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6. Warning to doctor. Carbamate exposure may be as common as organo-phosphorus exposure. The presenting symptoms of both types of poisoning are similar. While atropine is the antidote in both types of poisoning, pralidoxime must not be used in carbamate poisoning. If you have any doubt about whether it is a carbamate or an organo-phosphorus compound to which the patient has been exposed, proceed as indicated in step 1 and give atropine only until the chemical has been identified.

Write below the address and telephone number of the poison information centre or hospital nearest your place of work.



PESTICIDES WARNING CARD

Organo-phosphorus and Carbamate Compounds

IMPORTANT

This card is for your protection. Keep it on your person and show it to your family doctor or the doctor at your place of work if you become ill during or after working with organo-phosphorus or carbamate compounds.

INSTRUCTIONS

Three filled-out cards should be kept for you, two by your employer and one by you.

YEAR OF ISSUE:

+ FIRST AID ADVICE **+**

Adapted from the Medical Advisory Services of the Civil Service Department of the United Kingdom of Great Britain and Northern Ireland

**Integrated International
Safety Guidelines
for Pesticide Formulation
in Developing Countries**



United Nations Industrial Development Organization

Vienna, 1992

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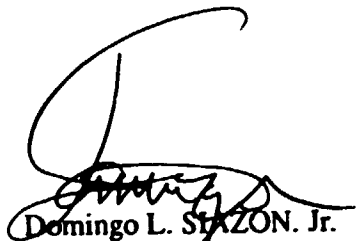
Foreword

The primary mandate of the United Nations Industrial Development Organization (UNIDO) is the promotion and acceleration of industrial development in developing countries. Within that context the development of chemical industries plays a major role on account of their importance to economic progress and their contribution to the furtherance of other industrial activities.

Any industrial undertaking involves an element of risk in terms of ensuring worker safety, protecting plant surroundings and conserving the environment. With proper planning, and by choosing the right technology that risk factor can be reduced or even eliminated. Impact assessments should thus be carried out as early as possible. This is vital especially for those industries dealing with hazardous substances, such as pesticides and their formulations.

In line with its mandate, UNIDO is committed to promoting cleaner technologies, occupational safety and environmental protection. In this connection, UNIDO addresses safety aspects in various subsectors of industry at the grassroots level. Today, in order to increase agricultural production, the majority of the developing countries are taking up pesticide formulation. They thus need integrated guidelines dealing with safety, health and environment issues in that area.

These integrated international safety guidelines were developed in consultation with experts from industrialized and developing countries. At the shop floor level their application will require the full support of industry and government alike. Combining safety practices at the production level with judicious use of pesticides in the field will allow mankind to enjoy the benefits of pesticides without incurring any detrimental impact on the environment.

A large, stylized handwritten signature in black ink, appearing to read 'Domingo L. Stazon, Jr.', is positioned above the printed name.

Domingo L. STAZON, Jr.
Director General
United Nations
Industrial Development Organization
UNIDO, Vienna, Austria

Introduction

The world population has already passed the five billion mark and even by a conservative estimate is likely to reach double digits within the next 25 years. Most of this increase will be in the developing countries. It is imperative that food output per unit area should increase with sufficient inputs such as fertilizers and pesticides to feed the ever growing population. While the use of fertilizers and pesticides have reached a peak in developed countries, according to a UNIDO survey, the use of agrochemicals in most of the developing countries will be on the increase. Pesticide manufacturing technology is very closely held by very few companies but their formulation is easily available to developing countries. More and more developing countries will be opting for formulation instead of importing finished formulated products.

By definition pesticides are toxic and whether or not a country has already established pesticide formulation facilities or planning to start new plants, they need to follow fully integrated safety guidelines covering operational, occupational and environmental aspects. Thus hazards involved in handling toxic chemicals are eliminated or kept to a minimum.

UNIDO, prior to developing the guidelines, prepared an extensive questionnaire which was sent to many pesticide formulators in developing countries. The answers received from large,

medium- and small-scale operators clearly indicated that waste management and disposal of toxic waste are major concerns. The small and medium-scale operators are badly in need of integrated safety guidelines for promoting industrial and environmental safety. Supported by funds from the Government of Finland, UNIDO organized a global meeting which brought together experts from developed and developing countries to discuss various aspects related to safety in pesticide formulation. These guidelines are intended for industries and governments to assist in addressing problems of safety, health and environment that may arise in the formulation of pesticides.

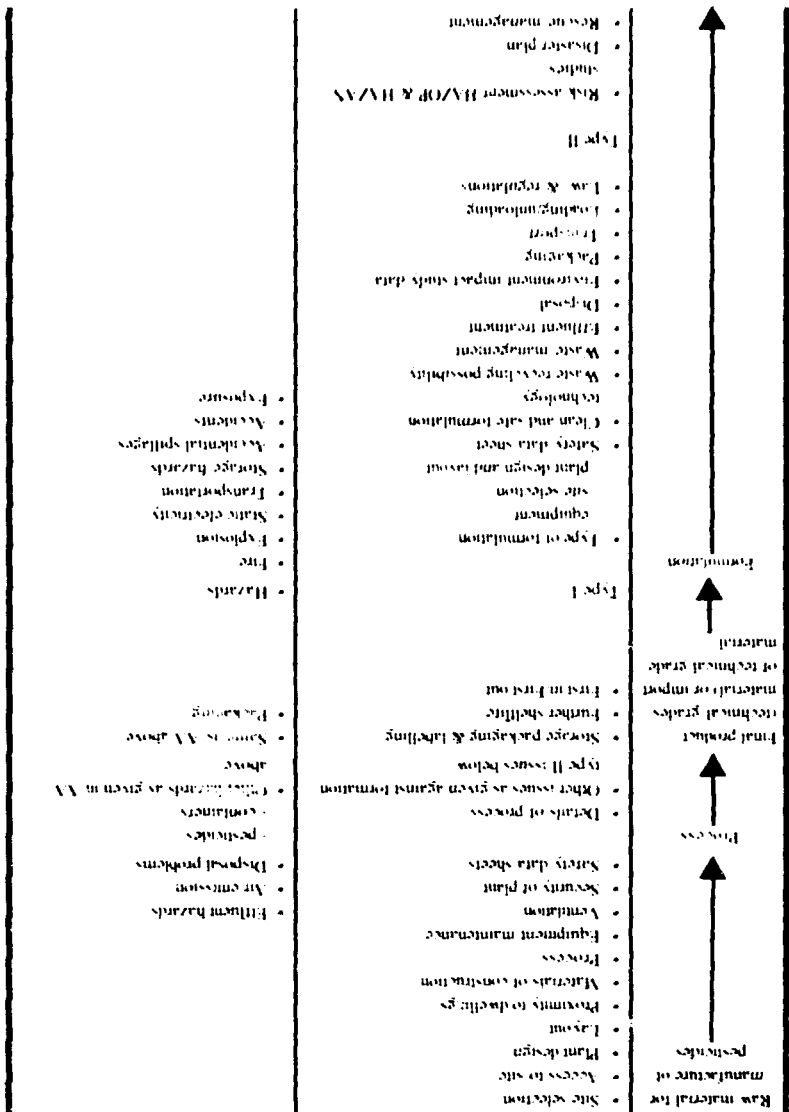
It is also the responsibility of the formulators to be interested not only in the safety of the workers, but also in the safety of the users in the field. Therefore, the safety guidelines also take into account product diversification towards user and environment friendly pesticides and/or their formulations and application technologies. These guidelines aim at promoting basic minimum, practicable and acceptable requirements in the production of pesticide formulation in developing countries, either for those who are starting at a "greenfield" site or operating existing formulation plants, including decommissioning of plants.

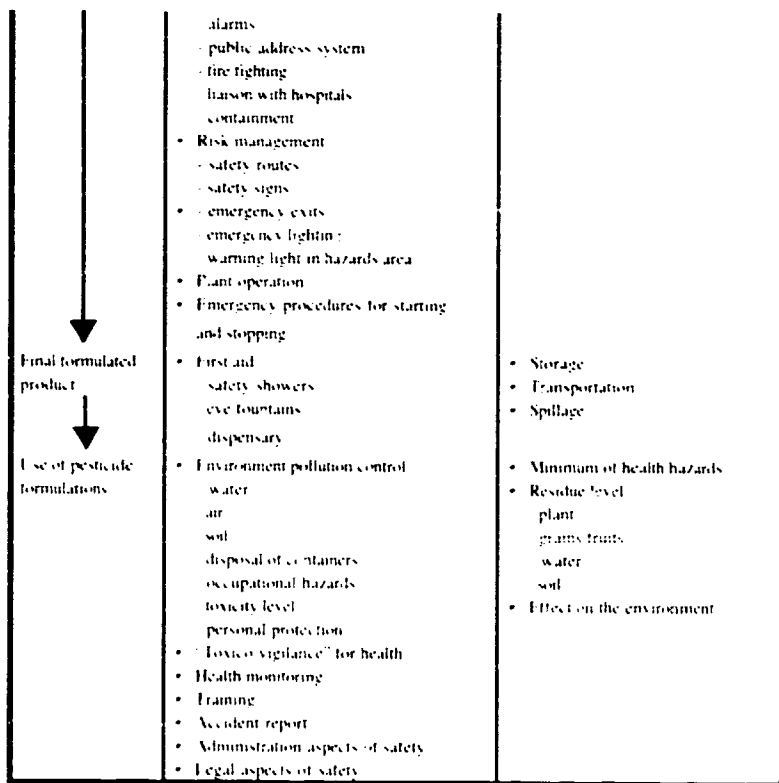
It is hoped that these integrated guidelines will help in the introduction and use of cleaner technologies as well as user and environment friendly formulations. The key considerations involved in the implementation of guidelines are recorded alongside but they are by no means comprehensive. They will have to be modified or enlarged on the basis of specific situations in the adopting countries.

Issues and specificities associated with the formulation of pesticides in the developing countries

In order to understand clearly the various issues and specificities associated with the formulation of pesticides in the developing countries, it would be necessary to take a close look at the various stages in the process of choice, identification, production and usage of pesticides as well as the various issues involved influencing the safety hazards. A schematic approach towards this end is presented.

Stages involved	Issues involved	Safety hazards
<p>Need for increase in food availability and freedom from vector borne disease</p> <p style="text-align: center;">↓</p> <p>Need for pesticides</p> <p style="text-align: center;">↓</p>	<ul style="list-style-type: none"> • Use of Agrochemicals and pesticides • Any other alternate successful technology • Target decided • Particular product (pesticide) less toxic • more toxic • degradable • environmental friendliness • residue problems • Product decided • Safety data sheet • Clean technology • Waste recycling possibilities • Effluent & disposal technology • Environmental impact studies • Packaging requirements • Law and regulations requirements • use PIC (prior informed consent) 	<ul style="list-style-type: none"> • Hazard • fire • explosion • static electricity • Transportation • Storage • Accidental spillages • Accidents • Exposure





Having taken note of the production processes and the issues involved in the determination of safety hazards, it would also be worthwhile to take note of the problems and hazards associated with the major pesticide formulations, both solid and liquid formulations.

**MAJOR PROBLEMS AND HAZARDS
ASSOCIATED WITH
PESTICIDE FORMULATIONS**

Physical State	Method of Application	Diluent	Formulation Type*	Risk / Hazard
Solid	Undiluted		DP	Operator exposed to concentrate by inhalation and skin contamination
			GR	Less exposure because of dust but due to inhalation
			Smoke generator	Operator exposed to concentrate by inhalation to greater extent
	Diluted	Bran	CB	Bait can be mistaken for food
		Water	WP	Mixer needs more protection than operator
	Water	SG / WG	Large drops moderate drift	
Liquid	Undiluted		UL	Operator exposed to full concentration and risk of inhalation of spray drift
			AE	Risk of inhalation
	Diluted	Water	EC	Mixer needs more protection than operator
		Oil	UL	Mixer and operator still exposed to high concentration and risk of inhalation of spray drift

DP = Dustable powder

WP = Wettable powder

UL = Ultra low volume liquid

GR = Granules

SG = Soluble granules

AE = Aerosol

CB = Bait concentrate

WG = Dispersible granules

EC = Emulsifiable concentrate

Yet another angle to look at would be the properties of different formulations pertaining to ease of production, safety and hygiene, packaging and transportation, ease of application, disposal of package and the physical stability, as presented below.

RELATIVE PROPERTIES OF DIFFERENT FORMULATIONS

	Best	Worst
Ease of Production	EC > WP > SC > WG	
Safety & Hygiene	SC > WG > WP > EC	
Packaging & Transportation Cost	WG > WP > FW > EC	
Ease of Application	SC > EC > WG > WP	
Disposal of package	WG = WP > SC > EC	
Physical Stability	WG > WP > EC > SC	

EC : Emulsifiable concentrate

WP : Wettable Powder

SC : Suspension Concentrate

WG : Water-Dispersible Granules

The interesting observation emanating from this analysis is that the EC formulations are generally on the worst end of the scale while the WG and SC formulations are at the best end pertaining to the important parameters influencing safety oriented decision making in the process of production and usage of pesticide formulations.

Acknowledgement

UNIDO would like to place on record its deep gratitude to the Government of Finland for its generous financial support through the United Nations Industrial Development Fund (UNIDF) for developing the guidelines. The Organization also acknowledges the technical inputs provided by Groupement International des Associations Nationales de Fabricants de Produits Agrochimiques (GIFAP), the Regional Network on Pesticides for Asia and the Pacific (RENAPAP), Growing Company Brussels and to a number of experts from both developed and developing countries who contributed to the discussion and in developing the guidelines.

Special thanks are due to UCB Chemicals, Ghent, Belgium, and to Ciba-Geigy Agro, Roosendaal, the Netherlands, for allowing a one-day visit of the participants to their plants and for explaining their safety practices used in their factory premises. We would also like to give sincere thanks to those companies and organizations that provided materials for the exhibition.

Safety guidelines

The proposed guidelines seek to be as comprehensive as possible, although it is recognized that they will have to be regularly revised to cope with new technology, new situations and new issues.

It is emphasized that the proposed guidance is intended as a first step in directing the guidelines user towards finding a solution to identified problems. Further assistance, involving expert consultation, may be necessary to evaluate and implement the best solution.

The guidelines are of a different nature dealing with operational (red), occupational (yellow), environmental (green) and/or managerial issues (blue). They are grouped accordingly although it is acknowledged that some overlap may often occur. A logical sequence has been adopted in the presentation of each safety guideline.

Presentation of Guidelines

A guideline needs justification. This section seeks to identify and emphasize the major issues associated with pesticide formulation. It stresses the importance to analyze all implications on the safety of the workers, the community and/or the environment, that may arise from pesticide formulation.

THIS SECTION GIVES A GENERAL STATEMENT OF THE GUIDELINE THAT SHOULD BE RATIFIED AND IMPLEMENTED. IT IDENTIFIES CURRENT ACTIONS AND MEASURES THAT SHOULD BE TAKEN TO ENSURE OR IMPROVE ALL ASPECTS OF SAFETY IN THE FORMULATION OF PESTICIDES.

Although not exhaustive, this section lists a number of key elements that should be considered in guideline implementation. It should help authorities and management seek the best practical options in finding the right solution.

Site Selection/ Location

Factors involving availability of energy, raw materials, proximity to dwellings, watercourses, markets are all critical for site location. The geographical environment of the plant and external developments may change with time and present safety, health and environmental problems for future operation.

SITE LOCATION OF A PESTICIDE FORMULATION PLANT SHOULD BE CAREFULLY SELECTED SO AS TO MINIMIZE ANY PRESENT AND FUTURE POTENTIAL RISK TO HUMAN HEALTH AND SAFETY, AND IMPACT ON THE ENVIRONMENT. PROVISION SHOULD BE MADE FOR POSSIBLE FUTURE EXTENSION.

Key elements for consideration in guideline implementation :

1. No proximity to residences/hospitals/schools, rivers or watercourses.
2. Area not prone to natural calamities.
3. Ground structure — Good loadbearing and permeability aspects.
4. Good access road/rail facilities.
5. Adequate energy — Power resources.
6. Prevailing wind direction.

Plant Design

The formulation of pesticide products is complex, involving multiple operations and activities in the use of, and exposure to potentially hazardous materials with associated risks arising from contamination, fire and other emergency situations.

A PESTICIDE FORMULATION PLANT DESIGN SHOULD COMPLY WITH RELEVANT LOCAL REGULATIONS AND INCORPORATE CONTAINMENT AND PREVENTIVE MEASURES TO ENSURE SAFE, HYGIENIC AND ENVIRONMENTALLY SOUND OPERATION.

Key elements for consideration in guideline implementation :

1. Separated operating areas.
2. Segregation — Dividing walls — Fire/contamination prevention.
3. Isolated solvent storage.
4. Bunded areas — Leakage containment.
5. Good internal road network — Transport and emergencies.
6. Site security — Unauthorized access.
7. Ventilation.

Site Layout

Formulation plant site layout reflects the sequence of process activities ranging through receipt of raw materials, formulation and finished product, storage or dispatch, and segregation to avoid cross-contamination of products. The strategic integration of site services, emergency facilities into the layout, communications between units and road access are vital to both routine operations and emergency situations.

SITE LAYOUT SHOULD REFLECT THE SEQUENCE OF SITE ACTIVITIES WITH PROVISION FOR UNHINDERED ROUTINE AND EMERGENCY PASSAGE BETWEEN EACH UNIT OR ZONE.

Key elements for consideration in guideline implementation :

1. Functional separation of areas in a logical sequence of plant equipment according to activities.
2. Separation of incoming raw materials from outgoing finished products.
3. Segregation of herbicides/rodenticides from other types of pesticides.

Access to Site and Buildings

The operation of a formulation plant may present considerable traffic and security problems during normal business and more so during emergencies.

A PESTICIDE FORMULATION SITE SHOULD HAVE UN-OBSTRUCTED, WELL LIT AND WELL MAINTAINED ACCESS AND APPROACH ROADS FOR SAFEGUARDING THE WORKERS, THE GENERAL PUBLIC AND THE SURROUNDINGS, AS WELL AS FOR FACILITATING EMERGENCY ACTIONS. SIMILARLY WITHIN THE SITE THERE SHOULD BE UNHINDERED AND WELL SIGN-POSTED ACCESS TO SITE BUILDINGS.

Key elements for consideration in guideline implementation :

- 1. Permanent road structure, good load-bearing and maintenance.**
- 2. Clear access to and around buildings.**
- 3. Identification of alternative emergency approach routes.**
- 4. Detailed emergency plans, including evacuation in cases of fire.**
- 5. Separate entries for personnel and goods.**

Materials of Construction

Overall safety of a formulation plant may be improved by a careful selection of materials of construction to protect against fire, corrosion, flood and other risks.

FORMULATION AND STORAGE BUILDINGS SHOULD BE CONSTRUCTED USING STRONG FIRE-RESISTANT MATERIAL IN PREFERENCE TO UNPROTECTED STEELWORK. ROOF CLADDING SHOULD BE LIGHT WEIGHT AND CAPABLE OF VENTILATING FUME AND SMOKE IN THE EVENT OF FIRE. FLOORS SHOULD BE IMPERVIOUS, EASY TO CLEAN AND HAVE A NON-SLIP SURFACE.

Key elements for consideration in guideline implementation :

Consideration of materials for construction :

- safety,
- functional considerations,
- compliance with laws and regulations,
- local availability.

Clean Technology

A new or existing formulation plant could be improved by the selection of appropriate clean technology that brings about increased efficiency, better utilization of materials and energy, and produces less wastes and emissions.

ALL PROCESSES SHOULD BE REGULARLY MONITORED AND IMPROVED FOR MORE EFFICIENT USE OF MATERIALS, RESOURCES AND ENERGY, AND REDUCTION OF EMISSIONS.

Key elements for consideration in guideline implementation :

Process technology review — Consideration of :

- safety.
- raw-materials.
- energy efficiency.
- nominal wastes and emissions.

Start-up Procedures

The start-up of a new plant or modified process always involves an element of safety risk requiring careful preparation and evaluation before handover for routine operation.

ALL RELEVANT PERSONNEL SHOULD BE TRAINED IN THE PLANT PROCESS WITH SPECIAL REFERENCE TO SAFE OPERATION BEFORE START-UP.

Key elements for consideration in guideline implementation :

1. Establishment of start-up teams and definition of responsibilities.
2. Process routes and equipment operation, and handling of chemicals.
3. Full identification and marking of equipment and piping before use.
4. Equipment and piping tests with or without water.
5. Final complete process check prior to actual production start-up.
6. Involve all relevant personnel in the plant commissioning stages to familiarize with use and minimize safety risks.
7. Operation procedures of equipment and piping.
8. Agreement and record of hand-over.

Safe Plant Operation

The formulation of pesticides involves the use of hazardous materials and the exposure and/or contamination leading to potential safety risks during plant operations.

ALL SAFETY PROCEDURES SHOULD BE INCLUDED IN THE OPERATION MANUAL AND ADHERED TO STRICTLY BY MANAGEMENT AND WORKERS. THE MANUAL SHOULD BE REVIEWED PERIODICALLY AND UPDATED.

Key elements for consideration in guideline implementation :

1. Authority approval for plant design and operation.
2. Training in process and handling dangerous materials.
3. Updated safety instructions.
4. Updated production procedures.
5. Formal safety assessment of plant and operation.

Equipment Maintenance

Pesticides are usually formulated in multi-purpose plants producing a wide range of products from the same basic equipment. Lack of proper maintenance may lead to accidents and product contamination.

THE SAFE AND CONTINUOUS OPERATION OF ALL FORMULATION UNITS SHOULD BE ENSURED THROUGH A REGULAR PLANNED EQUIPMENT MAINTENANCE PROGRAMME. A STOCK OF KEY SPARE PARTS SHOULD BE HELD.

Key elements for consideration in guideline implementation :

- 1. Regular and preventive equipment maintenance.**
- 2. Planned and scheduled maintenance — No temporary solutions.**
- 3. Recorded actions.**
- 4. Permit to work procedures.**
- 5. Post maintenance inspections.**
- 6. Correct spare parts and materials in use.**
- 7. Workers observations and report of abnormalities.**

“Permit to Work”

Formulation plants require shutdown for maintenance and/or repair on a planned or un-planned basis. This involves maintenance staff who are not always fully aware of hazards and safety risks.

ALL POTENTIAL RISKS TO MAINTENANCE AND/OR REPAIR PERSONNEL SHOULD BE IDENTIFIED, AND THE NECESSARY PREVENTIVE MEASURES STIPULATED IN A FORMAL AUTHORIZED “PERMIT TO WORK”, PRIOR TO THE COMMENCEMENT OF THE WORK.

Key elements for consideration in guideline implementation :

1. Permit to work formal document contains :
 - name of issuing authority,
 - period of validity,
 - identification of area and type of work.
2. Provision for appropriate Personal Protective Equipment (PPE).
3. Setting up of warning signs and notification.
4. Prior inspection of the work area is mandatory before issue of permit.
5. Full inspection of work area or equipment on completion of work.

On-Line Monitoring Equipment

The regular and reliable monitoring at all stages of formulation ensures safe and efficient production.

CAREFUL SELECTION OF MONITORING EQUIPMENT FOR SAFE, EFFICIENT AND QUALITY PRODUCTION SHOULD BE ENSURED.

Key elements for consideration in guideline implementation :

1. Location of equipment.
2. Specific duty required.
3. Information required (temperature, pressure, flows, etc...).
4. Separate and integrated systems.
5. Regular inspection, maintenance and calibration of monitoring equipment.
6. Availability of spare parts.

Safety Control Instrumentation

Operational process stages in pesticide formulation may present potential hazards and risks which may be minimized and/or controlled by in-built safety devices and instrumentation in the event of process failure or malfunction.

PROCESS PLANT AND EQUIPMENT SHOULD BE FITTED WITH FAIL-SAFE DEVICES AND INSTRUMENTATION. REGULAR INSPECTIONS AND TESTS SHOULD BE CONDUCTED SO THAT HAZARDOUS SITUATIONS DO NOT DEVELOP.

Key elements for consideration in guideline implementation :

1. Provision of overflow tanks or cut-off sensors to prevent overflow.
2. Activated fail-safe devices to prevent unscheduled breakdowns.
3. Purge equipment with inert gas to remove inflammable solvents if necessary.
4. Adequate ventilation.
5. Gas, vapour and dust monitoring equipment.

Fire Safety

A fire in a pesticide plant or warehouse presents enormous hazards to persons on and off the site with a serious immediate and future threat to the environment.

EMERGENCY PLANS, FIRE FIGHTING EQUIPMENT AND ENVIRONMENTAL PROTECTION MEASURES SHOULD BE CONSIDERED FOR EACH SPECIFIC LOCATION.

Key elements for consideration in guideline implementation :

1. Emergency/contingency plans including layout map of fire fighting systems.
2. Training, regular fire drills and evacuation procedures.
3. Fire extinguishers — Portable and mobile.
4. Hydrants, hoselines, sprinkler systems.
5. Spent water containment.
6. Post-fire clean-up procedures.

Materials Handling

The hazardous nature of active ingredients and the other raw materials used in pesticide formulation requires that all responsible personnel are fully aware and informed of their safe handling.

SAFETY INSTRUCTIONS SHOULD BE GIVEN TO ALL PERSONNEL INVOLVED IN THE MATERIALS HANDLING OF PESTICIDE FORMULATIONS.

Key elements for consideration in guideline implementation :

1. Material Safety Data Sheets.
2. Operational safety information.
3. Training.
4. Safety equipment and maintenance.
5. Workers participation.

Closed Operating Systems

Closed operating systems lead, in principle, to complete containment to avoid contamination at the working site and the environment.

ALL POTENTIALLY HAZARDOUS EMISSIONS FROM PROCESSES AND OTHER ACTIVITIES SHOULD BE REMOVED AT SOURCE, CONTAINED AND, WHERE POSSIBLE, RECYCLED OR RE-USED.

Key elements for consideration in guideline implementation :

1. Dust extractions and product recovery using cyclone, bag filters, etc...
2. Vapour absorption/adsorption.
3. Membrane technology, effluent reduction, re-use, etc...
4. Loading and unloading closed systems.
5. Effluent treatment, re-use.
6. Waste incineration, heat recovery.
7. Selected re-use of some containers.

Packaging and Labelling

Basic requirements in pesticide packaging are product containment, no leakage or permeation. It gives good physical protection during transport and storage and prevents decomposition. Labelling conveys product information and precautionary measures for distributors and users.

CONTAINERS, OUTER PACKAGES AND LABELS SHOULD CONFORM TO NATIONAL AND/OR INTERNATIONAL SAFETY STANDARDS RELATING TO HAZARDOUS SUBSTANCES.

Key elements for consideration in guideline implementation :

1. Storage tests on product stability and package suitability.
2. Use of the World Health Organization "Classification of Pesticides Based on Hazards", and the Food and Agricultural Organization "Code of Conduct on Distribution and Use of Pesticides".
3. Ease of handling, stacking and use (pouring).
4. Labelling — choice of direct print versus adhesive labels.
5. Label facing and durability.
6. Information — instruction — language.

Quality Control

Quality of raw materials influences the quality and safety of the finished products. Well equipped laboratory and qualified staff working to well-defined specifications are an essential requirement.

A FORMULATION PLANT SHOULD HAVE A QUALITY CONTROL PROGRAMME DESIGNED TO ENSURE PRODUCT QUALITY IN COMPLIANCE WITH NATIONAL/INTERNATIONAL SPECIFICATIONS. THE SYSTEM SHOULD CATER FOR THE QUALITY OF BOTH INCOMING AND OUTGOING MATERIALS INCLUDING PACKAGING.

Key elements for consideration in guideline implementation :

1. Well equipped laboratory and qualified staff.
2. Well defined sampling procedures, analytical methods and procedures (WHO and FAO specifications and Collaborative International Pesticide Analytical Council (CIPAC) methods).
3. Training facilities.
4. Data recording and security.
5. Compliance with national and international specifications.
6. Auditing performance by independent authority.
7. Samples retention.
8. Traceability of raw materials.

“Near Misses”

“Near misses” such as an unexpected escape of material or release of energy occurring wholly on-site are readily contained with minimal potential for off-site effects.

Such near misses are important lessons for unsatisfactory equipment or procedures.

ALL ABNORMAL OCCURRENCES, HOWEVER MINOR, SHOULD BE INVESTIGATED, CAUSES IDENTIFIED AND REMEDIAL ACTIONS IMPLEMENTED.

Key elements for consideration in guideline implementation :

1. Incident investigation and remedial action.
2. Inclusion of lessons in training programme.
3. Product spillage.
4. Localized fire outbreak.
5. Monitoring equipment failure.

Materials for equipment construction

Chemical or atmospheric corrosion, galvanic couple effect, and wear and tear of materials of construction, may lead to leakage and or breakdown of the equipment resulting in hazardous situations. Steel, stainless steel, anti-abrasion alloys, plastics and elastomers, are commonly used in formulation plants. Use of low quality of materials construction reduces safety and capability of the formulation plant.

MATERIALS FOR CONSTRUCTION OF EQUIPMENT AND RELATED PARTS SHOULD BE SELECTED TO RESIST THE CHEMICAL ATTACK BY LIQUIDS AND THE ABRASIVE ACTION OF SOLIDS INVOLVED IN THE FORMULATION PROCESS. THE ATMOSPHERIC CORROSION SHOULD ALSO BE TAKEN INTO ACCOUNT.

Key elements for consideration in guideline implementation :

1. Testing materials of construction, specially plastics and elastomers.
2. The presence of heavy metals may produce degradation of some pesticides.
3. Plate of characteristics attached to each piece of equipment.
4. Grounding/earthing and anti-static electricity devices for discharging static electricity.
5. Explosion proof electric motors and wiring in classified areas.
6. Spark-free fork lifts.

Signs

Display, at appropriate places, of signs and symbols giving warnings, information and instructions ensures safety and security in the formulation plant. Internationally accepted signs and symbols are available.

LABEL OR SIGN STEWARDSHIP SHOULD BE ESTABLISHED TO MANAGE THE OVERALL QUALITY, SUITABILITY AND ACCEPTABILITY OF LABELS, SIGNS AND PICTOGRAMS. IN ACCORDANCE WITH NATIONAL/ INTERNATIONAL STANDARDS.

Key elements for consideration in guideline implementation :

1. Use of standard sign.
2. Easily visible location.
3. Employee-friendly — Description in local language — Pictograms.
4. Durable, chemical resistant, weatherproof.
5. Regularly inspected.
6. Transport vehicles — Contact information in case of emergency.

Material Safety Data Sheet (MSDS)

The Material Safety Data Sheet (MSDS) for each chemical used in the plant provides essential safety information such as product properties and the associated handling safety, environmental and emergency advice. The MSDS is provided by the supplier and may be abstracted from other publications. The use of MSDS by management may prevent the occurrence of potential hazards.

A MATERIAL SAFETY DATA SHEET (MSDS) SHOULD BE HELD FOR EACH CHEMICAL BEING HANDLED, INCLUDING ACTIVE INGREDIENTS, FORMULATION INGREDIENTS AND THE FORMULATED PRODUCTS.

Key elements for consideration in guideline implementation :

- 1. Internationally accepted format (European Commission, International Labour Organisation) — Annex 1**
- 2. Access to MSDS on formal request — Competent authorities — Management and workers representative.**
- 3. Sources of information for MSDS :**
 - **Supplier.**
 - **International Programme on Chemical Safety (World Health Organization).**
 - **International Register of Potentially Toxic Chemicals (United Nations Environment Programme).**
 - **Occupational Safety and Health Administration (OSHA, USA)**

Emergency Safety Procedures

Emergency situations arise due to failure of plant equipment, human failure or natural calamities. These may involve fire explosion, injury, environmental hazard, loss of containment.

EMERGENCY SAFETY PROCEDURES SHOULD BE CAREFULLY PREPARED AND CONTAINED IN A CONTINGENCY PLAN COVERING :

- **PRE-EMERGENCY MEASURES TO IDENTIFY AND CONTROL HAZARDS, AND TRAINED PERSONNEL IN THE COPING PROCEDURES;**
- **ACTIONS TO CONTAIN AND MINIMIZE HAZARDS DURING EMERGENCY. MANAGEMENT SHOULD COORDINATE WITH LOCAL AUTHORITIES AND PROVIDE TRAINED PERSONNEL TO COPE WITH EMERGENCY.**

Key elements for consideration in guideline implementation :

1. Internal and third party assessment of hazard.
2. Alertness level zoning of high risk areas of the plant.
3. Documentation of emergency procedures.
4. Regular practice of emergency procedures.
5. Coordination of safety actions during emergency.
6. Warning systems and communication with neighbouring community.
7. Post emergency reporting, salvage, loss assessment (and claim), repair and recommissioning of plant.
8. Modification and improvement of procedures.

Occupational Health Monitoring

Health assessment of workers handling pesticides along with biological monitoring and medical examination is essential for the safety of workers and may identify early stage of health deviations.

AN OCCUPATIONAL HEALTH MONITORING PROGRAMME APPROPRIATE TO THE PRODUCTS AND PROCESSES SHOULD BE PROVIDED FOR THE WORKERS BY MANAGEMENT. MEDICAL RECORDS SHOULD BE MAINTAINED.

Key elements for consideration in guideline implementation :

- 1. Pre-employment and periodical examinations.**
- 2. Assessment of pesticide exposure.**
- 3. Personal and static hygiene monitors.**
- 4. Inhalation exposure assessment.**
- 5. Dermal exposure assessment.**
- 6. Threshold Limit Values (TLV).**
- 7. Maintenance of individual health records.**

Personal Protec- tive Equipment (PPE)

The use of appropriate Personal Protective Equipment (PPE) is a safeguard to any person and cannot be substituted by effective engineering controls, need for sound working practices/conditions and personal hygiene.

WORKERS IN PESTICIDE FORMULATION PLANTS SHOULD USE APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT (PPE) WHICH SHOULD BE PROVIDED BY MANAGEMENT.

Key elements for consideration in guideline implementation :

1. PPE programme and enforcement (responsibilities defined).
2. PPE appropriate to process and hazards category.
3. Comfort in use of PPE.
4. Decontamination, cleaning, maintenance and storage.
5. Training in proper use.
6. PPE for emergency situations.

Ventilation

Properly designed ventilation is essential in all pesticide plants, laboratories and warehouses to minimize the effects of dangerous fumes, vapours and odours. This problem is aggravated by hot climates.

ALL PLANTS, LABORATORIES AND WAREHOUSES SHOULD BE PROPERLY DESIGNED OR MODIFIED TO ENSURE REGULAR AIR CHANGES AND, WHERE NECESSARY, PROVIDED WITH ASSISTED AIR MOVEMENT USING FANS OR EXTRACTORS.

Key elements for consideration in guideline implementation :

1. Correct location of wall and roof vents.
2. Fan assisted air flow.
3. Controlled storage of materials for good air circulation.
4. Spot ventilation, if needed.
5. Monitoring of air quality in buildings.

Medical Facilities

The provision of adequate medical facilities in pesticide formulation plants is normally a legal requirement stipulating minimum acceptable standards to ensure health and safety of the workers.

THE PESTICIDE FORMULATION PLANT SHOULD PROVIDE WELL EQUIPPED MEDICAL FACILITIES AND QUALIFIED PERSONNEL TO HANDLE ALL MEDICAL REQUIREMENTS RELEVANT TO THE TYPE OF PRODUCT FORMULATED AND SIZE OF THE PLANT.

Key elements for consideration in guideline implementation :

1. Number of workers on-site.
2. Professional services of occupational health professionals.
3. Contract with emergency hospital and ambulance service.
4. Adequate medical emergency equipment.
5. Supplies of medicines, drugs and antidotes.
6. First aid training.
7. Periodical medical checks and individual health records.

Accident Reporting

Accident reporting and investigation of causes are vital in order to prevent further accidents.

THE ESTABLISHMENT AND MAINTENANCE OF SYSTEMATIC ACCIDENT REPORTING IN ACCORDANCE WITH NATIONAL OR INTERNATIONAL STANDARDS SHOULD BE THE COMMITMENT AND RESPONSIBILITY OF MANAGEMENT.

Key elements for consideration in guideline implementation :

1. Reporting system — Annex 2.
2. Process for follow-up and actions taken.
3. Maintain accurate records.
4. Sharing of accident experiences.
5. Reporting to external statutory authorities.
6. Analysis, evaluation of accident reports for corrective measures.

Environmental Impact Assessment (EIA)

An Environmental Impact Assessment (EIA) identifies the potential impact of a new or modified plant and how this may be eliminated or minimized at the design stage. It is particularly important to carry out an EIA in situations where local legislation and planning controls are inadequate or non-existent.

A FORMAL ENVIRONMENTAL IMPACT ASSESSMENT (EIA) SHOULD BE CONDUCTED AND DOCUMENTED FOR NEW PLANTS AT AN EARLY STAGE AND ALSO FOR MAJOR CHANGES IN EXISTING PLANTS.

Key elements for consideration in guideline implementation :

1. Site location.
2. Disposal of solid wastes, liquid effluents and gaseous emissions.
3. Containment of spillages, leakages and wastes.
4. Compliance with local legislation/standards.
5. Destruction of used containers.
6. Flora and fauna protection.
7. Soil and groundwater contamination.

Proximity of Dwellings

Houses, hospitals and schools sited in close proximity to a pesticide formulation plant can lead to extremely sensitive situations. Complaints relating to nuisance-noise, odours and road traffic can be expected. The event of a fire or other serious emergency situation could result in the severe restriction of future activity or even site closure.

A FORMULATION PLANT SHOULD PREPARE AND IMPLEMENT AN EMERGENCY PLAN WHICH CONSIDERS THE PROXIMITY OF DWELLINGS.

SITE OPERATIONS SHOULD UNDERGO A SAFETY AND ENVIRONMENTAL EXTERNAL IMPACT STUDY.

Key elements for consideration in guideline implementation :

1. Community relations initiatives — Site representative — Information on safety systems installed.
2. Investigate and respond to all complaints.
3. Open-house policy — Discuss operations and concerns with local residents.
4. Prepare action plans for implementation in event of an emergency.

Waste Recycling/ Disposal

Waste materials arising from pesticide formulation are potentially toxic, polluting and costly for disposal.

Recycling of all wastes, where possible at source, is essential to minimize quantities for disposal.

Non-recoverable wastes, unless properly managed during disposal may present toxic exposure and contamination risk to both man and the environment.

WASTE MINIMIZATION AND RECYCLING SHOULD BE REGARDED AS AN INTEGRAL PART OF THE FORMULATION PROCESS.

NON-RECOVERABLE WASTES SHOULD BE SAFELY DISPOSED IN A LEGAL AND RESPONSIBLE MANNER.

Key elements for consideration in guideline implementation :

1. Waste minimization studies.
2. Process selection and modifications.
3. Quantification of recovered materials/benefits.
4. Safe disposal of non-recoverable wastes using Best Available Technology (BAT).
5. Records — compliance with disposal regulations.
6. Off-sites disposal through certified contractor using BAT.
7. Community's right to know.

Decommissioning of Pesticide Formulation Plants

Pesticide formulation plants may be closed or moved to another site due to economic, health or environmental considerations. This may involve disposal of unused or unwanted raw materials and products which may create safety hazards.

DECOMMISSIONING OF PESTICIDE FORMULATION PLANTS SHOULD BE CAREFULLY PLANNED AND CARRIED OUT BY TRAINED PERSONNEL WITH THE KNOWLEDGE OF THE APPROPRIATE AUTHORITIES AND THE SURROUNDING COMMUNITY.

Key elements for consideration in guideline implementation :

1. Community's right to know.
2. Classification of chemicals and wastes.
3. Re-use and/or disposal of products and equipment.
4. Site decontamination.
5. Final clearance by appropriate local authorities.

Disposal of unwanted Pesticide Stock

Stock of unwanted pesticides for various reasons may accumulate into large quantities for storage. These present special problems for disposal particularly in developing countries where suitable disposal technologies may not exist.

UNWANTED PESTICIDE STOCKS SHOULD BE CLASSIFIED, SAFELY OVER-PACKED, LABELLED, RECORDED AND SECURELY STORED TO AWAIT RE-USE OR DISPOSAL OPTION.

Key elements for consideration in guideline implementation :

1. Good stock forecasting and turnaround.
2. Reformulation for use if suitable.
3. Sell or give to approved users.
4. Identification over packing and recording.
5. Safe and secure storage.
6. Disposal initiatives — Incineration — Government — multinational. Shared central resources.
7. International Group of National Associations of Manufacturers of Agrochemical Products (GIFAP) Guidance Booklet, "Disposal of Unwanted Pesticide Stocks", 1991.

Product Selection

Pesticide active ingredients and adjuvants including fillers, solvents, surfactants, may present hazards of toxicity, flammability and explosion.

PRODUCTS SHOULD BE SELECTED ON THE BASIS OF A FULL APPRAISAL OF THE HAZARDS ASSOCIATED WITH THE RAW MATERIALS AND THE TYPES OF FORMULATION.

Key elements for consideration in guideline implementation :

1. Material Safety Data Sheets (MSDS).
2. Proven technologies.
3. In-house process data.
4. Quality control capability.
5. Formulation recipe sheet.
6. Raw materials specifications.
7. Suitability of packaging materials.
8. Documents on banned or restricted pesticides.
9. World Health Organization classification of pesticides based on hazards.

Safety Audit

Periodic internal or external safety reviews or audits, assist in the early identification of hazards and their control. Involvement of management and workers will create awareness and responsibility in the safe operation of a pesticide formulation plant.

AN INTERNAL PERIODIC SAFETY AUDIT SHOULD BE UNDERTAKEN BY A TEAM COMPRISING MEMBERS FROM WITHIN AND OUTSIDE THE COMPANY, INCLUDING MANAGEMENT AND WORKERS REPRESENTATION, WITH AT LEAST ONE MEMBER KNOWLEDGEABLE IN SAFETY, HEALTH AND ENVIRONMENTAL COMPLIANCE AS REQUIRED BY LOCAL LAW.

Key elements for consideration in guideline implementation :

1. Checklist for audit.
2. Regular audits — All staff levels involved.
3. Hazard controls, accident reports, biological and environmental monitoring.
4. Equipment maintenance, training schemes.
5. Safety interviews — Discussions with staff.
6. Recommendations, follow-up actions.
7. Publicize actions — Results of actions taken.

Risk Assessment and Management

Assessment and management of risks in a formulation plant are essential elements of a progressive overall site safety strategy to evaluate potential risk areas and implement corrective actions to prevent occurrences.

RISK ASSESSMENT AND MANAGEMENT SHOULD FORM A PART OF THE OVERALL SITE SAFETY AND ENVIRONMENTAL STRATEGY AND BE ALIGNED SPECIFICALLY TO THE PRODUCTS AND OPERATIONS.

Key elements for consideration in guideline implementation :

1. Design, planning and modification.
2. Safety inspections and audits.
3. Elimination/reduction of risk.
4. Standard operation procedures.
5. Contingency planning including mutual aid arrangements with neighbouring plants.

Training

Ongoing and regular training of all staff is essential to promote awareness of safety needs and also to provide necessary knowledge and skills to prevent or minimize hazards.

REGULAR TRAINING AND REFRESHER PROGRAMMES FOR STAFF AT ALL LEVELS IN THE AREAS OF SAFETY, HEALTH AND ENVIRONMENTAL CONTROL MEASURES SHOULD BE IMPLEMENTED.

Key elements for consideration in guideline implementation :

1. Identification of training needs.
2. Development of training plan.
3. Implementation.
4. Evaluation and recording.
5. Improvement of training programmes and refresher courses.
6. Training of the trainers.

Security of Plants

Security risks arise from unauthorized entry or activity in plant premises, infrastructure, systems and facilities.

THE FORMULATION PLANT SHOULD BE SECURED AGAINST UNAUTHORIZED ENTRY AND SECURITY ARRANGEMENTS SHOULD BE PERIODICALLY REVIEWED AND UPDATED.

Key elements for consideration in guideline implementation :

1. Security of total premises (boundary wall/fence, gates, lighting).
2. Security guards (own employed/ hired).
3. Security of individual activity unit (plant, warehouse, etc...).
4. Workers identity.
5. Entry pass system for visitors.
6. Security of records.
7. Liaise with police.

User and Environment Friendly Formulations

The improvement of overall safety for both the manufacturer and user is dependent upon the continuous risk assessment and modification of product formulations from more hazardous to more user and environment friendly materials.

**MANAGEMENT SHOULD ADOPT STRATEGIES TO
SUBSTITUTE HAZARDOUS FORMULATIONS WITH
SAFE AND MORE USER AND ENVIRONMENT
FRIENDLY TYPES.**

Key elements for consideration in guideline implementation :

1. Reduction of inflammable solvents and propellants.
2. More water-based products.
3. Dust-free granules.
4. Liquid seed dressings.
5. Application—Reduced—Dosage rates.
6. Use of ozone-friendly propellants.
7. Slow release formulations.
8. Bio-pesticides.

Integration of Safety with Local Administration

The in-house safety procedures and equipment of the formulation plant can be linked with existing procedural requirements and facilities of the state/local administration and services. This optimizes the safety of the plant.

INTEGRATION OF SAFETY WITH LOCAL ADMINISTRATION AND SERVICES SHOULD COVER THE STATUTORY REQUIREMENTS OF A ROUTINE NATURE AS WELL AS THE MEASURES TO BE TAKEN DURING AN EMERGENCY.

Key elements for consideration in guideline implementation :

1. Routine inspections — actions.
2. Environment protection system — effluent treatment, air, water monitoring and use of approved landfill sites.
3. Procedures and resources to be utilized during fire.
4. Safety measures in case of an accident injury, poisoning or natural calamity.
5. Information and reporting to the local authorities.

Maintenance of Safety Databank

The efficient input, retrieval and protection of records are essential to ensure a quantitative and qualitative future base for monitoring and improving Safety, Health and Environment (SHE) aspects of operational activities.

THE DEVELOPMENT AND MAINTENANCE OF AN EFFICIENT SAFETY DATABANK SHOULD FORM AN INTEGRAL REQUIREMENT OF PESTICIDE FORMULATION ACTIVITY.

Key elements for consideration in guideline implementation :

1. Collection, processing and maintenance of safety data.
2. Data classification and protection.
3. Confidential and open-access.
4. Storage time limit of records.

Worker/ Management Responsibility

Both management and the workforce have a shared responsibility and commitment to ensure safe working conditions and practices within the workplace.

A COMMITTEE OF WORKERS AND MANAGEMENT SHOULD BE FORMED TO MEET REGULARLY TO DISCUSS AND AGREE ON SITE SAFETY POLICIES AN IMPLEMENTATION.

Key elements for consideration in guideline implementation :

1. Management/workers group meetings.
2. Worker observations and feedback.
3. Resources and manpower commitment.
4. Training and communication.
5. Performance - joint reviews and actions.
6. Periodic and emergency meetings.

Insurance cover

Insurance is necessary to cover damages to plant personnel, neighbouring community and environment. Insurance is not a substitute for safety measures but guarantees the economic plant viability in the event of an accident.

**MANAGEMENT SHOULD TAKE INSURANCE COVER
AGAINST DAMAGES INCURRED IN ANY ACCIDENT
IN ADDITION TO NORMAL LEGAL REQUIREMENTS.**

Key elements for consideration in guideline implementation :

1. Scope of cover — Annex 3
 - Personnel injuries/present and long term medical viability.
 - Neighbouring community and property.
 - Environment damages.
2. Third party risk against transport and transit accidents.
3. Periodic appraisal of insurance coverage.

Role of Governments

Governments should

- 1. Ratify the Integrated International Safety Guidelines for Pesticide Formulation and take necessary measures to assist pesticide formulation industries to adopt the guidelines.**
- 2. Consult international organizations and make necessary requests for advisory services to improve Safety, Health and Environment (SHE) aspects related to pesticide formulation in their countries.**
- 3. Provide co-ordination between industries and relevant ministries to facilitate implementation of the safety guidelines.**
- 4. Provide necessary incentives for improving SHE aspects related to pesticide formulation and encourage introduction of cleaner technology, safer and environment friendly products.**
- 5. Keep the community informed about local pesticide formulation plants, their safety records, the waste generated and disposed of every year and steps taken to minimize waste.**
- 6. Take necessary steps to join the UNIDO-Global Network on Safety (GLONESA) in pesticide formulation and seek on a cost sharing basis, and through Technical Cooperation among Developing Countries (TCDC), assistance from international organizations in order to improve the overall safety in pesticide formulation for the benefit of workers, users, the community and the environment.**

7. Encourage uniform accident reporting for the pesticide formulation industry and share the information with the Member Countries of GLONESA so that they could benefit by preventing similar types of accidents.

8. Promote through regional or sub-regional networking an efficient and economical way of dissemination of information through a centralized databank.

Role of the Industries

Industries should :

1. **Take necessary steps to adopt measures to improve safety, health and environment (SHE) aspects related to existing pesticide formulation plants or installation of new plants.**
2. **Maintain close contact with the local community and the authorities to make their plant operations transparent with respect to SHE aspects.**
3. **Seek assistance from international organizations directly or through their governments to provide information on international specifications or standards whenever needed and in getting advisory services to improve safety measures.**
4. **Co-operate with the local authorities and other chemical industries to solve waste disposal problems.**
5. **Maintain a databank regarding their waste generated, recycled/re-used and disposed of and aim at minimization of waste.**
6. **Endeavour to introduce cleaner technologies and consult their governments regarding suitable assistance for adoption of new technology.**
7. **Establish product stewardship so that their products are monitored with regard to their safety and acceptability by the users.**

8. Follow strictly "good manufacturing practice" and "responsible care" in their formulation activities.

Annexes

Material Safety Data Sheets

The criteria for the preparation of Material Safety Data Sheets for hazardous chemicals should ensure that they contain essential information including, as applicable :

1. chemical product and company identification (including trade or common name of the chemical and details of the supplier or manufacturer);
2. composition/information on ingredients (in a way that clearly identifies them for the purpose of conducting a hazard evaluation);
3. hazards identification;
4. first-aid measures;
5. fire-fighting measures;
6. accidental release measures;
7. handling and storage;
8. exposure controls/personal protection (including possible methods of monitoring workplace exposure);
9. physical and chemical properties;
10. stability and reactivity;
11. toxicological information (including the potential routes of entry into the body and the possibility of synergism with other chemicals or hazards encountered at work);
12. ecological information;
13. disposal considerations;
14. transport information;
15. regulatory information;
16. other information (including the date of preparation of the Material Safety Data Sheet).

Exemple of Material Safety Data Sheets

PRODUCT NAME		ICSC: 0000	
USE: CAS No. RTECS No. Other names:		WARNING PICTOGRAMS	
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE			
EXPLOSION			
EXPOSURE			
<input type="checkbox"/> INHALATION			
<input type="checkbox"/> SKIN			
<input type="checkbox"/> EYES			
<input type="checkbox"/> INGESTION			
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
ADDITIONAL INFORMATION			
SEE IMPORTANT INFORMATION ON BACK			
ICSC: 0000 - 1. 12-1988 Prepared in the context of cooperation between the IPCS and the Commission of the European Communities © CEC/ IPCS 1988 			

Annex 1 (continued)

I M P O R T A N T D A T A			
PHYSICAL PROPERTIES			
ENVIRONMENTAL DATA			
NOTES			
<table border="1"><tr><td data-bbox="474 938 677 958">ADDITIONAL INFORMATION</td></tr><tr><td data-bbox="474 958 677 1291"></td></tr></table>		ADDITIONAL INFORMATION	
ADDITIONAL INFORMATION			
ICSC 0000 - 2 12-1988 2 CEC IPCS 1988			

Accident Report

- Company/Plant.....
- Time of accident.....
(year, month, day, hour)
- Place.....
(location, province/state, country)
- Author ties informed yes [] no []

Injury to person		Material damaged	
own personnel	[]	by explosion	[]
others	[]	by fire	[]

Quantity released		Release	
negligible amounts	[]	spillage	[]
large amounts	[]	airborne	[]

Main process.....

Part of process.....

Device.....

Materials/Chemicals involved (common name, generic name, WHO classification category, formulation code).....

Operation (see coding list).....

Value of lost property.....

Consequential loss (downtime etc).....

Consequential loss (lost sale etc).....

Injuries to persons.....

Environment damage No [] Slight [] Medium [] Extensive []

Probable cause (see coding list, do not use code only).....

Short description of the incident with consequences (can also be attached).....

(Initiating event, equipment involved, activity at time of event).....

Action and recommendations to prevent recurrence.....

Where else could a similar incident happen.....

Signature of work or product manager.....

cc. Plant manager, Risk management contact person, Adapted from OECD

Plant safety manager, Plant, risk management, Head office Accident Report

Accident Report, Coding List

Operation during which the incident started

- 1 Normal production/work
- 2 Start-up of process/equipment etc.... test run
- 3 Shutdown of process/stopping of machinery, etc....
- 4 Failure in process/corrective action
- 5 Repair/maintenance/installation/modification
- 6 Loading/unloading
- 7 Transport
- 8 Weekend/night or other time outside working hours
- 9 Other operation/not known/of no importance

Trigger events — Causes of escalation

- 1 Absence or inadequacy of safety device
- 2 Safety device not functioning
- 3 Other construction defects, failures
- 4 Wrong or faulty construction material
- 5 Shortcomings in the process or in its control system
- 6 Poor condition due to insufficient maintenance
- 7 Incorrect use of equipment or material
- 8 Insufficient instructions/training/supervision
- 9 Lack of experience in duty/temporary manpower
- 10 Human error/illness/carelessness
- 11 Other triggering events. Which ?
- 12 Cause not known
- 13 Incorrect plant location or lay-out
- 14 Inadequate structural fire or explosion protection
- 15 Lack of space/crammed space
- 16 Insufficient fire fighting or rescue material
- 17 Insufficient instructions or training for emergency
- 18 Disregard of earlier damages and hazardous incidents
- 19 Other causes increasing the damages. Which ?

Causes of product liability incidents

- 20 Product quality does not correspond to the specifications
- 21 Product's packing inadequate
- 22 Product damaged during transport (e.g. residues of other products in the tank)
- 23 Packing damaged during transport
- 24 Product or packing damaged in intermediate storage
- 25 Insufficient operational instructions
- 26 User error
- 27 Other causes related to product liability
- 28 Soil contamination or water contamination

Formulation Type Codes

AB	gran bait	LI	liquid
AE	aerosol	LP	liquid paste
AS	aqueous solution	LS	liquid seed treatment
BB	block bait	MC	microcapsule suspension
BR	briquette	MG	microgranules
CA	coating agent	MS	mist spray
CB	bait concentrate	NB	fogging concentrate
CG	encapsulated granules	OF	oil-miscible flowable concentrate
CM	cream	OI	oil
CR	crystals	OL	oil-miscible liquid
CS	capsule suspension	PA	paste
DP	dustable powder	PB	plate bait
DS	dry seed treatment	PD	poison drink
EC	emulsifiable concentrate	PO	pour-on
EM	emulsion	PR	plant rodent
EO	water-in-oil emulsion	PS	seed coated with a pesticide
EW	oil-in-water emulsion	PT	pellets
FC	liquid cream	PW	powder
FD	smoke tin	PY	pump spray
FG	fine granules	RB	bait (ready for use)
FP	smoke cartridge	RS	ready-to-use suspension
FS	flowable concentrate for seed treatment	SB	scrap bait
FT	smoke tablet	SC	suspension concentrate
FU	fumigant	SG	water-soluble granules
FW	smoke pellets	SL	soluble concentrate
GA	gas	SM	solid material
GB	granular bait	SN	solution
GE	gas-generating product	SP	water-soluble powder
GF	smoke granules	SS	water-soluble powder for seed treatment
GG	macrogranules	ST	seed treatment
GL	gel	SU	Ultra Low Volume suspension
GP	flo-dust	TB	tablet
GR	granules	TC	technical material
GS	grease	TP	tracking powder
HN	hot fogging concentrate	TW	twin pack
IC	impregnated collar	UL	Ultra Low Volume liquid
IM	impregnated material	VP	vapour-releasing product
IS	impregnated strip	WG	water-dispersible granules
IW	impregnated wiping cloth	WP	wettable powder
KN	cold fogging concentrate	WS	slurry for seed treatment
LA	lacquer	WT	water-soluble tablet
LF	liquid fumigant		

Basic Insurance: Guidelines on Specific Classes of Insurance

RISK	CLASSES OF INSURANCE	PURCHASER
A. PROJECT RISKS		
Procurement and shipment of goods, materials, supplies and equipment to site	Transportation insurance	The buyer or the seller depending upon the terms of shipment
Goods, materials, supplies, equipment and work in progress on site. Testing risks	Insurance of the works	The buyer or the seller, in joint names
Contractor's plant and equipment	Insurance of contractor's equipment	Contractors
Project delays following loss or damage in transit or on site	Business interruption insurance	The buyer or the seller
Incidents causing injuries to third parties and/or damage to third party's property	Liability insurance, general liability insurance	The buyer or the seller, in joint names
Faulty design, engineering and project management	Professional indemnity insurance	Professional architects, engineers, project managers
Injuries, illness caused to employees	Employers liability insurance	All employers on site, unless their employees not permitted to site
B. PERFORMANCE RISKS		
Financial guarantees, surety bonds	Tender and performance bonds or guarantees	Tenderers, seller, contractors, sub-contractors on behalf of their clients
Product guarantees and/or warranties	Product guarantees	Provided by seller and/or suppliers
C. OPERATIONAL RISKS		
<ul style="list-style-type: none"> • Loss of or damage to the plant • Breakdown of machinery, explosion of pressure vessels • Business interruptions • Injuries to third parties and damage to third party property • Automobiles • Injuries to employees, illness of employees • Fraudulent acts of employees • Financial default of customers 	On going insurances	The owner of the plant

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