of entry at Bangkok railway station;
- 8.10 The Office of Commodity Inspection Dock 1, Commodity Tariff Exemption Warehouse, Lad Krabang , State Railway Station.

9. The licensee of importation of hazardous substance must notify the official of the arrival of such hazardous substance at the customs office or the customs point of entry and at the time of the release from customs formalities in accordance with the form HS/MOAC 7 annexed herewith.

Chapter 4 **Criteria and Operational Procedures for Exportation**

10. The exporter must notify quantity of hazardous substance for each of the exportation to the official of the Department of Agriculture at the customs office or the customs point of entry for such exportation through the customs office or the customs point of entry in accordance with the form HS/MOAC 7 annexed herewith.

Chapter 5 **Criteria and Operational Procedures for Having in Possession**

11. The person who has in possession of the type-2 or type-3 hazardous substance for sale shall comply with the following criteria and operational procedures:

11.1 Provide sale supervisor who has attended the training programs on hazardous substance trained by the Department of Agriculture, the sale supervisor shall be trained every 5 years and any sale supervisor who has been trained for more than 5 years must attend a training course within 2 years from the date of this Notification entering into force;

11.2 Provide segregation shelves of hazardous substance from other products;

11.3 Provide separation of sale hazardous substance by type and outreach from children;
11.4 The hazardous substance on shelf shall be in the original container of the manufacturer;

11.5 Provide materials with the absorbing property, for example, saw dust for the purpose of covering the broken container or leaking container and take the said absorbent for destruction as specified on the label;

11.6 Provide washing gears as soap and water for the person who contacts with the hazardous substance;

11.7 Provide protective system on odor, dust or vaporized mist of the hazardous substance from being troublesome, annoyed or harmful to person or property in the neighborhood of the selling place.

12. The person who has in possession of the type-2 or type-3 hazardous substance in case of transportation in accordance with the resolutions promulgated by the Committee on Hazardous Substance on land transportation of hazardous substance B.E. 2545 and if the transportation of any hazardous substance is exceeding 1,000 liters or 1,000 kilograms must accompany document of the materials safety data sheet with the vehicle.

13. The person who has in possession of the type-2 or type-3 hazardous substance for the purposes of service controls on termites, rodents (i.e. mouse and mole), plant pests, storage and silo pests, insect and animal pest and aerial spraying for plant pest must have the following qualifications:

13.1 The holder for service control must have age not less than 20 years of age;

13.2 Provide appropriate and effective equipment and materials in accordance with the service and take care of equipment and materials in good order for operation;

13.3 Must provide name of the service holder and permit number on the side of operating vehicle. The size of the letter shall not be less than 4 centimeters in height;

13.4 Provide record of the employees whose works are related to the hazardous substance by identifying their responsible positions and subject to health examination at least once a year in accordance with job description and type of hazardous substance. The record shall be kept for a period not less than two years and ready to be inspected by the official;

13.5 Provide documents demonstrating the method of use of the hazardous substance, the danger of hazardous substance that may cause injury to human, animals, plants, property and environment, including protective measures, preliminary aid assistance to the victim and other details concerning hazardous substance as deemed appropriate by the official;

13.6 Must keep the hazardous substance in the original and sealed container without being troublesome to others, and keep in the place that can be protected from strangers. The entrance to the storage shall provide with a warning signboard "HAZARDOUS SUBSTANCE" that can be clearly seen;

13.7 Provide the employees with sufficient gears during the operation concerning hazardous substance;

13.8 Provide medical tools as necessary to the employees including first-aid instruction for such incident;

13.9 Provide supervisor for the control of the use of hazardous substance who has attended the training programs on hazardous substance provided by the Department of Agriculture, such supervisor shall be trained every 5 years;

13.10 Contract of services to the customer must provide in writing by given details concerning the usage of hazardous substance including toxicological symptoms, method of medical treatment and warning;

13.11 Must eliminate the waste materials and used containers as instructed on the label of container;

13.12 In case where it contained waste water of hazardous substance from washing scrap or contaminated equipment, such waste water shall not be drained to public water courses and shall not make any troublesome problem to others. The waste water shall be treated in accordance with the Notification of the Ministry of Industry on the determination of the qualifications of drainage waste water out of the factory;

13.13 Provide record for the service of hazardous substance in accordance with the form HS/MOAC 8 annexed herewith;

13.14 Provide large and easily seen signboards with the phases “DANGER, NO ENTRY” and “PLACE FOR USING HAZARDOUS SUBSTANCE” placing in the vicinity of the entrance of the office, building area, freight container, storage facility and silo as the place for using hazardous substance for service;

13.15 Prudent use of hazardous substance in accordance with the law, label and purposes of such hazardous substance.

14. This Notification shall be effective the date after its publication in the Government Gazette.

Promulgated on 26 February B.E. 2547
Somsak Thepsutin
Minister of Ministry of Agriculture and Cooperatives

Annex 3-C

[Unofficial English Translation]

Notification of Ministry of Agriculture and Cooperatives Entitled Registration, Issuance and Extension of Hazardous Substance Registration Certificate Under Responsibility of Department of Agriculture B.E. 2551(2008)

By virtue of Section 5 Paragraph three, Section 20(1) and (4), Section 36 Paragraph three and Section 37 of the Hazardous Substance Act B.E. 2535 (1992) amended by the Hazardous Substance Act B.E. (No. 3) B.E. 2551 (2008) which is the law that has some provisions relating to limitation of rights and freedom of a person under Section 29 in complement with Section 32, Section 33, Section 41, Section 43 and Section 45 of the Constitution of the Kingdom of Thailand provided contents to be able to enact a notification by virtue of the provisions of the Law , the Minister of Agricultural and Cooperatives with the opinions of the Hazardous Substance Committee made the notification as followed.

No. 1 Repeal Notification of Ministry of Agriculture and Cooperatives on Registration of Hazardous Substance under Responsibility of Department of Agriculture B.E. 2538 dated 3 May B.E. 2538 (1995).

No. 2 Hazardous substance in this notification means type 2 or type 3 hazardous substance under responsible of the Department of Agriculture according to Notification of Ministry of Industry entitled List of Hazardous Substances issued under Section 18 paragraph two which is excluded from the list of hazardous substance issued under Section 36 paragraph one of the Hazardous Substance Act B.E. 2535 (1992).

No.3 Whoever wishes to produce or import type 2 or type 3 hazardous substances, shall submit the application for registration using form HS./AC/AG 1 annexed to this notification, together with documents and testimony specified in the said form to the Department of Agriculture or the agency determined by the Department of Agriculture.

In case the submitted application referred to in paragraph one has the trade secret according to the regulation of the Ministry of Agriculture and Cooperatives on the Overseeing Trade Secret of Agricultural Chemical B.E. 2547 (2004), the applicant shall inform the authority of such secret.

No. 4 Registration of hazardous substance shall consists of 3 phases as followed.

Phase 1 - Trials Clearance for knowing the efficacy and information on acute toxicity. In this respect, production or importation of hazardous substance sample in a limited quantity is allowed for the efficacy or residue test, as the case may be.

Phase 2 - Provisional Clearance for demonstrating the usage and knowing information on sub-acute toxicity, chronic toxicity related to teratogenicity, reproductive effect, mutagenicity, toxicity to nervous system, oncogenicity and carcinogenicity (if any) and toxic residues. In this respect, production or importation of hazardous substance sample in limited quantity for demonstration of usage in the limited area is allowed.

Phase 3 - Final evaluation for full registration by evaluating the results of experiments and various information so that efficacy and safety to human and the environment would be sufficiently known if it is for usage, including long term chronic toxicity (2 years) to testing animal.

The applicant may not apply for phase 2 (Provisional Clearance) in the case that he/she has the complete information required for phase 3 (Full registration).

No. 5 In processing phase 1- Trials Clearance, the applicant for registration must submit the technical documents, data requirement for hazardous substance registration, information on acute toxicity, experimental plan for efficacy test and/or experimental plan residue test, as the case may be, which is stipulated by the Department of Agriculture and published in the Government Gazette according to the data requirement for hazardous substance registration which is stipulated that the information relating to toxicity of technical grade material and finished product must be generated by the GLP Certified Laboratory according to OECD Standard and the registration certificate in the manufacturing country. All the documents must be certified by the authority, representative the country and shall be recognized as an international document.

No. 6 Upon considered on No. 3 and 5 by the authority and deemed it appropriate to give a license, the authority shall determine the quantity of hazardous substance samples to be produced or imported into the Kingdom, method for controlling, usage of the hazardous substance in the experiment, specify the prohibition on using or consuming the product obtained from experiment, surrender or dispose hazardous substance left over from experiment, including the time period for submitting the report on the result of efficacy test, and inform the applicant for registration.

After the applicant has accomplished the efficacy trials result or due date for trial clearance as specified by the authority has been met, the applicant for registration should inform the authority as specified by the Department of Agriculture and published in the Government Gazette.

No. 7 In case that the experiment in phase 1, trials clearance, needs to produce or import samples of hazardous substance which is applied for registration or needs to import other hazardous substances for producing the hazardous substance applied for registration, the applicant for registration should submit the application for production or import hazardous substance samples to the authority using the form HS./AC./DOA 12 annexed to this notification.

Upon considered by the authority and deemed it appropriate to give a license, the authority shall issue the license certificate for production of hazard substance sample using form HS./AC./DOA 13 or the license certificate for import of hazard substance sample using form HS./AC./DOA 14 annexed to this notification.

The license referred to in paragraph two shall be made upon each application.

The recipient of the license referred to in paragraph two would be exempted from having the license for have in possession of that hazardous substance.

No. 8 Hazardous substance samples permitted to produce or import for experiment must post the label on which at least shows the following information that can be obviously seen.

- (1) Trade name or code of the product.
- (2) Common name according to ISO system (if any) or common name in other system.
- (3) Scientific name of active ingredient. In case of chemical, specify the chemical name according to IUPAC system.
- (4) Proportion of the mixture and nature of product.
- (5) Usage type and plant, animal, crop or animal pest.

- (6) Caution or warning.
- (7) Producer and source of production plant of the product.
- (8) Statement "hazardous substance samples used specifically for particular experiment only".

No. 9 In case that the applicant for registration wishes to process into phase 2 -provisional clearance, the applicant for registration should submit the technical document required for registration of hazardous substance, identify the location at which provisional clearance will take place and experimental plan as specified by Department of Agriculture and published in the Government Gazette.

No. 10 When the authority considers technical document, location, and experimental plan for provisional clearance referred to in No. 9 and decides to give the permission, the authority should specify the quantity of hazardous substance which will be produced or imported into the kingdom, method in controlling usage of hazardous substance for provisional clearance, create the list of hazardous substance and its produced or imported quantity, applied and left over quantity, names of person conducting experiment, location for which hazardous substance will be used, schedule to use product obtained from the experiment, surrender or dispose the hazardous substance left over from experiment, time period to notify the result of provisional clearance, method of curing the plaintiffs affected by this experiment and inform the applicant for registration.

When the result of the provisional clearance comes out or when the time period for this experiment ends as specified by the authority, the applicant for registration should inform the authority as specified by the Department of Agriculture and published in the Government Gazette.

No. 11 In case that the provisional clearance according to phase 2 needs to produce or import hazardous substance sample for Provisional Clearance or it needs to import other hazardous substance for producing hazardous substance for Provisional Clearance, the provisions of No. 7 shall apply mutatis mutandis.

No. 12 Hazardous substance samples permitted to be produced or imported for the experiment should have the label posted which at least contain the following information that can be seen obviously.

- (1) Trade name or code number of the product.
- (2) Common name according to ISO system (if any) or common name according to other system.
- (3) Scientific name of active ingredient. In case of chemical, it should be specified by chemical name according to IUPAC system.
- (4) Formulation and appearance of the product.
- (5) Name and address of the business of the applicant for registration.
- (6) Name of the product owner in case that the applicant for registration is not the product owner.
- (7) Packing size
- (8) The statement concerning to the benefit, application method, storage method with warning, symptom of poisoning, first aid treatment, and the recommendation to take the patient to the physician immediately with the label or container.
- (9) The statement "Not for Sale"
- (10) The statement "hazardous substance sample used specifically for provisional clearance in the specified area"

No. 13 Any person who is listed and reported to the authority as the experimenter in the provisional clearance is exempted from getting the permission to have in possession of that hazardous substance.

No. 14 In case that the applicant for registration already completed phase 1 –trials clearance and phase 2- provisional clearance and wished to receive the registration certificate of hazardous substance, he should do the followings.

(1) Submit the technical document according to the data required for registration of hazardous substance as specified by the Department of Agriculture and published in the Government Gazette.

(2) Submit the analysis result of hazardous substance sample according to its specification issued by the laboratory of the Department of Agriculture or other government laboratories and private laboratories as specified by the Department of Agriculture and published in the Government Gazette.

(3) Submit the sample or document or photograph showing the container.

No. 15 Application for registration of mixed hazardous substance, the applicant for registration should do the same as application for registration of hazardous substance which has only one hazardous substance. The applicant for registration must submit the technical document of each hazardous substance and the technical document of hazardous substance mixture according the data required for registration of hazardous substance as specified by the Department of Agriculture and published in the Government Gazette.

No. 16 When authority considers and evaluates at the stage of trial clearance and result of provisional clearance, the technical document according to data required for registration of hazardous substance, result of analysis in accordance with specification of hazardous substance, appearance of container, if decide to give the permission for registration of hazardous substance, the authority should issue the registration certificate using Form HS./AG/DOA 2 annexed to this announcement. The registration certificate shall be valid in six years commencing from the date issued.

No. 17 In considering the application for registration of hazardous substance, the authority may ask the applicant for registration to submit any information other than the data required for registration of hazardous substance or to submit any details of that hazardous substance or arrange for conducting further studies. This must be specified by the Department of Agriculture and published in the Government Gazette.

No.18 In case of the application for registration of hazardous substance which is used to be registered or is licensed for production or import by any law, it is required to do the same process including not required to submit the complete set of dossiers according to the regulation and it is not allowed to use the letter of authorization as the substitution for submission of toxicological data.

Application for import registration is required to carry out the process following this new regulation. The existing registration which is registered under the Hazardous Substances Act B.E. 2535 shall be effective until the next 3 years commencing from the date the Hazardous Substances Act (No. 3) B.E. 2551 (2008) enters into force.

No. 19 If the recipient of the registration certificate of hazardous substance wishes to amend some items in the registration certificate, he or she should submit the application for amendment using the Form HS/AC/DOA 15 annexed to this notification to the Department of Agriculture or the agency specified by the Department of Agriculture. In this regard, the authority may notify the applicant to perform testing or something else as it deemed appropriate. And if the authority considered that the request for amendment is

reasonable and suitable, the amendment of the items in the registration certificate will be done and notified to the applicant respectively.

No. 20 Any person wishes to extend validity of the hazardous substance certificate shall submit the application using Form HS/AC/DOA 3 annexed to this notification to the Department of Agriculture or the agency specified by the Department of Agriculture within one hundred and eighty days prior to the expiry date of the hazardous substance certificate.

In perusal of the application for extension of the hazardous substance certificate, the criteria and procedure for issuance of the hazardous substance certificate shall apply mutatis mutandis.

No. 21 Permission for extension of the hazardous substance shall be done by indication at the back of the registration certificate or by issuance of the new registration certificate.

This Notification is effective one day after it is announced in the Government Gazette onward.

Announced on Date 1 December B.E. 2551 (2008)

.....(Signature)
(Mr. Theerachai Saengkaew)
Deputy Minister of Agriculture and Cooperatives

Annex 3-D

Notification of The Ministry of Interior

**Re: Working Safety in Respect to Environmental Condition
(Chemical)***

By virtue of the provisions of clause 2(7) of the Announcement of the Revolutionary Party No.103, dated 16 March 2515, the Ministry of Interior hereby prescribes welfare on health and safety of the employees as follows:-

General

Clause 1. In this Notification :

“Fibre” means matter having the characteristic of being strong and lengthy similar to thread , originated from mineral, plant, animal or synthetic fibre.

“Dust” means the atom of solid capable of being dispersed, spread, carried away or floated in the air.

“Spray” means the atom of liquid capable of floating in the air.

“Fume” means the atom of solid derived from the collection of vapor of matter and capable of floating in the air.

“Gas” means fluid having uncertain volume or shape which is capable of being dispersed, spread and change into solid or liquid by increasing the pressure or decreasing the temperature.

“Chemical Vapor” means vapor derived from chemical which is liquid or solid in its normal form.

“Employer” means the person who agrees to accept the employee for employment by paying wages, and shall also include the person assigned by the employer to act on his behalf. In the case that the employer is a juristic person, it means the person authorized to act on behalf of such juristic person, and shall also include the person assigned to act on behalf of the authorized person of said juristic person.

“Employee” means the person who agrees to work for an employer for a return in wages, regardless of the fact whether he receives the wages himself or not, and shall include permanent employee and temporary employee but not including an employee who performs domestic service.

“Permanent Employee” means an employee whom the employer agrees to employ on a permanent basis.

“Temporary Employee” means an employee whom the employer agrees to employ not on permanent basis, but for the employment of which the nature is occasional, temporary or seasonal.

CHAPTER 1 CHEMICALS

Clause 2. Throughout normal working period within the place of operation where the employee works, the average quantity of chemical density in the atmosphere shall not exceed the volume specified in Table 1 annexed to this Notification.

Clause 3. No matter at any time of the normal working period, the employer shall not let the employee work in the place where the chemical density in the atmosphere exceeds the volume specified in Table 2 annexed to this Notification.

Clause 4. The employer shall not let employee work in the place where the chemical density exceeds the volume specified in Table 3 annexed to this Notification.

Clause 5. The employer shall not let employee work in the place where there is mineral dust in the atmosphere, throughout the normal working period, on average to exceed the volume specified in Table 4 annexed to this Notification.

Clause 6. Within the place of operation where chemicals specified in Table 1, 2, 3, or 4 are used, and the conditions of use may be harmful to the user or to those nearby, the employer shall prepare a specific room or building for the use of such chemicals.

Clause 7. Within the place of operation where there are chemicals or mineral dust dispersed in the atmosphere in excess of those specified in Table 1, 2, 3 or 4, the employer shall make remedy or improvement to reduce the density of the chemicals or quantity of mineral dust not to exceed those specified in said Tables. If such remedy or improvement cannot be made, the employer shall have the employees wear personal safety equipment according to the standard prescribed in Chapter 2, throughout the period of time that the employees are working with chemicals having the nature or quantity which may be harmful to the health or body of the employees, as follows:-

- (1) Suitable air filter or respirator shall be worn for dust spray, fume, gas or chemical vapor;
- (2) Rubber gloves, shin-covering rubber boots, transparent face shield, and protective equipment against chemicals that are poisonous;
- (3) Rubber gloves and rubber shoes shall be worn for chemical in solid form which is poisonous.

CHAPTER 2 STANDARD OF PERSONAL SAFETY EQUIPMENT

Clause 8. Rubber gloves shall be made of rubber or similar material, having the length up to the wrist and covering all fingers, and shall be strong not easily torn, being water proof and chemical resistant.

Clause 9. The rubber shoes shall be made of rubber or rubber compounded material, covering shin length at least when put on, and be not easily torn, being waterproof and chemical resistant.

Clause 10. Transparent face shield shall have the shield made of clear transparent plastic or other similar material, and shall be capable of preventing harm from spilled chemicals and impact resistant. The frame shall be light weight and not flammable.

Clause 11. Air filter to cover the nose and mouth to protect against chemical shall be capable of reducing the density of chemical not to exceed those specified in Table 1, 2 and 3.

Clause 12. Air filter to cover the nose and mouth to protect against mineral dust shall be capable of reducing the quantity of mineral dust not to exceed those specified in Table 4.

Clause 13. Respirator used to protect against fume, gas or chemical vapor shall be the full-face type which is self-contained with air cylinder, or be the type which the air hose is connected from other source of supply.

Clause 14. Protective equipment against spill of chemical shall be made of fabric, plastic, leather, synthetic leather or other material capable of resisting chemical.

CHAPTER 3 MISCELLANEOUS PROVISIONS

Clause 15. Prescriptions on health and safety in this Notification are only the minimum basis requirements which must be adhered to.

Clause 16. The employer may, for work of any nature for which the employee cannot conveniently utilize the protective personal safety equipment as prescribed in this Notification, allow the employee to suspend the use of such protective equipment temporarily for such specific work.

Clause 17. In case the competent official finds that the chemicals in the place of operation are not as specified in this Notification, the competent official shall make recommendation in writing, warning the employer to carry out proper action within the specified time.

Clause 18. This Notification of the Ministry of Interior shall become effective after the lapse of one hundred and eighty days from the date of publication in the Government Gazette.

Given on the 30 May B.E. 2520

KANUNG LUECHAI
Deputy Minister of Interior,
acting for Minister of Interior.

Annex : Notification of The Ministry of Interior

Re: Working Safety in Respect to Environmental Condition (Chemical)

Table 1

Item	Chemical name	Amount of chemical	
		ppm by volume	mg/M ³
1.	Aldrin	-	0.25
2.	Azinphos-methyl	-	0.2
3.	Chlordane	-	0.5
4.	DDT	-	1
5.	DDVP	-	1
6.	Dichlorvos	-	1
7.	Dieldrin	-	0.25
8.	Dimethyl 1, 2 Dimethyl 1,2-dibromo 2, 2 dichloroethyl (Dibrom)	-	3
9.	Endrin	-	0.1
10.	Guthion	-	0.2
11.	Lead arsenate	-	0.15
12.	Lindane	-	0.5
13.	Malathion	-	15
14.	Nicotine	-	15
15.	Methoxychlor	-	0.5
16.	Systox	-	0.1
17.	Thallium(Soluble compound s TI)	-	0.1
18.	Tiram	-	5
19.	Toxaphene	-	0.5
20.	Parathion	-	0.11
21.	Phosdrin	-	0.1
22.	Pyrehrum	-	5
23.	Warfarin	-	0.1
24.	Carbaryl	-	5
25.	2, 4 – D	-	10
26.	Paraquat	-	0.5
27.	2, 4, 5 T	-	10
28.	Acetic acid	10	25
29.	Ammonia	50	35
30.	Arsenic and compounds as As	-	0.5
31.	Arsine	0.05	0.2
32.	Biphenyl	0.2	1
33.	Bisphenol A	0.5	2.8
34.	Carbon dioxide	5000	9000
35.	Carbon monoxide	50	55

Item	Chemical name	Amount of chemical	
		ppm by volume	mg/M ³
36.	Chlorine	1	3
37.	Chlorine dioxide	0.1	0.3
38.	Chromium and compounds	-	1
39.	Copper Fume	-	0.1
40.	Dust or spray of copper	-	1
41.	Cotton dust (raw)	-	1
42.	Cyanide as CN	-	5
43.	Ethyl alcohol (Ethanol)	1000	1900
44.	Fluoride (as F)	-	2.5
45.	Fluorine	0.1	0.2
46.	Hydrogen cyanide	10	11
47.	Iron Oxide Fume	-	10
48.	Methyl alcohol (Methanol)	200	260
49.	Nickel carbonyl	0.001	0.007
50.	Nickel, Metal and soluble compounds , as Ni	-	1
51.	Nitric acid	2	5
52.	Nitric oxide	25	30
53.	Nitrogen dioxide	5	9
54.	Nitroglycerine	0.2	2
55.	Sodium hydroxide	-	2
56.	Sulfur dioxide	5	13
57.	Sulfuric acid	-	1
58.	Tetra ethyl lead (as Pb)	-	0.075
59.	Tetra methyl lead (as Pb)	-	0.07
60.	Stannum and inorganic compounds, as Sn	-	2
61.	Stannum and organic compounds, as Sn	-	0.1
62.	Phenol	5	19
63.	Phosgene (Carbonyl chloride)	0.1	0.4
64.	Phosphine	0.3	0.4
65.	Phosphoric acid	-	1
66.	Phosphorus (yellow)	-	0.1
67.	Phosphorus pentachloride	-	1
68.	Phosphorus pentasulfide	-	1
69.	Phosphorus trichloride	0.5	3
70.	Xylene (Xylol)	100	435
71.	Zinc chloride fume	-	1
72.	Zinc oxide fume	-	5

Table 2

Item	Chemical name	Amount of chemical	
		ppm by volume	mg/M ³
1.	Allyl glycidyl ether (AGE)	10	45
2.	Boron Trifluoride	1	3
3.	Butylamine	5	15
4.	Tert-Butyl chromate (as CrO ₃)	-	0.1
5.	Chlorine trifluoride	0.1	0.4
6.	Chloroacetaldehyde	1	3
7.	Chloroform (trichloromethane)	50	240
8.	o- Dichlorobenzene	50	300
9.	Dichloroethyl ether	15	90
10.	1,1- Dichloro-1-nitroethane	10	60
11.	Diglycidyl ether (DGE)	0.5	2.8
12.	Ethyl mercaptan	10	25
13.	Ethylene glycol dinitrate and / or Nitroglycerine	0.2	1
14.	Hydrogen chloride	5	7
15.	Iodine	0.1	1
16.	Manganese	-	5
17.	Methyl bromide	20	80
18.	Methyl mercaptan	10	20
19.	α Methyl styrene	100	480
20.	Methylene bisphenyl isocyanate (MDI)	0.02	0.2
21.	Monomethyl hydrazine	0.2	0.35
22.	Terphenyls	1	9
23.	Toluene -2,4-Diisocyanate	0.02	0.14
24.	Vinyl chloride	1	2.8

Annex 4

Emergency Response Plan

Emergency response plans should be in place for all pesticides in use, in storage, in transport or at disposal sites. While the emergency response plans can vary for each situation and each type of pesticide, the principal elements of an emergency response are always clearly spelled out in the pesticide label. Those include:

- (a) Identifying all potential hazards, risks and accident events;
- (b) Identifying of relevant local and national legislation governing emergency response plans;
- (c) Planning for anticipated emergency situations and possible responses;
- (d) Identifying flammable and explosive chemicals on site;
- (e) Training of personnel in response activities, including simulated response exercises and first-aid;
- (f) Maintaining mobile spill response capabilities or retaining the services of a specialized firm for spill response;
- (g) Notifying fire services, police and other government emergency response agencies of the location of hazardous chemicals and the routes of transport;
- (h) Installing mitigation measures, such as fire suppression systems, spill containment equipment, fire-fighting water containment, spill and fire alarms and firewalls;
- (i) Installing emergency communication systems including signs indicating emergency exits, telephone numbers, alarm locations and response instructions;
- (j) Installing and maintaining emergency response kits containing sorbents, personal protective equipment, portable fire extinguishers and first aid supplies;
- (k) Integrating facility plans with local, regional, national and global emergency plans, if appropriate; and
- (l) Regular testing of emergency response equipment and review of emergency response plan.

Emergency response plans should be prepared jointly by interdisciplinary teams that include emergency response, medical, chemical and technical personnel as well as representatives of labor and management. When applicable, representatives of potentially impacted communities should also be included.

Annex 5

Thailand National Methyl Bromide Phase-out Plan (NMBPP) Summary of Consultation Process on Code of Good Practice for Phosphine Fumigation

Summary of the Consultation Process

The consultation process on phosphine fumigation was conducted as part of the training workshops (train-the-trainer workshop and series of training workshop for fumigators). During the workshops, the training modules were distributed to participants. Code of good practice and safety rules on phosphine fumigation were educated to trainees in both theoretical and practical session. During the workshop, experiences and feedbacks from stakeholders were exchanged to make the code of good practice being more practical in light of Thailand's conditions.

In addition to the above, the Brain Storming Workshop on Methyl Bromide Phase-out and Phosphine Fumigation was also organized to present the proposed good practices (as shown in Annex 2-B) and safeguard procedures (as shown in Annex 2-C) for phosphine fumigation and to seek feedback from 172 participants. The plenary session was conducted on 11 March 2009, while the specific group session was conducted on 12 March 2009. The draft translated code of good practice for phosphine fumigation was discussed during the specific group session. Comments from stakeholders have been incorporated into the translated code of good practice for phosphine fumigation (Annex 2-A). During the workshop, the training modules were also distributed to participants.

Detail of each workshop can be found at the later session.

Feedback from the Consultation Process

1. All stakeholders are aware of potential risks and the need to follow the code of good practice in adopting phosphine. However, the main concern on the use of phosphine is the difficulties of using phosphine as alternative due to its longer exposure time than that of methyl bromide. In this regard, the participants were advised that work flows of the enterprise, starting from the sale department, procurement department till logistic and inventory management, have to be adjusted to cope with longer required exposure times in warehouse of raw materials and of packaged products. Adjustment of these processes needs time as it involves everyone in the enterprise. Given that the enterprises have about 3 years to phase-out consumption of methyl bromide in non-QPS applications, the enterprise should use the remaining period to adjust its management to accommodate phosphine fumigation.

2. Training from the DoA regarding code of good practice for phosphine fumigation, safety rules for phosphine fumigation, IPM, and monitoring of insect resistance to phosphine is critical for the sustained adoption of phosphine. The participants were suggested that the code of good practice for phosphine fumigation will be published and distributed after incorporating comments from the workshops. With regard to the insect resistance to phosphine, the laboratory resistance control unit has been established under the NMBPP to monitor potential resistance to phosphine. Any enterprises having suspicious on insect resistance to phosphine can contact the laboratory resistance control unit to collect insect sample and undergo testing to determine appropriate dosage if resistance is detected.

3. The Maximum Residue Limits, MRL of phosphine in crops should be referred to the reference of Codex Alimentarius.

4. Given that pure phosphine (i.e. from phosphine generator) is odorless and the odor of impure phosphine is detectable when the concentration of phosphine is 0.5 ppm (which is higher than the threshold

limit value, TLV, it is essential to emphasize that the absence of smell does not always indicate the absence of phosphine.

5. The validity of the faced gas mask's cartridge should be referred to the label attached to the cartridge.

6. Important information / instruction for safety should be in the box to make reader aware of these information / message.

7. After the workshops, a number of enterprises / new enterprises contacted DoA to get additional copies of training modules for their operation regarding insect pest management.

1. Train-the-trainer Workshop

Date and Venue: 12-14 May 2008, KU Home Kasetsart University, Bangkok

Objective: To provide training to officers of DoA who will provide the nation-wide training to methyl bromide users.

Type of Workshop Theoretical and practical training

Participants: Approximately 35 persons comprising of

- (1) DoA's officers from the 8 regional offices of the Office of Agricultural Research and Development and the Port of Bangkok Plant Quarantine Station (Authorized Training Center)
- (2) DoA officers,
- (3) Department of Industrial Works
- (4) World Bank and UNEP
- (5) Safety equipment specialist and
- (6) Medical practitioner.

Workshop topic:

Theoretical Session

- (1) Ozone Layer and the Montreal Protocol;
- (2) Hazardous Substances Act B.E. 2535
- (3) National Methyl Bromide Phase-out Plan and Maximum Allowable Consumption;
- (4) Stored Product Insect Pests and Biological Control Agents;
- (5) Chemical Control for Stored Product Pests;
- (6) Methods for the Detection and Measurement of Resistant of Major Beetle pests of Stored Cereal with Methyl Bromide and Phosphine;
- (7) Rodents and Their Control;
- (8) Birds and Their Control;
- (9) Fumigation Procedures;
- (10) Symptoms and First Aid for Patients Exposing to Methyl Bromide and Phosphine;
- (11) Integrated Pest Management (IPM)

Practical Session

- (12) Training on code of good practices for fumigation with methyl bromide and phosphine

Pictures of Train-the-trainer Workshop





2. Brain Storming Workshop on Methyl Bromide Phase-out and Phosphine Fumigation

Date and Venue:	11-12 March 2009, Rama Garden Hotel, Bangkok
Objective:	To present the proposed good practices and safeguard procedures for phosphine fumigation and to seek feedback from stakeholders. The plenary session was conducted on 11 March 2009, while the specific group session was conducted on 12 March 2009.
Type of Workshop	Public hearing / brainstorming Workshop
Participants:	Approximately 172 persons (104 from private sector and 68 from government agencies and associations) comprising of
<u>Private Sector (104 participants)</u>	<ul style="list-style-type: none"> (1) Owners of storage facility who use methyl bromide and phosphine for fumigation (2) Importers / traders of methyl bromide, phosphine and alternatives (3) Fumigation servicing companies
<u>Government Agencies and Associations (68 participants)</u>	<ul style="list-style-type: none"> (4) DoA (5) Department of Industrial Works (6) Department of Pollution Control (7) Department of Domestic Trade (8) Thailand Tobacco Monopoly (9) National Food Institute (10) Rice Exporter Association (11) Thai Crop Protection association (12) National Bureau of Agricultural Commodity and Food Standard (13) Marketing Organization for Farmers (14) World Bank (15) Government Savings Bank
Workshop topic:	
<u>11 March 2009</u>	<ul style="list-style-type: none"> (1) Accreditation Scheme on Manufacturing Process for Issuance of Phytosanitary Certificate for Processed Commodities (2) Operation of Management Information System (MIS) (3) Alternatives to methyl bromide for QPS and non-QPS in Thailand (4) Good practice for phosphine fumigation (5) Monitoring and management of phosphine resistance
<u>12 March 2009</u>	<ul style="list-style-type: none"> (6) Discussion on Good practice for phosphine fumigation

Pictures of Brainstorming Workshop





3. 1st Training Workshop for Fumigators

Date and Venue: 6 May 2009, Sofitel Centara Grand Bangkok Hotel, Bangkok

Objective: To provide training to fumigation servicing companies

Type of Workshop Theoretical training

Participants: Approximately 70 persons comprising of

- (1) 41 trainees from 30 fumigation servicing companies
- (2) DoA officers
- (3) Government Savings Bank
- (4) Department of Industrial Works
- (5) World Bank and UNEP
- (6) Authorized equipment suppliers
- (7) Bureau of Occupational and Environmental Diseases
- (8) Medical practitioner (Vibhavadi Hospital)

Workshop topic:

- (1) Government policy to phaseout the use of MB and implementation of Management Information System (MIS)
- (2) Monitoring of insect resistance to phosphine and insect resistance database
- (3) Operational safety for phosphine and the use of safety device
- (4) Symptoms and First Aid for Patients Exposing to Phosphine
- (5) Demonstration on the use of fumigation and safety equipment

Pictures of 1st Training Workshop for Fumigators





4. 2nd Training Workshop for Fumigators

Date and Venue: 16 September 2009, Port of Bangkok Plant Quarantine Station, Bangkok

Objective: To provide training to fumigation servicing companies

Type of Workshop Theoretical and practical training

Participants: Approximately 50 persons comprising of

- (1) 30 trainees from 20 fumigation servicing companies
- (2) DoA officers
- (3) Government Savings Bank
- (4) Authorized equipment suppliers

Workshop topic:

Theoretical Session

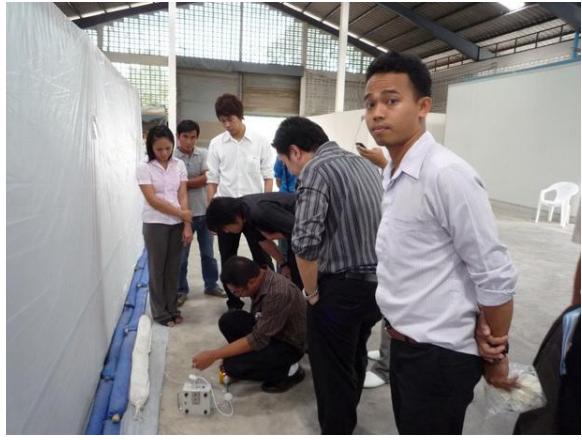
- (1) Code of Good for Fumigation
- (2) Integrated Pest Management (IPM) and experiences in USA.
- (3) Operation and maintenance of fumigation and safety equipment

Practical Session

- (4) Code of Good for Fumigation
- (5) Operation of fumigation and safety equipment

Pictures of 2nd Training Workshop for Fumigators





5. 3rd Training Workshop for Fumigators

Date and Venue:	4 February 2010, Port of Bangkok Plant Quarantine Station, Bangkok
Objective:	To provide training to fumigation servicing companies
Type of Workshop	Theoretical and practical training
Participants:	Approximately 35 persons comprising of (1) 30 trainees from 14 fumigation servicing companies (2) Government Savings Bank (3) Authorized equipment suppliers

Workshop topic:

Theoretical Session

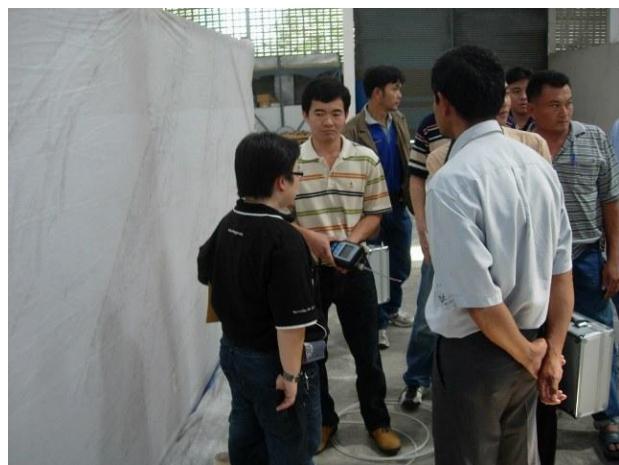
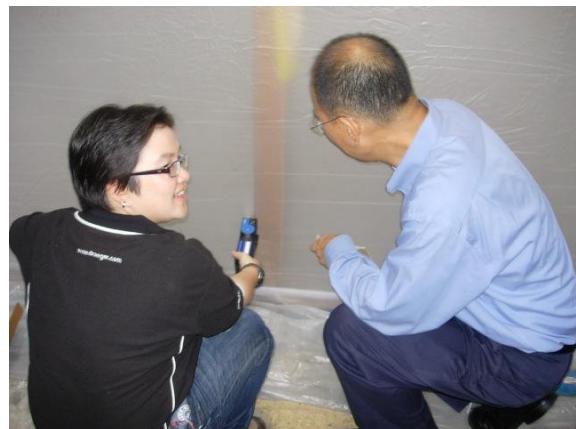
- (1) Code of Good for Fumigation
- (2) Operation and maintenance of fumigation and safety equipment

Practical Session

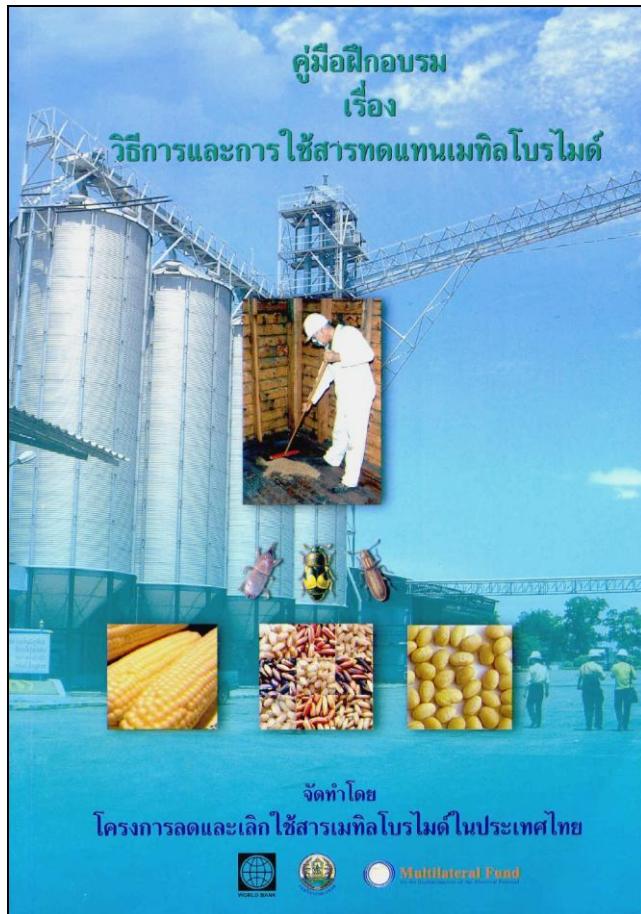
- (3) Code of Good for Fumigation
- (4) Operation of fumigation and safety equipment

Pictures of 3rd Training Workshop for Fumigators

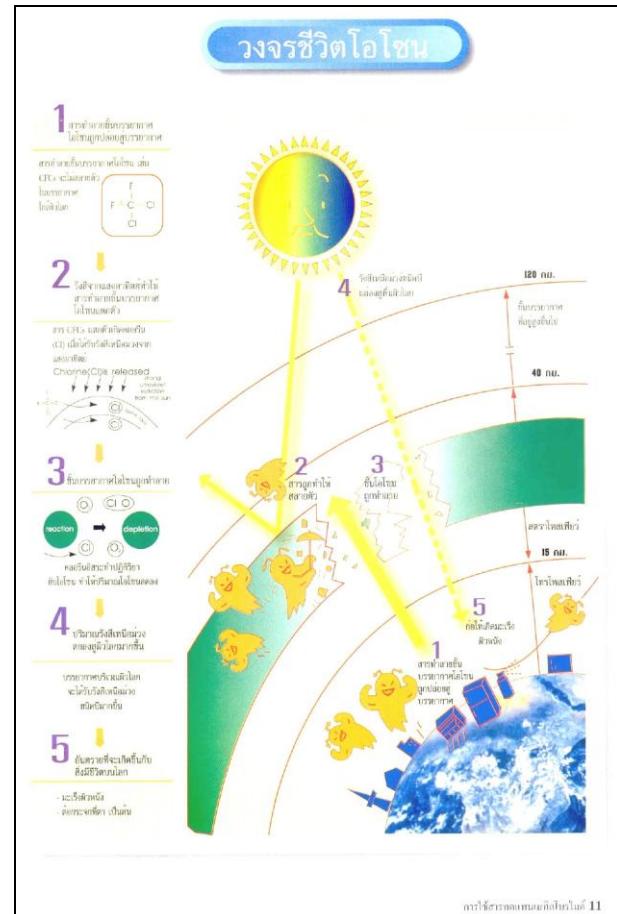




THAI MeBr MANUAL



Thai MeBr Manual 1



Thai MeBr Manual 2

THAI MeBr MANUAL



อุปกรณ์ที่ใช้ในการเตรียมเชื้อเพลิง

(จากทางลัง และขับไปขวาง) ถังเก็บเชื้อเพลิง, อัมบากลิบรามิเตอร์, ที่คุ้นเคยกับไวนิล (vaporizer), สายพานความเข้มข้นแก๊ส, เครื่องวัด, เตาไฟ, กระบอกตรวจแก๊ส, manometer, ปืนฉีดเชื้อเพลิงสาย, สายไฟ, เสือก, หน้ากากป้องกันแก๊สพิษของอุบัติเหตุ, เครื่องวัดความเร็วแก๊ส ยี่ห้อ Riken, เครื่องวัดความเข้มข้นแก๊สเพื่อความปลอดภัย, เทคโนโนมเดค, ตะเกียงชาลส์, clamp, ไฟฉาย



การติดตั้งและดูแล และการติดตั้งและดูแลอุปกรณ์ที่ใช้

158 การติดตั้งและดูแล และการติดตั้งและดูแลอุปกรณ์ที่ใช้

Thai MeBr Manual 3



การติดตั้งและดูแลอุปกรณ์ที่ใช้ และ การติดตั้งและดูแลอุปกรณ์ที่ใช้



การติดตั้งและดูแลอุปกรณ์ที่ใช้ และ การติดตั้งและดูแลอุปกรณ์ที่ใช้



การติดตั้งและดูแลอุปกรณ์ที่ใช้

การติดตั้งและดูแลอุปกรณ์ที่ใช้ 159

Thai MeBr Manual 4