

Guidebook on Integrated Waste Management in the Military

A Joint United States – Republic of South Africa
Environmental Security Working Group Report



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Preface

The relationship between the United States of America (US) and the Republic of South Africa (RSA), which has been shaped under the auspices of the US-RSA Defence Committee, is critical to both these countries. This co-operative relationship has deepened our mutual commitment to jointly address common interests, solve common problems and serves as a model for other nations.

During the existence of this extended relationship, we have witnessed and confirmed the basic premise that bilateral and multilateral co-operation on subjects of mutual concern and interest reap great rewards such as saving resources and time as well as learning from the past experiences of other nations. This is especially true in the area of international defence-related environmental co-operation. The environmental security initiative between the US Department of Defense and the RSA Department of Defence has already developed a number of specific documents. This guidebook is one of the most recent products. A list of other completed documents is provided at the end of this guidebook.

Global dynamics are creating new challenges and requirements for militaries worldwide. In this sense, military organisations must be able to sustain their installations in an environmentally sound manner without impairing military mission readiness.

The guidebook is intended to assist the international military community in developing an Integrated Waste Management Program, compiling a plan and ensuring that the plan is implemented and executed during all military activities/operations to include contingency operations.

The guidebook is written in a manner that can be utilised by any defense department organisation to assist them in achieving their overall environmental goals and objectives and to ensure environmental legal compliance.

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United States Co-Chair

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Environmental Security Working Group
United States-Republic of South Africa Defence Committee

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EXECUTIVE SUMMARY

The management of waste remains one of the major environmental issues throughout the world today. Over the past two decades, an increased awareness of improper disposal of wastes has led to a focus on how waste impacts human health and the environment. These issues as well as the uncontrolled dumping of hazardous waste have been addressed by international organisations, mostly under the auspices of the United Nations Environmental Program (UNEP).

All military organisations face environmental challenges as part of their day-to-day operations. The principles associated with proper waste management are relevant to increased environmental stewardship by different nations on a global scale. International acceptability in terms of environmental practices is closely related to a country's acceptability as a trading partner and to its ability to participate in international affairs. It is therefore important that the management of waste be internationally acceptable.

The Integrated Waste Management (IWM) approach aims to minimise the risks associated with the handling and disposal of waste to the point where they are acceptable to man and the environment. The objective of IWM is to move away from fragmented and uncoordinated waste management to an integrated system. Such a holistic approach extends over the entire life cycle of a product or system from "cradle to grave" and covers prevention, generation, collection, treatment and the final disposal. It therefore represents a paradigm shift by moving away from waste management based on impact management and remediation to waste management focused on prevention and minimisation.

The purpose of this guidebook is to facilitate and assist the international community in the development, implementation and execution of an IWM Program. It provides information that can be utilised by military organisations in developing and/or tailoring their own waste management policies and procedures. It provides guidelines and principles for effective waste management, and contains guidance on how to compile an integrated waste management plan.

This guidebook was developed through a joint US-RSA project team, comprised of subject matter experts in both environmental and disposal management from both countries. A list of team members is provided at the end of this guidebook.

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Background

Ever increasing urban and industrial development throughout the world is leading to levels of waste and pollution, which seriously threaten the natural resources upon which humankind depends for its survival. International commitments to principles of sustainable development include consideration of waste and the use of renewable resources. Thus the implications for waste disposal throughout a product's life cycle need to be recognised in order to assess the true environmental impact of waste. The complexities of legal and safe waste management have increased considerably in recent years and are likely to continue.

Some military activities generate waste that is difficult to dispose of, both in terms of cost and strict legal requirements. Effective measures to deal with such unavoidable waste will remain necessary, but much greater attention must be directed to the introduction of preventative strategies aimed at waste minimisation and prevention. This will contribute to the protection of human health as well as supporting the military mission through reducing the environmental liability of the military commander. In addition to these advantages created for the sustainability of the environment, the products derived from applying integrated waste management measures can also be considered as a potential resource in other areas of the military or the economy of a country.

Purpose

The purpose of this guidebook is to assist and guide environmental waste managers at different levels of their military organisation to develop policies, plans and programs on Integrated Waste Management (IWM). The focus is on solid waste including hazardous waste and does not include wastewater.

Intended Users of this Guidebook

This guidebook has been developed with a wide target audience in mind. It is intended for use by the broader international military community and civilian personnel responsible for the integrated management of waste within their organisation. This guidebook is designed to assist:

- Policy makers in developing broad environmental governance regarding waste management practices and providing direction for anticipating and solving future problems in waste management.
- Product system managers with incorporating environmental considerations in the life cycle of product systems.
- Procurement or supply chain managers with integrating environmental considerations in procurement and supply activities.
- Waste managers in developing, implementing and managing an IWM program at the base or contingency operation level.
- Commanders towards increasing awareness of their legal liability and financial accountability with regard to waste management.

It is designed to assist all users in identifying waste in terms of the waste management hierarchy during the life cycle of a product and in identifying the appropriate methods of managing resultant waste in accordance with an IWM plan. This information can also be utilised as a tool to support informed decision making on the handling of waste products in a sustainable manner.

This guidebook is not intended to prescribe comprehensive methods or required information on integrated waste management. It is rather intended to be a guide or a tool for utilisation by military organisations to assist in their approach and strategy towards the management of waste during military activities and operations.

Guidebook Organisation

SECTION 1 – This section provides the definition of waste, identification of waste streams, legal framework and the principles of IWM.

SECTION 2 – This section defines IWM, the benefits of IWM, the hierarchy of IWM and general guidelines for IWM.

SECTION 3 – This section discusses decision factors, IWM guidelines for policymakers, procurement and acquisition product system managers, and waste managers at military installations and during contingency operations.

SECTION 4– This section discusses IWM information management.

SECTION 5 – This section discusses partnerships, education and awareness training and the link to risk and safety management.

Appendices and diagrams must be read in conjunction with the text. Guidelines are also provided in the text in the form of explanation and discussion. A glossary of terminology, abbreviations and references are also provided at the end of this guidebook.

SECTION 1

What is Waste

Waste can be defined as an undesirable or superfluous by-product, emission, or residue of any process or activity, which has been discarded, accumulated or been stored for the purpose of discarding or processing. It may be gaseous, liquid or solid or any combination thereof and may originate from a residential, commercial or industrial area from military or non-military activities. Useable items that are still serviceable but are not required for a specific service anymore and cannot be utilised for another purpose, are also considered as waste.

Hazardous waste is waste that has the potential, even in low concentrations, to have a significant adverse effect on public health or the environment. It is defined as an inorganic or organic element or compound that, because of its toxicological, physical, chemical or persistency properties, may exercise detrimental acute or chronic impacts on human health and the environment. It can be generated from a wide range of commercial, industrial, agricultural and domestic activities and may take the form of gas, liquid, sludge or solid. These characteristics contribute not only to the degree of hazard but are also of great importance in the ultimate choice of a safe and environmentally acceptable method of disposal. In accordance with the *United Nations Recommendations on the Transport of Dangerous Goods*, hazardous waste is classified into nine classes for transport purposes namely:¹

- Class 1 Explosives
- Class 2 Gases
- Class 3 Flammable Liquids
- Class 4 Flammable Solids
- Class 5 Oxidising Substances and Organic Peroxides
- Class 6 Toxic and Infectious Substances
- Class 7 Radioactive Substances
- Class 8 Corrosives
- Class 9 Other Miscellaneous Substances

Identification of Waste Streams

Several waste streams are likely to originate from the core activities of the military. Some of these waste streams may not be hazardous, but the majority may contain a component(s) that may need special treatment. The nature of these waste streams may also vary due to composition and physical form. In order to make informed decisions on determining the appropriate waste management options to handle, treat and dispose of waste, the different waste streams associated with the core business of the military must be identified in terms of hazardous and non-hazardous wastes. Waste streams can be categorised into six different streams, based on similar health and environmental concerns namely:²

- **Inorganic wastes** – acids, alkalis, cyanide wastes, heavy metal sludges and solutions, asbestos wastes and other solid residues.

¹ UN Recommendation - UN3473. This classification is used by many countries, including South Africa and the United States.

² Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition, Department of Water Affairs and Forestry, Republic of South Africa, 1998.

- **Oily wastes** – primarily from the processing, storage and use of mineral oils.
- **Organic wastes** – halogenated solvents residues, non-halogenated solvent residues, polychlorinated biphenyl (PCB) wastes, paint and resin wastes.
- **Putrescible Organic Waste** – wastes from production of edible oils, slaughter houses, tanneries and other animal based products.
- **High Volume/Low Hazard Wastes** – waste based on their intrinsic properties present relatively low hazards but may pose problems due to high volumes such as fly ash from power plants.
- **Miscellaneous Wastes** – infectious waste from diseased human/animal tissue, redundant chemicals, laboratory wastes and explosive wastes from manufacturing operations or redundant munitions.

See Figures 1, 2 and 3 for examples of waste streams identified with regard to the operation of tactical equipment, aircraft and naval ships. See section 3 for examples of waste streams identified with regard to functional and operational activities.

Figure 1. Example of Waste Streams associated with A Tactical Vehicle



Figure 2. Example of Waste Streams associated with an Aircraft

Figure 3. Example of Waste Streams associated with a Ship



Legal Framework for Waste Management

International concern about waste and its management is evident in protocols, conventions, reports and conferences that have arisen from significant international bodies. These include the report of the World Commission on Environment and Development and the 1992 Rio Conference with Agenda 21, which serve as a blue print for sustainable development. In order to uphold their global responsibilities, countries must ensure their international commitments regarding waste management are met through the implementation and enforcement of sound waste management policies and processes. Legislation at many governmental levels has been developed to standardise and control waste management.

International

The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989) is the international framework legislation that regulates the management of waste. This convention aims:

- to ensure the generation of hazardous and other wastes is reduced to a minimum, and ensure the availability of adequate disposal facilities for the environmentally sound management of hazardous and other wastes,
- to ensure that persons involved in the management of hazardous or other wastes take such steps as are necessary to prevent pollution due to hazardous and other wastes,
- to minimise the consequences of such pollution occurrence on human health and the environment and that the transboundary movement of hazardous and other wastes is reduced to the minimum,
- to be consistent with the environmentally sound and efficient management of such wastes, and
- to ensure that it is conducted in a manner which will protect human health and the environment against the adverse effects which may result from such movement.

National

The laws of a country provide the legal basis for regulating rights with regard to the environment and human health. In addition, national policy and law covers and enforces international agreements and conventions within a country. In this sense, national policy on waste management will set out the vision, strategic goals and objectives that a government will use for achieving integrated waste management. Such policy must be identified and form the basis for the development of waste management strategies and plans within the military organisation.

Regional

The regional governments' policies are often derived from the national framework policy and must also be incorporated in the waste management plan at regional and local levels.

Principles for Waste Management

Based on international and national legislation, the following basic principles for waste management have been derived:

- Waste Avoidance and Minimisation. Waste management must minimise and avoid the creation of waste at the source, especially in the case of toxic and hazardous wastes. It should also encourage waste recycling, separation at source and safe disposal of unavoidable waste.
- Transboundary Movement. Potential transboundary effects on human health and the environment must be considered.
- Duty-of-care. Any individual or institution that generates waste should always be accountable for the management and disposal of this waste and should be penalised appropriately for any and every transgression committed.
- Cradle to Grave. Responsibility for the environmental, health and safety consequences of a policy, program, project, product, process, service or activity exists throughout its life cycle. It starts with conceptualisation and planning and runs through all stages of implementation to reuse, recycling and ultimate disposal of products and waste or decommissioning of installations.
- Precautionary Principle. A risk-averse and cautious approach should be applied that recognises the limits of current knowledge about the environmental consequences of decisions or actions.
- Polluter Pays. Those responsible for environmental damage must pay the repair costs both to the environment and human health, and the costs of preventive measures to reduce or prevent further pollution and environmental damage.

An IWM program addresses all these waste management principles.

SECTION 2

What is IWM

IWM is a holistic, integrated system and process of management aimed at prevention and minimisation at the source, managing the impact of waste on the receiving environment and remediating impacted environments. It integrates waste management for maximum efficiency and minimal impacts and financial costs. It aims at planning the management of waste in advance in an environmentally responsible way from its generation until its final disposal.

Benefits of IWM

The following benefits can be derived from an integrated preventative approach to waste management within the military:

Economic

- Reduces the cost of input materials and waste management.
- Generates income (from the sale of waste products).
- Reduces penalties and fees for non-compliance to legislative provisions.
- Effectively allocates resources.
- Reduces disposal and/or remediation costs.

Military Mission

- Enhances the military mission.
- Ensures efficiency.
- Prevents adverse impacts to military operations due to non-compliance or human health issues.

Security

- Prevents unauthorised access to military information and materials and equipment.

Environmental

- Promotes sustainability.
- Reduces the source(s) of materials.
- Reduces the impact on the environment.

Legal

- Ensures compliance with legislative provisions.
- Facilitates authorisations.
- Minimises the future and unknown liabilities.

Social

- Reduces the risk to human health.
- Creates jobs.
- Contributes to improved public relations.

The IWM Hierarchy

The benefits of an IWM can be best achieved by using an orderly process involving four steps of the waste management hierarchy: cleaner products and services; recycling; treatment; and, finally, disposal. This process is illustrated in figure 4.

IWM Hierarchy Processes

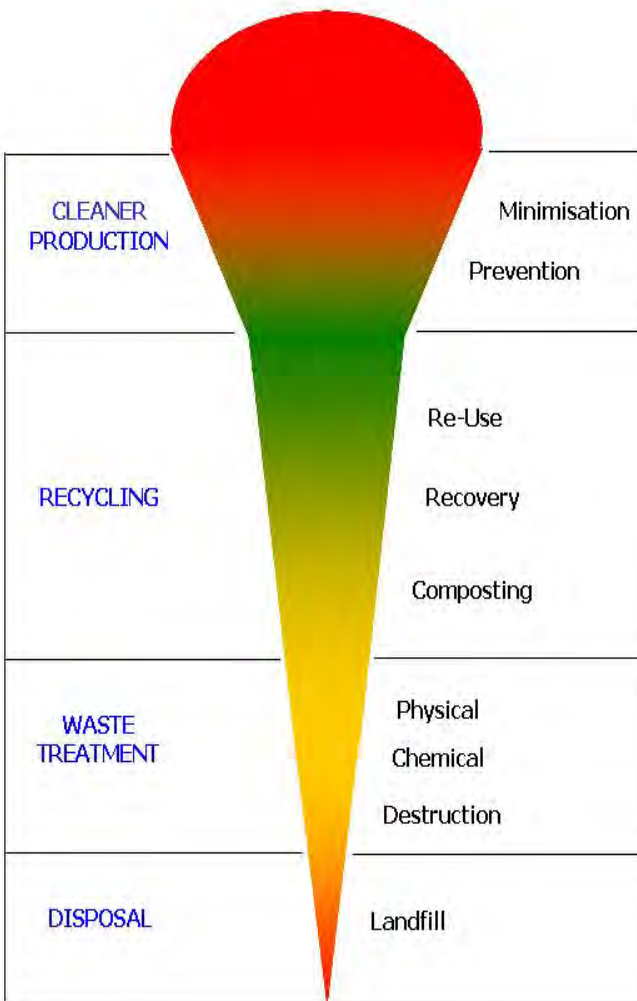


Figure 4. Steps in the IWM Hierarchy

CLEANER PRODUCTS AND SERVICES - Avoidance, reduction or elimination of waste, generally within the confines of the production unit through changes in industrial processes or procedures. This first step in the waste hierarchy consists of applying the measures of **prevention and minimisation** for reducing the amount of waste generated. [Examples: double-sided printing, citrus-based solvents]

RECYCLING - The re-use and recovery of wastes for the original or some other purposes such as input material and materials recovery. This second step requires processes of **reuse, recovery and composting**. Reuse can be for another or the same purpose and with or without treatment of the waste. Recovery entails the separation and reclamation of material for reuse. Composting is the chemical process of breakdown or change of characteristics of organic wastes to recover elements of such materials. [Examples: recycling construction materials, recycling antifreeze, metal recovery from plating operations, composting broken non-treated shipping pallets, donation of excess military supplies and equipment]

WASTE TREATMENT - The destruction, detoxification, neutralisation or other treatment of wastes into less harmful substances and with less volume of waste. This step includes **physical, chemical and biological treatment and destruction**. Physical treatment relates to the processes of compacting, shredding, melting and crushing. Chemical treatment is the process of chemically treating wastes to alter or minimise the adverse characteristics of the waste. Biological treatment relates to using living organisms to break down contaminants into less harmful components. Destruction entails demolition or incineration of waste. [Examples: shredding tyres, neutralising corrosives, biodegradation of fuels, burning waste oil for heat]

DISPOSAL - The discharge of wastes to air, water or land in properly controlled or safe ways. Secure land disposal may involve volume reduction and treatment prior to **landfill** disposal. [Examples: landfill of solid waste, discharge of treated sewage effluent]

See Appendix A for examples of the steps in the IWM hierarchy.

Guidelines for IWM

The first step in embarking on the path of IWM is to ensure that the necessary resources such as facilities, trained personnel and transport are available to the waste manager. In terms of the above-mentioned waste management hierarchy, the guidelines contained in Table 1 are of importance.

Table 1. Guidelines for Waste Management Hierarchy Processes

Step		Guidelines
Cleaner Production & Services	Prevention	<ul style="list-style-type: none"> • Process Analysis. <ul style="list-style-type: none"> □ Complete a Life Cycle Analysis. <ul style="list-style-type: none"> ➤ Determine process frequencies. ➤ Complete an Alternative Process Analysis. ➤ Embark on green purchasing. ➤ Buy pollution prevention equipment. ➤ Redesign processes to eliminate or reduce the use of materials that contribute to waste. ➤ Buy items you can recycle and/or re-use. ➤ Investigate green technologies. • Paperwork reduction. <ul style="list-style-type: none"> □ Eliminate unnecessary forms, reports, and publications. □ Make use of E-documents. □ Set all printers/copiers to default to double-sided printing. • Domestic Waste Reduction. <ul style="list-style-type: none"> □ Minimise Packaging. <ul style="list-style-type: none"> ➤ Eliminate excess packaging. ➤ Borrow or rent items infrequently needed. ➤ Buy durable products instead of disposable/cheaply made ones. ➤ Ship items on returnable/reusable pallets and containers.
	Minimisation	<ul style="list-style-type: none"> • Stock Control. <ul style="list-style-type: none"> □ Introduce a Hazmat “Pharmacy” System (Appendix B). □ Make use of an Authorised Use List (AUL). □ Rotate stock. □ Introduce a “Shelf Life Program.” □ Ensure “just in time” delivery. • Process Control. <ul style="list-style-type: none"> □ Review and improve application methods. □ Review and improve dispenser methods. □ Minimise and control spills. □ Review and improve cleanup methods. • Buy recycled products such as toner cartridges, paper and oil.
Recycling	Reuse	<ul style="list-style-type: none"> • Establish central recovery collection for “excess to requirement” materials (base or higher levels). • Donate to other authorised users. • Use for alternative purposes. • Use for same purposes after treatment. • Implement “two on one” principle (cannibalisation of non-usable items) to construct or build a serviceable product from components.

Step		Guidelines
Recycling (cont)	Recovery	<ul style="list-style-type: none"> • Identify recoverable waste (e.g. glass, paper, metal, plastics). • Identify market opportunities. • Separate waste materials. • Establish facilities and processes to support recovery. • Establish contract to facilitate recovery.
	Composting	<ul style="list-style-type: none"> • Identify organic waste. • Establish facilities for composting or establish a contract. • Identify use (and cost savings) for compost on facility or identify market opportunities.
Treatment Consider if waste requires further treatment to reduce hazards/volume; apply for permits/authorisations; if contracted out, consider suitability, permits, inspections and documentation	Physical	<ul style="list-style-type: none"> • Identify waste alteration to facilitate transportation and disposal such as compaction, shredding, melting and crushing. • Buy equipment for waste alteration. • Train personnel on equipment operation. • Contract for transport and disposal.
	Chemical	<ul style="list-style-type: none"> • Identify alteration of chemical properties to a less hazardous by product. • Consider the secondary impact on the environment. • Buy equipment and appropriate personal protective equipment. • Train personnel on equipment operation. • Ensure spill prevention and contingency plan and equipment are available.
	Biological	<ul style="list-style-type: none"> • Use sewage treatment facilities. • Bio-remediate polluted soil and water. • Consider the secondary impact on the environment. • Buy equipment and appropriate personal protective equipment. • Train personnel on equipment operation.
	Destruction	<ul style="list-style-type: none"> • Consider types of waste suitable for destruction. • Consider the secondary impact on the environment (process and end products). • Buy equipment and appropriate personal protective equipment. • Train personnel on equipment operation. • Consider recovery of energy from the process.
Disposal	Landfill	<ul style="list-style-type: none"> • Landfill. <ul style="list-style-type: none"> □ Utilise approved local authority or private landfill sites. □ Use appropriate landfill sites for the specific waste category. □ Ensure a physical inspection of the site is carried out prior to use. □ Ensure safe disposal documentation/manifest system for hazardous waste. • Sewage disposal system. <ul style="list-style-type: none"> □ Utilise existing local authority sewage disposal system. □ If not available, consider environmentally sustainable sewage disposal.

SECTION 3

IWM in Military Operations

IWM must be a part of all military operations to include policy-making and strategic planning, procurement, acquisition, base management and contingency operations. All levels of personnel have responsibilities in IWM—from policymakers integrating proper waste management into policy to individuals following their waste management Standard Operating Procedures (SOP). Leaders and managers must make decisions that ensure waste management is included in planning, budgeting and resourcing.

Decision Factors

Decision factors will ensure that informed management decisions are made in terms of the allocation and prioritisation of scarce resources as well as options for waste management to be considered, taking life cycle costs into consideration. The current situation must be considered as a course of action. Thereafter the following elements must be considered when deciding on an alternative course of action:

- The type of waste.
- Legal compliance.
- Quantity of the waste.
- Impact on the environment.
- The available waste management options in terms of technologies, service providers, facilities, industrial support, etc.
- The availability of internal resources to support waste management options, e.g. facilities, personnel, equipment and transport.
- The type of military mission.
- The impact on the military mission.
- A cost-benefit analysis of waste management options and/or the process or the product changes.
- Cost to be avoided by weighing up different methods when implementing a waste management option.
- Revenue generated from the waste.
- Safety, health and quality of life.
- Public relations.

IWM in Policy Making and Strategic Planning

Senior policy makers and strategic planners set the course for current and future military activities and operations. To ensure IWM is a consideration in policy making and planning, senior leaders should follow these guidelines:

Legislative implications. Ensure that legislative provisions are adhered to (see section 1 on the Legal Framework) and that these are applicable to the implementation of the relevant policies on IWM. Constantly monitor changes in legislation.

Departmental goals and objectives. Identify short-, medium- and long-term goals on IWM.

Recommend changes to policy and doctrine.

- Monitor changes in policy and doctrine.
- Apply a green procurement approach in policy.

- ❑ Incorporate IWM into product system policy.
- ❑ Determine the implication and influence on doctrine.
- ❑ Ensure a feedback system from lower levels.

Training. Ensure training is available, approved and resourced.

Inter- and intra-departmental liaison to align policy and activities. Ensure the participation in the legislative process as well as participation in formal structures and forums.

Resources. Determine and ensure the required organisational resources.

Integration. Ensure integration with other policy and systems.

Research and Development. Stay current with the latest environmental trends and technologies.

Stakeholders. Determine the role of stakeholders.

Liaison. Provide corporate oversight/review/governance.

Recognition. Introduce an award system or incentives for proper IWM practices.

International Contributions. Provide waste management inputs into Status of Force Agreements (SOFAs) or Memorandums of Understanding (MOUs).

The Product System Life Cycle

A Basic Perspective

The life cycle of any product is illustrated in Figure 5 below.

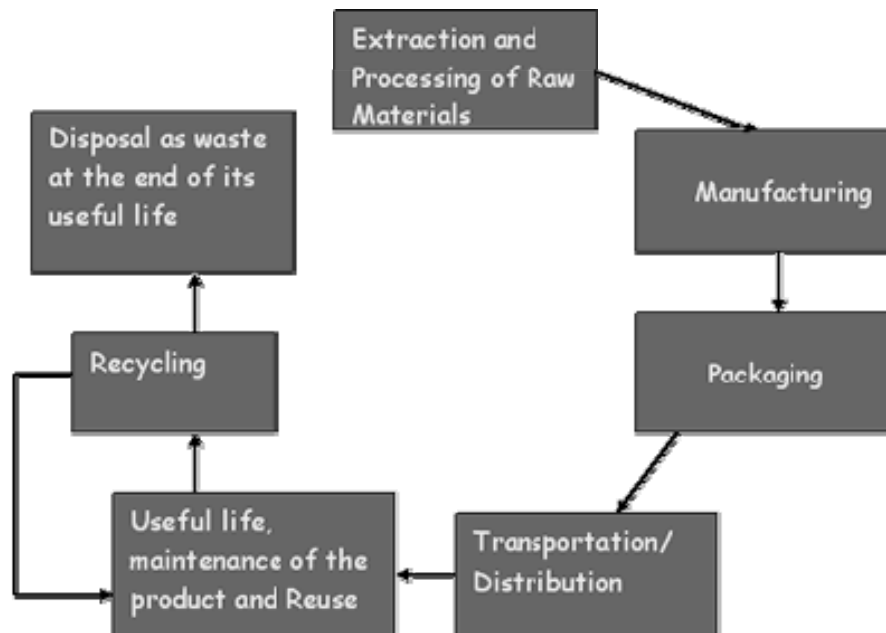


Figure 5. Product Life Cycle

From an IWM perspective it is important to realise that waste is generated during each step of the life cycle and not only at the end of the useful life of a product. Military role players must influence each step in the product life cycle to:

- Ensure cleaner production.
- Facilitate recycling.
- Reduce the extent, cost and hazards associated with waste treatment.

- Minimise the amount of waste to be disposed or remediated.

Sources of Military Inventory

The military users' ability to exert influence over the product life cycle is, however, influenced by the sources and processes to acquire inventory. Some are simple with a short product life, while others are very complicated with an extended product life, sometimes spanning decades. Militaries obtain inventory in a number of ways, which can be broadly grouped under one or more of the following:

- **Procurement**
 - Universal/general commodities and consumables.
 - Commercial off the shelf (COTS) items.
 - Non-specialised equipment adapted for military use but available in the open market. This is often referred to as general military off the shelf (General MOTS) equipment.
- **Acquisition**
 - Weapons systems developed for a specific military or coalition of forces (e.g. NATO).
 - Munitions developed for use with specific weapons systems.
 - Specialised equipment developed specifically for military use yet available in the open market. This is often referred to as specialised military off the shelf (Special MOTS) equipment.
- **Donations**
 - This can emanate from any of the above two categories.

Life cycle management responsibility and more specifically the responsibility for IWM is discussed in the following sections.

IWM in Procurement Activities

The following role players play an important role in the life cycle and IWM of procured products and services:

- **Commodity Manager.** In instances where an organisation procures large quantities of a specific product or service, such as fuel, stationery, food, clothing, catering services, etc. it is customary to appoint commodity managers to manage the procurement, use and disposal of these products. The commodity manager has amongst others the following responsibilities:
 - Interpret the requirement/need of end users.
 - Ensure that product and service delivery specifications are compiled.
 - Promote "green" purchasing.
 - Incorporate IWM specifications/language into contracts and ensure contracts are monitored for compliance with IWM.
 - Negotiate contracts on a centralised basis to enable procurement at either a centralised or decentralised level.
 - Manage stock if held in reserve at a central depot.
 - Monitor consumption and replenishment.
 - Manage disposal of redundant stock.

- **End User.** As the name suggests the end user is the primary user or beneficiary of services procured. In the case of simple products or services, the end user has control over the full life cycle of the product from procurement to eventual disposal.

IWM in Acquisition Activities

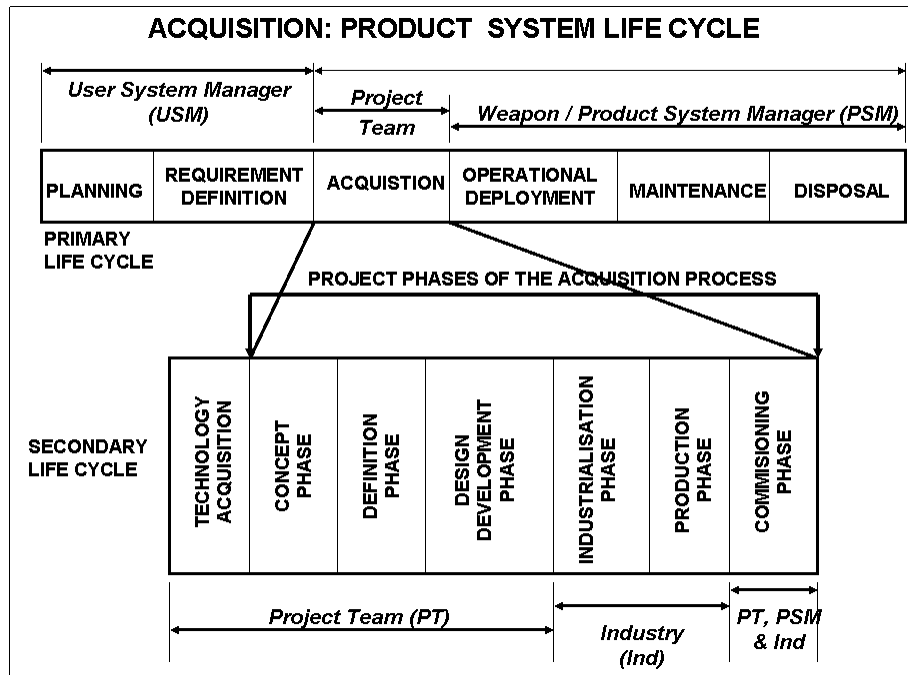


Figure 6. Responsibilities of Various Role Players over the Weapon/Product System Life Cycle during the Acquisition Process

Acquisition: Life Cycle Responsibility

As can be seen from Figure 6, the life cycle responsibility for military inventory is essentially shared by four major role players. They are responsible for specific steps in the life cycle, which can be summarised as follows:

- **User System Manager** interprets medium and long term higher order operational guidelines and is responsible for the planning of capital equipment regarding the:
 - Continuation of equipment, employment and support.
 - Formulation of equipment performance objectives.
 - Formulation of needs regarding maintenance or upgrades of existing equipment.
 - Development of new equipment.
 - Formulation of needs regarding phase-out of existing equipment.
- **Project Team** receives specific capital equipment development planning guidelines from the system manager. The project team is then responsible for detail planning and execution of specific capital equipment regarding the:
 - Upgrading of existing equipment.
 - Development of new equipment.
- **Weapon/Product System Manager** is responsible for the deployment (employment), maintenance (support) and eventual disposal (phase-out) of existing equipment.
- **Industry** is responsible for the manufacture and long-term industry support to the weapon/product system.

Responsibilities for IWM during the Acquisition Process

The IWM responsibilities of each of the above-mentioned role players, over the weapon/product system life cycle are summarised in Table 2.

Table 2. IWM Responsibilities of Major Role Players Over the Weapon/Product System Life Cycle

Product System Life Cycle Phase	Manipulator	Integrated Waste Management Action/Consideration
Planning	Strategic Planners & User System Manager	<ul style="list-style-type: none"> • Take note of the legal and natural environment in which the mandate will be executed. • Commit the organisation to comply with international treaties to which one's country is a signatory.
Requirement Definition	User System Manager	<ul style="list-style-type: none"> • State the following requirements: <ul style="list-style-type: none"> ▪ Compliance with environmental legislation. ▪ Incorporation of environmentally friendly/sustainable technologies into the design. ▪ Incorporation of waste minimisation into the design. ▪ Cost of the environmental program. ▪ Integration of the project with existing Environmental Management System (EMS). ▪ Continual environmental evaluation of the project.
Acquisition (Concept Definition)	Project Team	<ul style="list-style-type: none"> • Conduct a legal review (environmental law) with regard to: <ul style="list-style-type: none"> ▪ Waste streams associated with maintenance concept. ▪ Manufacturing processes. ▪ Development and utilisation of project specific facilities. ▪ Environmental impact management during tests and evaluation. • Develop environmental management programs with regard to: <ul style="list-style-type: none"> ▪ Waste streams associated with maintenance concept. ▪ Manufacturing processes. ▪ Development and utilisation of project specific facilities. ▪ Environmental impact management during tests and evaluation. • Ensure system requirements documents include IWM processes. • Ensure contracts with industry include IWM processes and provide for monitoring compliance in accordance with the IWM plan.

Product System Life Cycle Phase	Manipulator	Integrated Waste Management Action/Consideration
Acquisition (Concept Definition) (cont)	Project Team	<ul style="list-style-type: none"> • Establish baseline support, operations and maintenance concept. • Determine the cost of the environmental management program. • Ensure development of user education programs (include environmental considerations in user manuals). • Obtain environmental expertise for the remainder of the program's development phases.
Acquisition (Design Development)	Project Team	<ul style="list-style-type: none"> • Develop overall HazMat control and management program including related hardware (Appendix B). • Develop pollution prevention program. • Develop program environmental budget. • Begin environmental assessment with regard to testing, operations and disposal. • Conduct legal compliance review and identify permit requirements. • Develop disposal plan; consider option to donate.
Acquisition (Production)	Industry	<ul style="list-style-type: none"> • Institute overall HazMat control and management program and monitor contractor's compliance. • Establish pollution prevention program and evaluate contractor's compliance. • Demonstrate compliance (ISO 9000 and 14001).
Acquisition (Commissioning)	Project Team, Product System Manager & Industry	<ul style="list-style-type: none"> • Conduct final operational test and evaluation (FOT&E) of: <ul style="list-style-type: none"> ▪ Pollution prevention measures. ▪ Pollution containment and rehabilitation technologies. ▪ Waste management technologies. • Document modifications that could not be incorporated within given time frames. • Qualify waste management and pollution prevention doctrine and technologies.
Operational Deployment	Weapon / Product System Manager Operational User Support Organisation	<ul style="list-style-type: none"> • Ensure environmental legal compliance with regard to: <ul style="list-style-type: none"> ▪ Permit requirements. ▪ Waste streams associated with operations and maintenance. • Environmental impact of operation and maintenance processes. <ul style="list-style-type: none"> ▪ Development and utilisation of project specific facilities. • Continual monitoring and review. • Institute environmental management programs with regard to:

Product System Life Cycle Phase	Manipulator	Integrated Waste Management Action/Consideration
Operational Deployment (cont)	Weapon / Product System Manager Operational User Support Organisation	<ul style="list-style-type: none"> ▪ Waste streams associated with operations and maintenance. ▪ HazMat control and management, including technologies required. ▪ User education. ▪ Environmental impact of operation and maintenance processes. ▪ Development and utilisation of project specific facilities. ▪ Establish baseline support, operations and maintenance concept. <ul style="list-style-type: none"> • Continual monitoring and review. • Finalise the environmental budget.
Disposal	Product System manager & User system Manager	<ul style="list-style-type: none"> • Review disposal plan to ensure all environmental requirements are up to date. • Finalise the disposal budget. • Prior to deciding to dispose of the system or components, ensure that all components and spare parts have been evaluated for potential recycling and reuse. Also, ensure that all potential re-users have been notified of disposal or donation plans. • Ensure that an environmental impact assessment that addresses the environmental impacts of disposal is complete. • Ensure that disposal contracts and plans clearly communicate hazardous waste removal, handling, and disposal procedures, as well as worker safety procedures.

IWM for Base Operations

An IWM program must be integrated into all levels of the organisation. Its development and implementation is a team effort with the waste manager as the co-coordinator in conjunction with the Hazmat committee. Other members of a waste team include the users, procurement personnel, supply support personnel, transport personnel, disposal personnel, a health and safety officer, an environmental manager, the integrated waste manager, service providers, the local authority, a legal advisor and the public relations officer. An IWM program at a military base or installation requires a “baseline analysis” consisting of the following elements:

1. Map the base and all its facilities.
2. Identify and analyse all waste-generating processes and activities taking place on the base.
3. Define waste streams in terms of hazardous and non-hazardous or general waste. (See figures 8 and 9 for examples.)
4. Analyse the waste streams against the IWM hierarchy.
5. Evaluate waste management options in the waste management hierarchy. (Refer to the section on Decision Factors in this chapter.)
6. Set objectives and priorities for management of waste types.

All other elements of this IWM process, as shown in Figure 7, have been discussed in the previous sections.

FLOW CHART FOR THE DEVELOPMENT AND IMPLEMENTATION OF AN INTEGRATED WASTE MANAGEMENT (IWM) PROGRAM

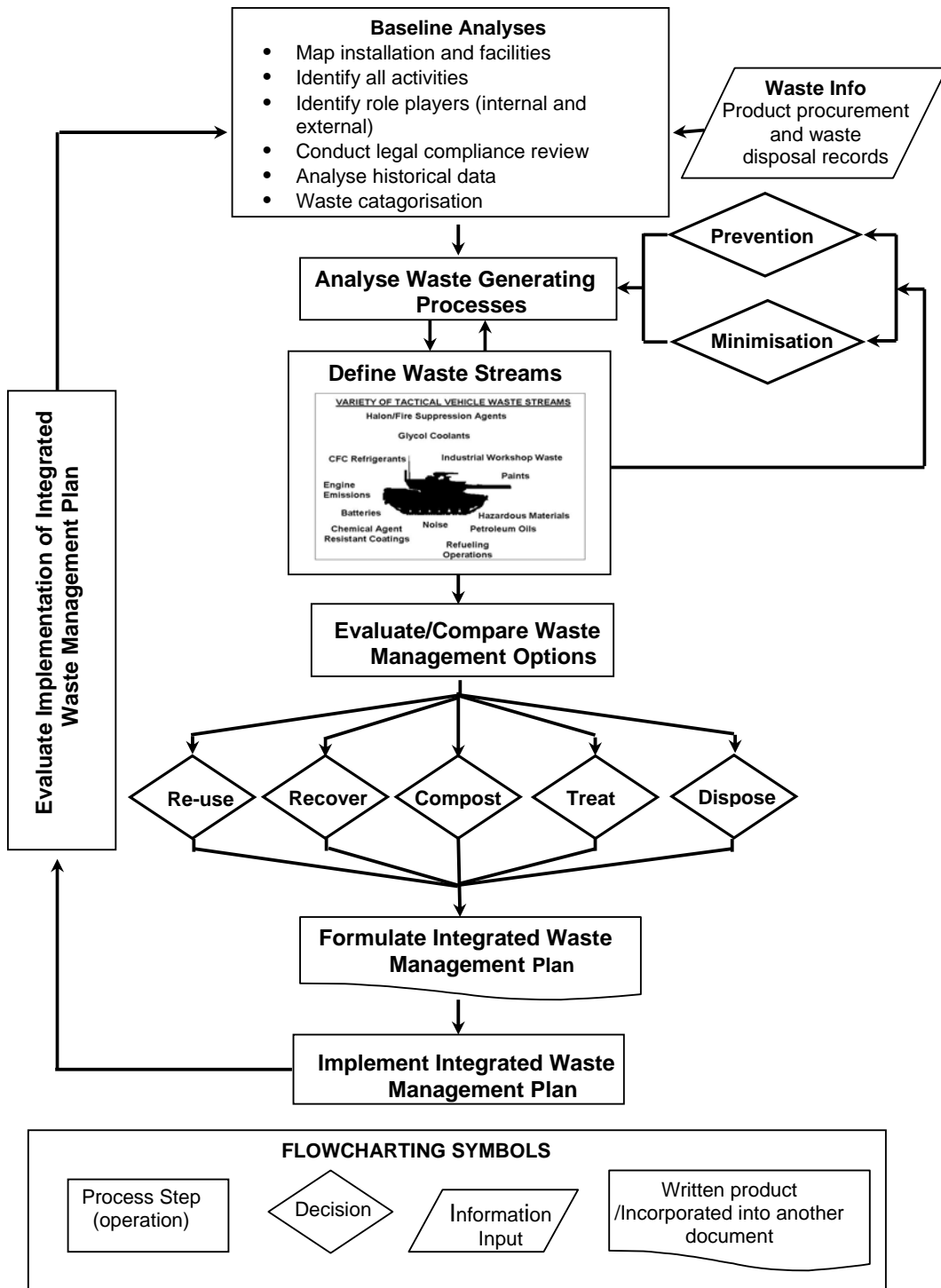


Figure 7. Development and Implementation of an IWM Program

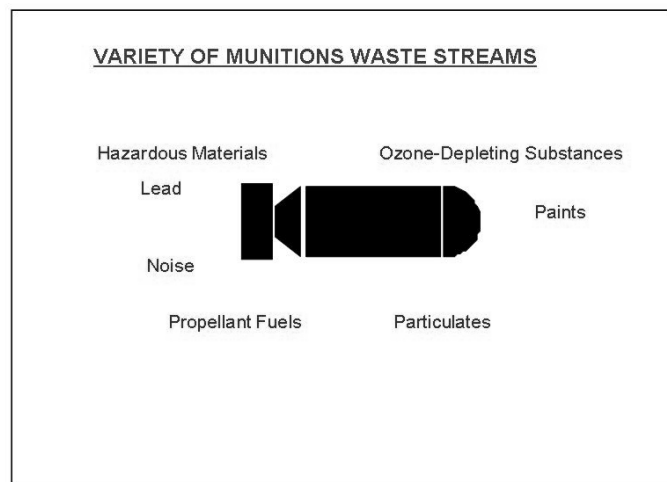
Develop IWM Program

1. Develop an IWM plan. (See Appendix C for the format.) The following requirements should be adhered to in the compilation of the plan:
 - The plan must be:
 - ⇒ simple,
 - ⇒ specific,
 - ⇒ measurable,
 - ⇒ achievable and realistic.
 - Resources and responsibilities must be allocated.
 - Targets and objectives must be coupled to a time frame.
 - The IWM plan should address continuous improvement and be reviewed regularly.
 - Flexibility is important.
 - The IWM plan must provide for contingency planning.
2. The IWM program must be integrated in the EMS in terms of risk assessments and management (see Appendix D).
3. The processes of all users and activities should be addressed.
4. The presentation and management of the program must be user friendly.

Implementation and Execution

1. The commitment from top management is of utmost importance.
2. It is essential that responsibilities for the implementation and execution of the plan be assigned.
3. Acquire and assign resources necessary for the execution of the program such as facilities, collection points, supplies etc.
4. A plan of action coupled to milestones and time frames must be established.
5. SOPs must be drafted.
6. Compile emergency response procedures and ensure they are tested regularly.
7. Ensure contracts are managed effectively.
8. Ensure that an education and awareness campaign is implemented to assist in the implementation and execution of the IWM program.
9. Ensure only approved materials on the AULs are procured and utilised.
10. Ensure IWM training materials are current and maintain training certificates.

Figure 8. Example of Waste Streams associated with Munitions



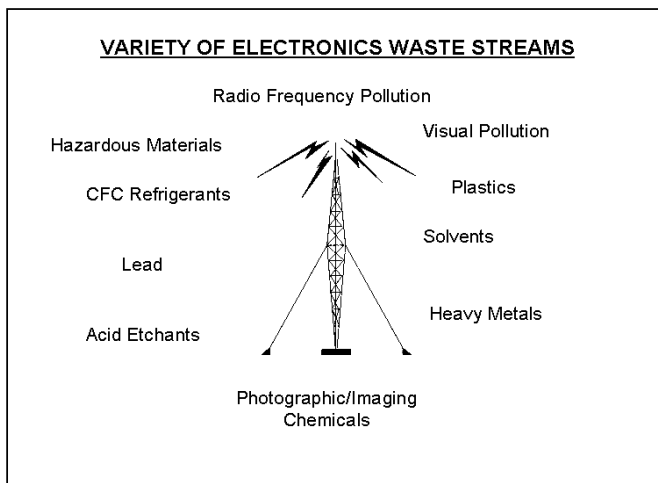


Figure 9. Example of Waste Streams Associated with Electronics

Monitoring and Measurement

1. Ensure that records are kept including manifests, volumes (in and out) and cost accounting. Record keeping must cover all aspects of the waste management hierarchy. The following information should be recorded:
 - Removal certificates.
 - Trend analysis.
 - Incident reporting.
 - Measurement on levels and volumes.
 - Self-assessment.
2. Corrective actions must be implemented to rectify shortcomings by setting new objectives to ensure continual improvement of the IWM program.

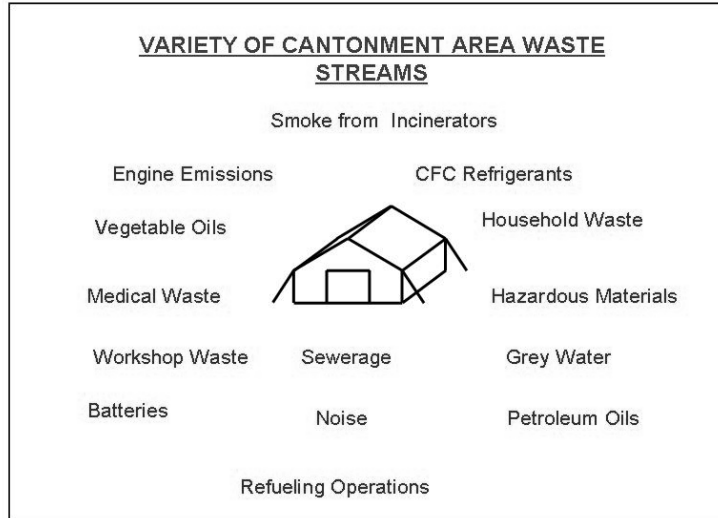
IWM during Contingency Operations

In essence the IWM process during contingency operations, such as deployments, training and exercises, is the same as for the base level as discussed in the previous section. However the IWM process for contingency operations also requires the following:

- The waste manager is involved in the planning process from the onset to ensure IWM supports the mission.
- Waste management must be included in the MOU.
- An environmental baseline survey and mapping of potential waste sites must be included in the Environmental Baseline Survey (EBS) report.
- There is a greater emphasis on greener products to reduce the waste load that must be managed.
- The host nation and home country legislation and policies must be considered, including the social implications of the generated waste.
- The support systems and facilities within the host country must be considered.
- When considering the back loading option, international legislative implications such as the Basel Convention, responsibility and accountability as well as disinfestation measures must be addressed.
- Decontamination of equipment and vehicles must be considered, to include management of decontamination wastes.
- The impact of the rotation of forces on the IWM program must be considered.

- Captured equipment must be managed.
- The compliance of all participants in multi-national operations must be ensured.
- The continuity of the IWM program during operations must be ensured by providing for human resource (HR) continuity.
- Mobile environmental technologies in the area of operations should be considered.
- Mitigation and remediation should be planned and budgeted for.

Figure 10. Example of Waste Streams associated with Cantonment Areas



IWM must be included in the Environmental Annex to the Operational Order. Consult the Guidebook on Environmental Considerations during Military Operations, Publication ESWG/006 for more detail on this process.

SECTION 4

Information Management

An information management system must be developed and maintained so that data can be collected and processed. Personnel at various levels (from policy making to base operations) may require different information or analysis. The data collection and analysis is used to promote continual improvement in IWM. Data collected must be verified and made available to all stakeholders. Responsibility must be assigned for the collection, processing and dissemination of information.

Information for Policy Makers and Strategic Planners

Data collected for policy makers and strategic planners is usually compiled from data at other levels or from legislation. The information helps policy makers and planners to support IWM at higher levels of military planning and operations. Types of information required by policy makers include:

- ❑ Legislative changes (external and national goals).
- ❑ Changes in systems and processes within the organisation (e.g. new weapon systems) and will include projections and forecasts.
- ❑ Internal policy and doctrine changes influencing IWM.
- ❑ Trends in IWM.
- ❑ Compliance status (legislation and policy).
- ❑ Trend analysis internal to IWM.
- ❑ Internal feedback on applicability and feasibility of existing policy.
- ❑ Success stories.
- ❑ Financial implications.
- ❑ Information on resources available and required for IWM (manpower, money, equipment, training).

Information for Procurement and Acquisition Product System Managers

Procurement and Acquisition managers need data to provide for current needs and project for future needs. Types of information required by product system managers include:

- ❑ Available alternative products/services.
- ❑ Waste streams coupled to equipment type.
- ❑ Failure report analysis.
- ❑ Intended life cycle of the product/service.
- ❑ Actual use versus planned use.
- ❑ Cost versus durability (lifespan).
- ❑ Cost of IWM along whole life cycle process.
- ❑ Methods/trend changes in IWM.
- ❑ Legislative changes.
- ❑ Material Safety Data Sheet (MSDS) specifications including disposal requirements.
- ❑ Information to be supplied to IWM at the base.

Information for Waste Managers

Waste managers require data to effectively manage their IWM program and need a database that monitors waste generation, waste streams, waste types and quantities. Waste managers analyse this valuable information to determine trends and continuously improve the IWM program.

The purpose of collecting IWM information is to:

- Ensure proper storage, handling and transportation of waste.
- Support risk management.
- Ensure legal compliance.
- Assist in reporting.
- Allow for public access to information.
- Assist in the introduction of green procurement.
- Assist in financial planning.
- Ensure only authorised use of hazardous materials.
- Assist in meaningful planning and effectiveness.
- Identify areas for continual improvement.
- Identify appropriate waste management practices.
- Identify capabilities available, both internal and external to the organisation (a list of service providers).
- Identify waste sources and generators.
- Identify potential pollution prevention or minimisation opportunities.
- Provide an indication of realistic quantities generated which could influence the selected materials.
- Inform the tender and contract process.
- Inform/alter policy and doctrine.

The following types of information will assist in developing and maintaining the IWM plan:

1. General Information on Non-Hazardous Waste

- ❖ Access to a database of alternative products/services.
- ❖ Information on the waste hierarchy and waste streams.
- ❖ An indication of types of wastes.
- ❖ The generators of waste.
- ❖ The quantity and/or volume for all elements of waste managed.
- ❖ The location of waste generated.
- ❖ Service providers (recycling/disposal/treatment).
- ❖ Disposal costs per unit of measure.
- ❖ Procurement costs of sources of waste (where applicable).
- ❖ Revenue generated.
- ❖ Management costs involved in IWM.
- ❖ Audit reports.
- ❖ IWM training records.

2. Specific Information on Hazardous Material (Hazmat) Waste

- ❑ Indication of types/classification of hazardous substances in use.
- ❑ Access to database of alternative products/services.
- ❑ Access to database of procurement of prohibited toxic substances.
- ❑ Users of hazardous substances.
- ❑ MSDSs applicable (can be sourced from product system manager).
- ❑ What the Hazmat is used for.
- ❑ Quantity of Hazmat procured.
- ❑ Quantity of Hazmat used.
- ❑ Quantity of Hazmat waste disposed.
- ❑ Specific Hazmat waste disposal requirements.
- ❑ Location of Hazmat waste.
- ❑ Manufacture information (lot, batch, serial numbers) (can be sourced from the product system manager).
- ❑ “Best before date” of the Hazmat (can be sourced from the product system manager).
- ❑ Incident reports (waste) along organisational channels (See Appendix E).
- ❑ Procurement costs per unit of measure.
- ❑ Service providers (procurement, application and disposal).
- ❑ Disposal costs per unit of measure.
- ❑ Audit reports.
- ❑ Protective and safety measures applicable to Hazmat.
- ❑ IWM training records.

Data should be used to determine the effectiveness of the IWM plan, whether targets and objectives are met and potential areas for improvement.

SECTION 5

Continual improvement

IWM always has room for improvement. Sharing of information helps to generate new processes and opportunities for waste minimisation. Partnerships, education and awareness training, and links to other related programs contribute to continual improvement and mission enhancement.

Partnerships

Partnerships formed between government (national and provincial, municipalities), the private sector, and non-governmental organisations (NGOs) are important for the implementation of IWM. Such partnerships allow for the combining of resources and the sharing of knowledge and experiences for effective implementation of IWM programs. Listed below are organisations with which partnerships can be developed:

- Regulatory authorities and agencies (at all levels).
- NGOs and forums.
- Academic programs.
- Co-users.
- Service providers/contractors.
- Private organisations through public-private partnerships (PPPs).
- Local communities.
- Other government departments.

Education and Awareness Training

The level of awareness regarding waste and waste management issues varies among members within the military. IWM education and awareness training programs must be included in the education and awareness plan of a unit in order to:

- Ensure that members are aware of the negative implications of poor waste management practices on mission, human health and the environment.
- Increase awareness of, and concern for, waste issues and to assist in developing the knowledge, skills, values and the commitment necessary to achieve sustainable development.
- Educate members in a new paradigm of waste minimisation, reduction, recycling, reuse and safe disposal.
- Create waste recycling and reuse opportunities with financial, institutional and educational support from the appropriate levels within the military departments.
- Ensure that all members act together and support the waste management program.
- Maintain IWM training records.

The development of an Environmental Education and Awareness Training (EE&T) plan should include the following:

- Identify opportunities for EE&T in the unit.
- Ensure that all personnel undergo appropriate education and awareness training regarding IWM practices when joining a unit.
- Ensure all deploying personnel receive contingency operation IWM procedures as part of their induction training.

- Ensure that IWM issues and emergency response planning are included in the in-post and functional training of members within a unit.
- Provide education and awareness training to units that operate waste treatment plants as well as incinerators in order to empower personnel to manage these plants in accordance with legislative requirements.
- Assign responsibilities with regard to EE&T to a qualified member who will also maintain IWM training certificates and training records.

The guidebook on Development and Implementation of EE&T in the Military (ESWG Publication 004) provides suggested processes for the establishment of education and awareness training programs at the different levels within the military.

The following matters should also be addressed in such an education and awareness training plan:

- Green procurement – educate members involved in the procurement of products to look into the manufacture of products (the use of clean technology, processes, sourcing of raw material) and packaging of products.
- All stakeholders to be included at all levels within the military and neighboring property owners.
- Media utilised to run awareness campaigns, communicate waste information to the public.
- Training of personnel responsible for environmental equipment/materials, waste information system and reporting.
- Public outreach.
- Top management and commander training.
- Incorporate in force preparation training from induction to senior management.
- Introduce and utilise an award program as a tool for participation.
- Ensure base participation in clean-up activities.
- Offer pre-operational and rotation of forces training.

Link to Risk and Safety Management

Incorrectly managed waste compromises human health and affects the quality of the environment. This can lead to the outbreak of communicable diseases, contamination of natural resources and can have major impacts on the health of soldiers and on the mission readiness of the force. Therefore, IWM must be linked to Occupational Health and Safety (OHS) and environmental health requirements such as the safety of workers.

Risk Management. IWM risks must be identified and recorded in a risk management worksheet to be included in the IWM plan to ensure pro-active management. (See Appendix C for an example of a risk management worksheet.)

Safety Management. The following are of importance:

- Safe handling and storage of hazmat/waste. Ensure that the MSDS of the product is supplied by the manufacturer. The MSDS is a form that provides the user with information on the handling, working with or the storage of the material. Ensure users receive hazard communication training and know where the MSDS and personal protective equipment are located.

- Compilation of contingency and emergency response plans. Purchase and test spill response kits. Ensure that they are located in all areas that store and utilise hazardous waste and ensure personnel are trained in their use. Ensure that contingency and emergency response plans are compiled, updated, posted and tested at regular intervals. Assign responsibilities to personnel in the execution of contingency and emergency response plans.
- Investigation of reported incidents. Incidents must be reported as per Appendix E and non-conformances noted. These reports and non-conformances must be investigated and reported on for corrective action to ensure continual improvement of the IWM plan during the review process.

Conclusion

The IWM approach, process and plan as described in this guidebook will be of great value to any military organisation through the minimisation of the risks associated with the handling and disposal of waste within acceptable international standards and thereby saving money as well as generating money through the sale of waste products. This paradigm shift also results in pro-active waste management measures focused on minimisation and prevention rather than a reactive system of managing impacts and remediation. This holistic approach is suitable for all military activities over the entire life cycle of any product or system from “cradle to grave” during force preparation as well during contingency operations.

APPENDIX A

EXAMPLES OF IWM HIERARCHY

HAZARDOUS WASTE: FLUORESCENT LIGHT TUBES

Prevention:	Source reduction by buying environmentally friendly tubes/long life tubes.
Minimisation:	Limit number, size and wattage of tubes for purpose necessary. Automatic lighting/switches. Natural light sources incorporated in the design of the building. Reactive replacement. Regular maintenance on ballast and light fitting.
Reuse:	If scheduled replaced – reuse.
Recover:	Possible recovery of components.
Composting:	None.
Treatment:	Physical – crushing in a contained situation. Chemical – breakdown of hazardous properties. Destruction – None.
Landfill:	Registered hazardous waste disposal site.

NON-HAZARDOUS WASTE – OFFICE PAPER

Prevention:	Make use of electronic documents.
Minimisation:	Eliminate unnecessary documentation especially in the review process of finalising documents. Make use of double sided printing, faxing and copying. Make use of used paper for drafts documents. Proof read documents on the computer screen. Reduce fax sending confirmation slips by making use of the cover page size. Utilise A5 documentation printing (format and font). Reduce paper handouts. Procure recycled paper.
Reuse:	Use as note paper. Use as packaging material (after shredding). Use as fuel. Use as insulation and building materials. Utilise for arts and crafts.
Recover:	Use to manufacture recycled paper.
Composting:	If not suitable for recovery, use as material in compost as aerobic catalyst (broken up).
Treatment:	Physical – shredding, wetting and compressing (back into hierarchy). Chemical – treat for use as insulation. Destruction – incineration.
Landfill:	Ideal is zero waste to the landfill site.

APPENDIX B

HAZARDOUS MATERIAL PHARMACY (HAZMART) SYSTEM

The objectives of a Hazmart are to help ensure compliance with applicable hazardous material and waste management laws and regulations, minimise the hazards associated with chemical use, track hazardous material usage, identify mission critical uses of hazardous material, and ensure the safety and health of personnel. Benefits of using this system include cost savings realised by the reduction in the amounts of hazardous materials needed for purchase and reduction in disposal of excess hazardous material.

The Hazmart pharmacy system is so-named due to its similarity to the medical pharmacy in a hospital. The medical pharmacy requires an authorisation in the form of a prescription, an approval by a recognised authority (the doctor), an automated tracking system to ensure that only the prescribed amount of medication is given to an authorised customer, and it is the only place to get these prescription medications. The ideal Hazmart has similar controls in place through an authorisation process consisting of reviews by recognised authorities (environmental, safety and industrial health), it is the only place to get items identified as hazardous, and it uses a tracking system to ensure that only authorised chemicals and quantities are issued.

The “components” of the Hazmart include a storage location for hazardous materials (warehouse), an automated tracking system, an authorisation group, and usually a hazardous material working group. The Hazmart can function as a cell, wherein all components are collocated, or it can be a “virtual” operation with each component working from their respective offices. In the virtual concept, the warehouse and personnel do the normal functions of a warehouse: stock, store, inspect, issue, and distribute. The tracking system is used to store/verify authorisations as well as issue and track materials. As a result, it also helps ensure proper rotation of the materials so that the oldest ones get used first. The authorisation group members operate from their individual offices through the networked tracking system. The working group meets at scheduled intervals to discuss controls, authorisations, and other hazardous material issues. The key advantage to the virtual operation is that it can likely use existing infrastructure instead of creating an entire new building.

Different levels of authorisation can be used. The first level (least restrictive) authorises materials at the installation level and all units on the installation are allowed to use the materials on the “global” list. The system still tracks the use of materials to the unit or even the individual level but places no limits on quantities. The second level has AULs at the unit level but does not limit quantities. The third level incorporates unit-level authorisation but also sets limits for each material (per week or month) and may include tracking of the empty containers to verify only the authorised quantities are being issued.

Authorisations must be obtained prior to bringing any hazardous material onto an installation, regardless of the source of supply (through normal military-specific supply channels, local purchase with use of government purchase cards, contractors, etc.). Work centre supervisors initiate authorisation requests and ensure new materials/processes are incorporated into the units’ safety briefings and Hazard Communication Program. Work centre supervisors must also include any directives/manuals/technical documents requiring use of the hazardous material in the authorisation request. Without this justification, a less hazardous material may be substituted.

Each of the authorities in the approval process manages their programs through the authorisation process. The environmental authorisation considers the types of hazardous material being used throughout the installation, if a less hazardous material can be substituted, and the potential waste streams generated through the use of the material. The safety authorisation considers safe storage and handling of the material, and incorporation of the types, quantities, and location of the hazardous materials in emergency response programs. The industrial health authorisation considers exposure to hazardous constituents and acceptable exposure limits, associated personal protective equipment required, and any occupational physicals required to monitor effectiveness/use of the protective equipment.

In most Hazmart operations, “blanket” authorisations allow units to use materials common to many units, which aren’t extremely dangerous. It is still important the authorisation be made so the tracking system can track the how much is used and for what purpose. Examples include motor oil, general cleaning products, etc. These blanket authorisations may exist in all three authorities or individually. For general cleaning products the hazards are minimal: the product is not flammable, only slight corrosive attributes, does not require protective equipment, does not have special precautions for fire-fighting, and is used completely in the process. In this case the environmental impacts are minimal, there are no special storage requirements, and no occupational hazards. All three authorities would likely issue a blanket authorisation so all units could use the material. In the case of motor oil, storage and personal protective equipment are not an issue so safety and industrial health might issue a blanket authorisation but since its use generates hazardous waste, the environmental office may place limitations on its use.

Another aspect of placing tighter restrictions on the use of hazardous material is the return of unused or partially used products to the issue centre. These items can become “free issue” products available at no cost to users. The authorisation and tracking must still be used and there will be limitations on the types of material that are “eligible” for the free issue program. For “safety of flight” (aircraft maintenance) or similar products, only unopened product with remaining shelf life may be eligible. Products having multiple components, which have been opened are not candidates for this program as there is a strong likelihood they won’t perform as intended. Products such as cleaners, paints, etc are all likely candidates and will make up the bulk of the free issue program. This system also ensures proper rotation of stock, which allows for stock that came in first to distributed first.

Procedures for Implementing a Hazmart Pharmacy System

Establishing a Hazmart at a new location requires an investment of time and effort from many offices to ensure success. However, this up-front investment is well worth and does not require a lot of financial investment. The first step is acquiring an automated tracking system. The installation must have a solid understanding of the level of control desired and must purchase or develop a tracking system meeting the requirements. Failure to properly identify these will result in an inadequate system or increased cost and delays while modifying the system.

The next step is identifying all hazardous materials used on the installation. The various shops must review all of their processes and supporting technical documents. The highest priority is given to items required by technical documents. The shops then prepare a package with the list of hazardous materials, their MSDSs, and the requiring document information. If the material is not specifically called out in a technical document, other justification for its use is required.

Next the information must be entered into the authorisation request (a paper or electronic form) and submitted for review by the members of the authorisation group. The authorisation request form includes user, material, and process information and has fields for reviewer co-ordination and comments.

The authorisation group decides if the material is to be authorised or not, if a suitable substitute exists, and the amount the requestor is allowed to have on hand. This amount should be enough to ensure continuation of operations through work surges or delays in future deliveries but prevent expiration of shelf lives due to overstocking. Other requirements, such as personal protective equipment, are annotated in the request.

Once a request has been approved, the shop supervisor submits an order to the Hazmart and the product is issued. One option the installation must decide on is whether or not to utilise a bar-coding system for each issuance. Under this system, a unique bar-code label is printed and attached to the hazardous material container. This allows true “cradle to grave” tracking of the hazardous material. To maximise control of the hazardous materials, the installation may require the turn-in of an empty container to the Hazmart before another container is issued. When all authorisations have been approved, the Hazmart can determine the amounts of each material they must keep on hand and the frequency and amount of future orders. AULs should be utilised to monitor and ensure only approved material and quantities are maintained at each work centre.

After the Hazmart has been established, maturation of the system includes routine review of authorisations to confirm if the need still exists and determine if a less hazardous material might now be available.

APPENDIX C

STRUCTURE AND FORMAT OF AN IWM PLAN

- Introduction
- Definitions
- Policy Statement
- Principles of IWM
- Aim and Scope
- Initial Review
 - Legal Framework
 - Types of Wastes and Waste Streams
 - Nature and Quantity of Waste
 - Waste Hierarchy vs Waste Streams
 - Risk Assessment and Management
- Objectives
- Procedures for General Waste
 - Waste Management Methods
 - Contingency Plan for General Waste
- Procedures for Hazardous Waste
 - Containment Measures
 - Contingency Plan for Hazardous Waste
 - Hazardous Waste Contractors
 - Site Inspections
 - Permits and Manifest System
 - Contract Management
- Disposal Plan
 - Transportation
 - Registered Waste Disposal/Landfill Sites
- Procedures for Pollution Prevention
- Implementation
 - Partnerships
 - Functional Training
 - Education and Awareness Training
 - Financial Implications
 - Assigned Responsibilities
 - Standard Operating Procedures
 - Required Resources
 - Emergency Response Procedures
- Monitoring and Measuring
 - Record Keeping
 - Reporting
 - Measurement and Assessment
 - Legal Compliance and Management of Non-compliance
- Corrective Action
 - Waste Incident Reporting
 - Continual Improvement
- Review of Plan

APPENDIX E

PROFORMA OF WASTE INCIDENT REPORTING

WASTE INCIDENT REPORT SHEET		
Zone: _____ Date: _____ Name: _____		
DESCRIPTION OF INCIDENT <i>(to include location, type of waste released, size of release etc:</i>		
ORGANISATION RECOMMENDATION:		
Recommended by:	Position:	Target Date:
ORGANISATION CORRECTIVE AND/OR PREVENTATIVE ACTION:		
Taken:	Position:	Target Date:
ORGANISATION CORRECTIVE ACTION FOLLOW-UP:		
Feedback give to Initiator:	Sign:	Date:
Taken by:	Position:	Target Date:
CLEARED BY: _____ SIGNATURE: _____		
COMMENT:		

APPENDIX F

GLOSSARY

Biological Treatment	Biological degradation of contaminants using microbial population. The treatment of waste and contaminated soil or groundwater may take place either <i>ex-situ</i> or <i>in-situ</i> and may be enhanced (Enhanced Biological Remediation) by altering the environment to optimal conditions for the remediating organism (i.e nutrients, moisture, temperature, agitation etc.).
Biodegradable	Capable of being decomposed by living matter, especially bacteria.
Chemical Treatment	The process of involving reduction/oxidation (redox) reactions that chemically convert hazardous contaminants to non-hazardous or less toxic compounds that are more stable, less mobile or inert. Redox reactions involve the transfer of electronic from one compound to another. Specifically one reactant is oxidised (loses electrons) and one is reduced (gains electrons). The oxidizing agents most commonly used for treatment of hazardous contaminants are ozone, hydrogen peroxide, hypochlorites, chlorine and chlorine dioxide.
Cleaner Products and Services	A comprehensive and pro-active approach to terms used globally including waste minimisation, cleaner technology, waste reduction, non-waste technologies and source reduction. It includes measures to eliminate toxic and dangerous raw materials and product constituents and to reduce at source the quantity and toxicity of all emissions and waste emitted to air, land and water.
Cleaner Technologies	Production processes or equipment with a low rate of waste production and/or high levels of resource efficiency. Treatment and recycling are not classed as cleaner technologies.
Incineration	A form of treatment and disposal. It is the controlled combustion of waste materials to a non-combustible residue or ash and exhaust gases such as carbon dioxide and water.

Integrated Waste Management Plan

A general and hazardous waste planning procedure comprising a description of the baseline situation, and an analysis of the problems and needs and sets priorities and targets for the implementation of the IWM plan.

Landfill

A commonly used method of solid waste disposal, which includes placing the waste in a specially designed site and covering it.

Life Cycle Analysis

A systematic compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle, from raw material acquisition to final disposal.

Manifest System

A system for documenting and controlling the fate of hazardous waste from cradle to grave.

Material Safety Data Sheet

A form that provides the user of a hazardous material with information on the safe handling, working with or the storage of the material.

Physical Treatment

The process involving the physical alternation (compacting, shredding, melting and crushing) of wastes to reduce the volume but also improve ability for air, water and microbial population penetration and consequently biological and chemical transformations of the wastes.

Risk Assessment

A process of gathering data and making assumptions to estimate short- and long-term harmful effects on human health and the environment from exposure to hazards associated with the use of a particular product or technology; or establishing the probability of an event occurring, the factors that could bring about that event, likely exposure levels and the acceptability of impacts resulting from exposure.

Sustainability

The long-term strategy for the environment that connects human activities today to those of tomorrow with sound business and environmental practices. The ability of an activity to continue indefinitely, at current and projected levels, without depleting the social, cultural and natural resources required to meet present and future needs.

Toxic	Poisonous, causing death or serious injury such as burns, respiratory diseases, cancer or genetic mutations.
Treatment	The process to remove, separate, concentrate or recover a hazardous or toxic component of a waste or to destroy or to reduce its toxicity in order to minimise its impact on the environment.
Waste Stream	A continuous flow of waste from an industry, activity, process or group.

APPENDIX G

ABBREVIATIONS

AUL	Authorised Use List
COTS	Commercial off the Shelf
DefCom	Defence Committee
EBS	Environmental Baseline Survey
ECOps	Environmental Considerations during Military Operations
EE&T	Environmental Education and Awareness Training
EMS	Environmental Management System
ESWG	Environmental Security Working Group
FOT&E	Final Operational Test and Evaluation
HAZCOM	Hazardous Material Committee
HAZMART	Hazardous Material Pharmacy System
HAZMAT	Hazardous Material
HAZMIN	Hazardous Material Minimisation
HR	Human Resources
HW	Hazardous Waste
ISO 9000	International Standards Organisations Standard for Quality Management Systems
ISO 14001	International Standards Organisations Standard for Environmental Management Systems
IWM	Integrated Waste Management
MOTS	Military off the Shelf
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NATO	North Atlantic Treaty Organisation
NGO	Non-governmental Organisation
OHS	Occupational Health and Safety
PCB	Polychlorinated Biphenyl
PPP	Public-Private Partnerships
RSA	Republic of South Africa
SOFA	Status of Forces Agreement
SOP	Standard Operating Procedure
UNEP	United Nations Environmental Program
US	United States

APPENDIX H

REFERENCES

Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, Second Edition, Department of Water Affairs and Forestry, Republic of South Africa, 1998.

National Waste Management Strategies and Action Plans, Department of Environmental Affairs and Tourism, Republic of South Africa, October 1999.

Solomon, R., Sterner O. *et al*, 1999. *Environmental Considerations in the Systems Acquisition Process*. Joint publication of Sweden and the United States. Deputy Assistant Secretary of the Navy (Environment and Safety), 1000 Navy, Pentagon, Washington, DC 20350-1000, USA.

White Paper on Integrated Pollution and Waste Management for South Africa, A Policy on Pollution Prevention, Waste Minimisation, Impact Management and Remediation, Department of Environmental Affairs and Tourism, Republic of South Africa, May 2000.

ADDITIONAL SOURCES OF INFORMATION

- *Environmental Considerations in the Systems Acquisition Process: Guidebook*. Look in the Intern'l Menu of the DENIX web site at <http://www.denix.osd.mil>.
- *The US Department of Defense Acquisition Deskbook*. Available online at the website <http://www.deskbook.osd.mil>.
- *The Pollution Prevention Equipment Program (PPEP) Website*. Available online at the website <http://www.lakehurst.navy.mil/p2/index.html>.

APPENDIX I

OTHER DOCUMENTS DEVELOPED UNDER THE AUSPICES OF THE US-RSA

DEFCOM ESWG

The following are guidebooks previously developed for use by the international defense environmental community by joint US-RSA teams.

Publication ESWG/001 – Conversion of Military Bases in South Africa.

Publication ESWG/002 – Military Integrated Training Range Management Guidebook.

Publication ESWG/003 – Partnering to Build a South African Ministry of Defence Facilities Management Website.

Publication ESWG/004 – Guidebook on the Development and Implementation of Environmental Education and Training in the Military.

Publication ESWG/005 – Guidebook on Environmental Impact Assessment in the Military.

Publication ESWG/006 – Guidebook on Environmental Considerations during Military Operations.

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