

Image Cover Sheet

CLASSIFICATION UNCLASSIFIED	SYSTEM NUMBER 497181 
---	---

TITLE
HAZARDOUS WASTE MANAGEMENT AT DEFENCE RESEARCH ESTABLISHMENT SUFFIELD

System Number:
Patron Number:
Requester:

Notes:

DSIS Use only:
Deliver to:

UNCLASSIFIED

DRES



DEFENCE RESEARCH ESTABLISHMENT SUFFIELD

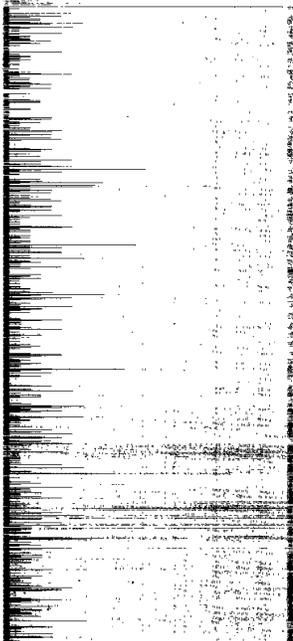
SSP 178

UNCLASSIFIED

Hazardous Waste Management at Defence Research Establishment Suffield

BY

John. McAndless



March 1996

WARNING

"The use of this information is permitted subject to recognition of proprietary and patent rights."



CRAD



National Defence Défense nationale

Canada

UNCLASSIFIED

UNCLASSIFIED

DEFENCE RESEARCH ESTABLISHMENT SUFFIELD
PO BOX 4000, MEDICINE HAT, ALBERTA

SUFFIELD SPECIAL PUBLICATION No. 178

HAZARDOUS WASTE MANAGEMENT AT DRES

by

J.M. McAndless

WARNING
"The use of this information is permitted subject to
recognition of proprietary and patent rights".

UNCLASSIFIED

UNCLASSIFIED

ACKNOWLEDGEMENTS

The author thanks the following members of the Ad Hoc Committee on Life Cycle Management of Hazardous Waste Generating Materials for their contributions in developing and implementing a functioning waste management system at DRES.

Vern Fedor
Noel Thomas
Cam Boulet
John Cherwonogrodzky
Gordon Briosi
Jerry Fitzgerald
Capt. Wayne Sturgeon

UNCLASSIFIED

ABSTRACT

DRES has developed a waste management program to address the issue of hazardous waste generated by Establishment research and development activities. The types of waste generated are typical of industrial or university chemical laboratories but include several types of special waste streams such as radioactive tracers, chemical warfare agent residues, biological materials as well as old chemical-filled ordnance items found on the DRES Experimental Proving Ground.

This Report outlines the key elements of the DRES Hazardous Waste Management Program and describes procedures for the proper collection, storage and disposal of specific types of hazardous waste.

UNCLASSIFIED

TABLE OF CONTENTS

	Page No.
ACKNOWLEDGEMENTS	ii
ABSTRACT	iii
TABLE OF CONTENTS	iv
LIST OF TABLES	vi
LIST OF FIGURES	vi
INTRODUCTION	1
DESCRIPTION OF DRES	2
Location	2
Programs	2
Experimental Proving Ground	3
WASTE MANAGEMENT POLICY AND APPROACHES	4
WASTE MANAGEMENT PROGRAM BACKGROUND	6
Waste Disposal Practices	6
Environmental Audit	7
Waste Management	7
Hazardous Materials Management	8
Hazardous Materials Committee	8
CRAD Environmental Action Plan	9
DRES WASTE MANAGEMENT PLAN	9
General Outline	9
Disposal Methods	11
Facilities	11
Hazardous Materials Storage Modules	11
Mini-incinerator	12
CFB Suffield Repair and Disposal Unit	16
CFB Suffield Sanitary Landfill	16
MSDS Data Bases	17

UNCLASSIFIED

Inventory Tracking	17
Environmental Assessment	18
Inspection Programs	20
 PROCEDURES	 21
Purchase and Transfer of Chemicals	21
Laboratory Waste Disposal	21
Chemical Warfare Agents	21
Unused Chemicals	22
Laboratory Waste	22
Biomedical Waste	26
Field Waste Disposal	27
Reporting Requirements	28
 EMERGENCY RESPONSE TO WASTE SPILLS AND LEAKS	 30
Laboratory Spills	30
Stored Waste Leaks	31
Reporting	31
 MANAGEMENT AND STAFF RESPONSIBILITIES	 32
 REFERENCES	 32
 ANNEX A	

UNCLASSIFIED

LIST OF TABLES

	Page No.
TABLE I: EPG Sites Associated With Hazardous Waste Activities	4
TABLE II: DRES Waste Disposal Environmental Assessments	20

LIST OF FIGURES

	Page No.
Figure 1: DRES Life-Cycle Waste Management Plan Schematic	10
Figure 2: DRES Hazardous Materials Storage Modules	13
Figure 3: DRES Mini-Incinerator (Front View)	15
Figure 4: DRES Mini-Incinerator (Side View)	15
Figure 5: Hazardous Materials Disposal Requisition Form	23
Figure 6: Hazardous Waste Container Labels	25
Figure 7: Technical Services Section Disposal Record	29

UNCLASSIFIED

1

INTRODUCTION

The Defence Research Establishment Suffield (DRES) has developed a life-cycle management program for hazardous waste which is based on a waste minimization philosophy. That is, a corporate approach is taken which attempts, as far as practical, to reduce the quantity and toxicity of waste that is generated, treated, stored and disposed of as a result of Establishment activities. The program embodies the four R's of modern waste management practice, *viz*:

- ◆ Reduce;
- ◆ Recycle;
- ◆ Reuse, and
- ◆ Recover.

These practices attempt to minimize the need for expensive waste disposal using commercial facilities as well as to reduce excessive inventories of hazardous materials which are used in DRES laboratories for research and development (R/D) purposes or are used in support of field trials on the Experimental Proving Ground (EPG). Through such practices, a greater portion of the annual DRES budget may be directed towards meeting requirements of the research and development program.

DRES R/D programs generate two basic waste streams, *viz*: "standard" waste and "special" waste. The standard waste is typical of that produced by industrial or university chemical laboratories and includes, for example, solvents and solvent mixtures, partially-used chemicals, empty compressed gas cylinders, paper, cleaners, degreasers, used vacuum pump oil and other petroleum-based products, used appliance batteries, scrap metals, glass and plastics and disposable laboratory items such as pipettes, spatulas and syringes. This type of waste is generally amenable to disposal at commercial facilities, to landfilling if classed as non-hazardous or, in the case of empty compressed gas cylinders, for return to the supplier.

The DRES Chemical-Biological (CB) Defence Program annually produces small quantities of special waste. Examples of this waste include:

- ◆ old ordnance items found on the EPG which are suspected or known to contain chemical warfare agent fills and/or explosives;
- ◆ decontaminated chemical warfare agent residues;
- ◆ detoxified biological/pathogenic material and biomedical waste;
- ◆ potentially-contaminated used protective clothing and respirator canisters;
- ◆ old and/or damaged compressed gas cylinders which cannot be returned to their source, and
- ◆ ultra low-level radioactive waste (e.g. radiological tracers).

These special wastes are not disposed of at commercial facilities; instead, a variety of in-house treatment methods are used (see below). For example, commercial facilities cannot be used for the disposal of chemical-filled ordnance as these facilities are not licensed for, nor are their staff properly trained in, the safe handling and disposal of such items. Moreover, strong negative public reaction would result should certain special wastes (e.g. waste derived from chemical/biological agents) be transported and disposed of in the public domain.

The purpose of this Report is to outline the DRES Hazardous Waste Management Program and describe the procedures which are followed with the respect to the disposal of specific types of hazardous waste. The approaches which are taken to develop and maintain a waste minimization philosophy are also described.

DESCRIPTION OF DRES

Location

DRES is located at the Canadian Forces Base (CFB) Suffield, approximately 50 km northwest of the city of Medicine Hat, Alberta. CFB Suffield incorporates a 2600 square kilometre federal land reserve known as the Suffield Military Range which is used primarily for mechanized training exercises conducted by the British Army Training Unit Suffield (BATUS). The Experimental Proving Ground (EPG), an area of approximately 495 square kilometres located in the southernmost portion of the range, is dedicated to field trials in support of DRES research and development programs and other DND projects.

Programs

Approximately one-half of the DRES R/D Program is directed towards military engineering defence technologies, including weapons systems evaluation, systems integration, mine and counter-mine technologies and vehicle mobility. Specific program focus is on obstacle clearance, minefield breaching, ordnance detection, remotely-piloted and robotic vehicles for use in hazardous environments, structural response to shock and blast effects, and vehicle concepts for off-road environments.

The other half of the R/D program involves research in chemical and biological defence (CB Defence). The principal activities in CB Defence include hazard assessment, detection and identification, medical countermeasures, decontamination and development of physical protection systems.

DRES provides a range of support services for the research and development

UNCLASSIFIED

3

activities, including meteorology, photography, information services, material management, field trial support, hazardous materials disposal, facilities design and development, and prototype equipment development/construction.

Experimental Proving Ground

The use of CFB Suffield for military research was initiated in 1941. During and following World War II, the EPG was used extensively for a variety of activities, including:

- ◆ the testing, storage and disposal of chemical warfare agents and chemical-filled ordnance;
- ◆ field trials to evaluate the protective capabilities of military equipment in chemical warfare environments;
- ◆ the development and testing of equipment and procedures for mine and ordnance detection;
- ◆ shock and blast trials to evaluate the strength and blast resistance of military construction materials and equipment;
- ◆ the development and testing of unmanned robotic vehicles;
- ◆ field trials to develop methods to identify, detect, decontaminate and treat toxic effects of chemical/biological agents;
- ◆ training of military personnel in chemical/biological defence.

The EPG currently incorporates a number of fixed, well-developed sites which are dedicated to a variety of defence research activities. In addition to conducting field trials in support of the R/D Program, DRES also utilizes limited areas on the EPG for the storage, treatment and disposal of hazardous and toxic chemical materials which cannot be treated at commercial facilities. The EPG is also used by other DND and outside agencies. Outside agencies include the Alberta Energy Corporation (AEC) who undertake oil and gas exploration activities and the Prairie Farm Rehabilitation Administration (PFRA) who conduct controlled cattle grazing on a small portion of the EPG. The easternmost portion of the EPG borders on the National Wildlife Area and South Saskatchewan River; no R/D or military activities are conducted in this protected area.

Those areas/sites on the EPG which are designated for the storage and disposal of hazardous materials are listed in Table I.

UNCLASSIFIED**TABLE I****EPG SITES ASSOCIATED WITH HAZARDOUS WASTE ACTIVITIES**

EPG LOCATION	DESCRIPTION
Cameron Centre (Building 60 Complex)	Field Storage: waste laboratory chemicals small chemical agent stocks
490 Site - Inner Fenced Area	Field storage: laboratory waste low-level radioactive waste contaminated scrap material Disposal Methods: contained thermal treatment incineration explosive demolition
Field Flammable Stores	Bulk flammable chemicals storage
CFB Suffield Sanitary Landfill	Non-hazardous waste
CFB Suffield Asbestos Landfill	Asbestos waste
CFB Suffield Landfarm	POL-contaminated soils bioremediation
CFB Suffield Construction Landfill	Waste construction materials
Swiftsure Landfill	Concrete-stabilized arsenic waste

WASTE MANAGEMENT POLICY AND APPROACHES

In general terms, a hazardous material (HazMat) is any substance which has potential to affect the health and safety of humans or create environmental impairment whether in normal use or if handled improperly [1]. A listing of materials considered hazardous has been issued by the Major Industrial Accidents Council of Canada [2]. The use, storage, handling and disposal of such materials are governed by numerous acts and regulations. Incidents involving hazardous materials or non-compliance with any of these regulations have potential to cause severe environmental damage with resultant heavy legal penalties imposed on officials of the organization which caused the problem. For this reason, hazardous materials management, including waste management, is recognized as an essential element in DND planning and operational activities.

The cradle-to-grave management concept for hazardous material is well established

UNCLASSIFIED

DRES-SSP-178

UNCLASSIFIED

5

in DND policy. In support of the Departmental Code of Environmental Stewardship, DND policy documents promote the application of safe and environmentally-responsible practices with respect to the acquisition, handling, storage, transportation and disposal of hazardous materials. Overall, cost-effective programs are being developed and implemented to reduce raw material consumption and usage of toxic substances, energy, water and other resources as well as to reduce the generation of waste and noise associated with day-to-day operations.

Life-cycle waste management activities at DRES are intended to comply with policy stated in the following documents:

- ◆ NDHQ Policy Directive P5/92: Canadian Forces And National Defence Policy On The Environment;
- ◆ Environment Canada "Green Plan";
- ◆ Canadian Environmental Protection Act;
- ◆ National Defence publication A-GG-040-004/AG-0001 General Safety Program. Volume 4: Hazardous Materials Safety;
- ◆ CFAO 36-50: Environmental Protection Management;
- ◆ CFAO 36-55: Hazardous Materials Management;
- ◆ CFAO 36-31: Annex H - Disposal of Hazardous Chemicals;
- ◆ CRAD Material Management Manual A-LM-007-006/AG-000;
- ◆ CRAD Environmental Action Plan , October 1994.
- ◆ DRES Safety Manual, Suffield Special Publication No. 133.

A typical waste management strategy includes some or all of the following approaches [3]:

- ◆ the development of a complete inventory of chemical usages and waste generation practices for the organization;
- ◆ a listing of storage and disposal practices and requirements;
- ◆ the identification of chemical wastes for possible recycling, recovery or re-use;

UNCLASSIFIED

- ◆ the development of organizational knowledge with respect to regulations, codes or guidelines which affect management strategies and practices, including waste management standards for labelling, packaging, worker safety, fire and health protection, emergency response and storage, treatment and disposal;
- ◆ the implementation of education, instruction and safety awareness programs for personnel;
- ◆ the implementation of supervised and coordinated centralized waste chemicals information and information about waste collection, storage and disposal systems available within the organization;
- ◆ the procurement, installation, proper operation and maintenance of appropriate equipment, devices or systems for use in monitoring, containment and clean-up of hazardous materials and for ensuring a safe working environment;
- ◆ the development of contingency plans and emergency response plans tailored to encompass organizational programs associated with waste management activities.

WASTE MANAGEMENT PROGRAM BACKGROUND

In accordance with CFAO 36-55, CFB Suffield has the prime responsibility for hazardous material life-cycle waste management, including management of those wastes generated by DRES. In practice however, the appropriate expertise to deal with wastes generated by DRES R/D activities, especially those wastes related to the CB Defence program, resides with Establishment personnel. Therefore, DRES requires its own internal waste management plan and program. This is integrated where feasible with the Base programs in waste management.

Waste Disposal Practices

A variety of hazardous waste disposal practices have been utilized in the past by DRES to deal with laboratory waste and unwanted CB Defence program materials. Waste disposal usually took place at one or more sites on the Experimental Proving Ground and involved relatively small amounts of material in each case in order to minimize and localize any environmental impacts. Depending on the waste type, disposal methods included open air burning, explosive demolition, neutralization, contained incineration, landfilling, landfarming of biodegradable organic byproducts, landfilling of heavy metal-containing products stabilized in concrete, and dilution in water followed by discharge to the CFB Suffield sewage treatment lagoon. Field disposal operations were supervised and

UNCLASSIFIED

7

conducted by experienced DRES personnel under conditions which called for maximum safety. In most cases, waste awaiting disposal was stored in the open at field sites without any special precautions.

In keeping with the modern trend towards environmental protection, most of these practices were curtailed or abandoned in the 1980s in favour of stockpiling wastes while awaiting appropriate disposal technology to be acquired. A program commenced recently to transfer standard laboratory chemical waste and unused solvents, where possible, to the CFB Suffield Repair and Disposal Unit for commercial disposal under contract. In the early 1990s, DRES let several contracts to remove and dispose of stockpiles of obsolete laboratory chemicals, as well as pesticides and radioactive waste stored at DRES on behalf of other DND agencies. As part of the emerging waste management program, industry-standard hazardous materials storage facilities (see below) were acquired for the proper interim storage of wastes awaiting disposal.

Environmental Audit

In response to recommendations from an independent review of DND and Canadian Forces programs in CB Defence [4], a baseline environmental audit of DRES was completed under contract in 1991. The audit focused mainly on those DRES laboratory facilities located in the CFB Suffield Base Administration Area, but did include some of the activities associated with the EPG.

The purpose of the environmental audit was:

- ◆ to verify that DRES programs and management practices were in compliance with existing safety and environmental legislation, and
- ◆ to identify any compliance problems, areas of risk and/or deficiencies in environmental management practices.

Eight subject areas were covered, *viz.*: occupational health and safety, emergency response plans, hazardous waste management, hazardous materials management, environmental management, air pollution control, water pollution control, and management of cultural and natural resources.

In those areas related to hazardous materials and waste management at DRES, the audit findings were as follows:

Waste Management

The DRES hazardous waste management system was basically sound but required

further improvement to conform with current federal and provincial practice. In particular, proper facilities were needed for storing generated hazardous waste along with improved means to handle and dispose of such waste. A hazardous waste management plan (see below) was required which embodied a waste minimization philosophy and provided for regular, documented inspections of the waste inventory.

Hazardous Materials Management

Hazardous materials management at DRES is generally well executed with respect to chemical and biological agents and explosives materials, particularly for the Experimental Proving Ground. However, improved materials management was needed for the more common industrial chemicals and hazardous materials, particularly with respect to storage practices and regular, documented inspection programs. Improved documentation was needed with respect to training taken by staff in materials management. The responsibility for "cradle-to-grave" hazardous materials management at DRES needed to be coordinated and vested in a single office (OPI).

The audit also noted that DRES laboratory programs do not involve large-scale processes that could potentially produce atmospheric emissions. As well, the size of the Experimental Proving Ground, distance of the perimeter from various field sites, size and scope of DRES disposal operations and the controlled manner in which such operations are conducted all mitigate against any air quality impacts occurring beyond the boundaries of the EPG. With respect to chemical wastes being discharged to the CFB Suffield treatment lagoon, the audit found that DRES laboratory personnel were conscientious with respect to disposal of waste chemicals and biological materials and in preventing such materials from entering laboratory drains. Recent Building 1 (Central Laboratory) renovations have included the elimination of most floor drains which were connected to the sewer system. Nonetheless, the audit recommended that detailed written procedures were required for the disposal of laboratory chemicals. Some procedures are described [5] in Volume I of the DRES Safety Manual and in Standard Operating Procedures [6] related to field waste disposal operations.

Hazardous Materials Committee

DRES established an *ad hoc* Committee on Life Cycle Management of Hazardous Waste Generating Materials (HazMat Committee) following the environmental audit in 1991. This committee, which was made up of scientific and technical specialists from the various DRES programs and chaired by the Environmental Officer, reported directly to senior management. The committee was charged with developing a "cradle-to-grave" system for managing hazardous waste-generating materials at DRES and made recommendations on the development and implementation of procedures to ensure compliance with federal and provincial regulations regarding the acquisition, storage, use

UNCLASSIFIED

9

and disposal of hazardous materials. Meetings were held bi-monthly over a period of two years until the development of a waste management plan was completed (see below).

CRAD Environmental Action Plan

The Chief of Research and Development (CRAD) recently issued an Environmental Action Plan [7] which described overall CRAD Branch environmental goals, policies and approaches for developing individual environmental action plans at the Defence Research Establishments. In keeping with this CRAD initiative, each Establishment will produce an environmental management plan which includes approaches for reducing hazardous materials usage and for implementing waste minimization programs. The waste management plan developed by DRES (see below) and the program described in this Report satisfy these requirements.

DRES WASTE MANAGEMENT PLAN

General Outline

A schematic of the life-cycle waste management plan developed by the HazMat Committee and approved for implementation at DRES is shown in Figure 1. This plan incorporates the following waste minimization practices:

- ◆ control of chemical and hazardous materials purchases to avoid duplicating or augmenting existing stocks which are already available in-house;
- ◆ tracking of chemical inventory and waste inventory to enhance re-use and recycling opportunities¹;
- ◆ waste management co-ordination through a single office (DRES Environmental Officer);
- ◆ co-ordination of waste transfer and disposal activities with the Base Repair and Disposal Unit;
- ◆ maintaining detailed records with respect to disposal requests and waste disposal activities carried out in-house.

¹ Bar code tracking of chemical inventory, as indicated in Figure 1, has not been implemented yet. Currently, chemicals are tracked by reference to purchase orders and through information provided by users for the chemical inventory data base.

DRES LIFE CYCLE WASTE MANAGEMENT PLAN

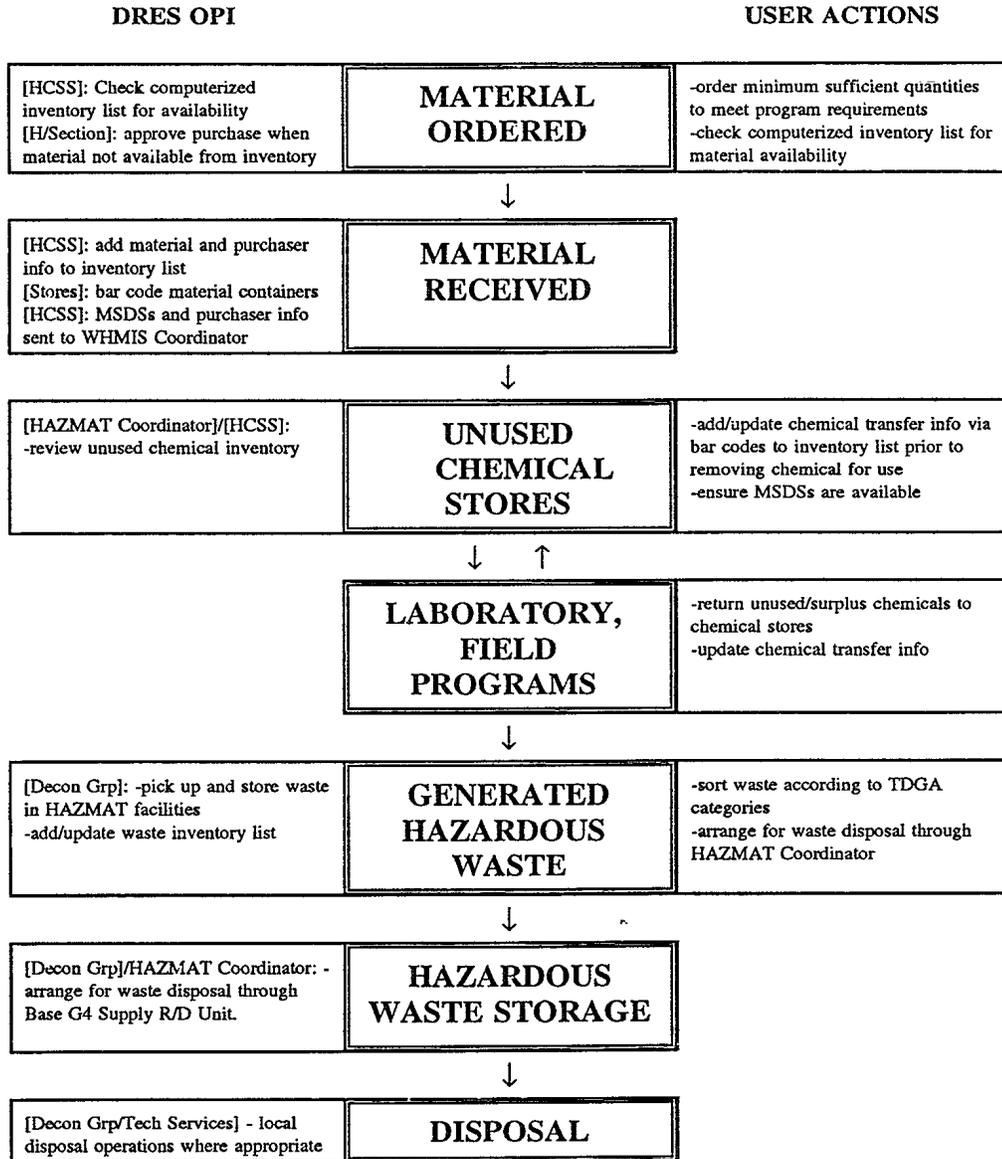


Figure 1: DRES Life-Cycle Waste Management Plan Schematic

UNCLASSIFIED

11

The unit cost for a chemical or material typically decreases as larger amounts are purchased. However, purchasing and stockpiling larger quantities also creates potential for generating high costs associated with the disposal of excess, unused chemicals which eventually become surplus to project requirements. Costs associated with the disposal of a chemical should be considered at the time of purchase. Simply put, the true cost of a chemical (and to the R/D budget) consists of the initial purchase price and the cost of disposal for any unused portion and the empty container.

Disposal Methods

Currently, several field disposal methods, as listed below, have been reserved for CB Defence Program wastes which are continually generated in small quantities and must undergo on-site disposal.

- ◆ chemical neutralization (chemical warfare agents);
- ◆ explosive demolition (explosive and/or chemical-filled ordnance);
- ◆ biomedical waste incineration;
- ◆ small-scale incineration (chemical waste, contaminated scrap);
- ◆ contained burning (low-level radioactive-contaminated waste);
- ◆ autoclaving/inerting (pathogenic materials);
- ◆ stabilization in concrete (metals and salts), and
- ◆ landfilling (non-hazardous residues only).

A number of local Standing Operating Procedures (SOPs) have been developed for these waste disposal methods [5,6,8]. The choice of method depends upon the nature of the waste.

Certain other program-generated laboratory wastes may be disposed of through the Base Repair and Disposal Unit (see below), or through locally-arranged contracts with waste disposal firms. For these latter contracts, Alberta Environment has assigned a Waste Generator Number (ABG 3962) for DRES.

Facilities

Special facilities have been acquired by DRES to support the waste management program, as follows:

Hazardous Materials Storage Modules

Two Hazardous Materials Storage Modules (Buildings 95 and 99) have been stationed in a fenced compound near Building 60 at the Cameron Centre Complex for the

purposes of storing hazardous waste and unused chemicals slated for disposal. An exterior view of the Modules is shown in Figure 2. The Modules are approximately 8' x 8' x 20' in dimension and are rated for safely storing the following Transportation of Dangerous Goods substances under outdoor conditions:

- Class 2 (compressed gases)
- Class 3 (combustible liquids)
- Class 4 (flammable solids)
- Class 5 (oxidizing substances)
- Class 6.1 (poisons)
- Class 8 (corrosives)
- Class 9 (miscellaneous hazardous substances)

Each Module includes the following features:

- divided into two compartments separated by chemical-resistant walls;
- equipped with a chemical-resistant spill containment tray which covers the entire internal storage area and with sufficient capacity to retain several 205 L spills;
- fire-resistant walls, ceilings and doors rated for a 2-hour fire-resistant standard;
- explosion-proof lighting, forced-air ventilation and electrical fixtures;
- dry chemical fire-suppression system;
- explosion venting system;
- one compartment equipped with a hoist system for 205 L drums;
- corrosion-resistant interior and exterior surfaces;
- secure doors for each compartment.
- placard display for waste classes in storage.

The Cameron Centre HazMat Storage Modules are supervised by the Head of the Decontamination Group and inspected routinely.

A third HazMat Storage Module is stationed at the EPG 490 Site for storage of hazardous materials in support of Technical Services field programs.

A specially-engineered Agent Storage Module is stationed in a secure compound at the Cameron Centre Complex. This module is used for the storage of small quantities of munitions-grade agents such as mustard, as well as other hazardous precursors, which are used in support of CF NBC School training and CB Defence Program requirements.

Mini-incinerator

A portable propane-fired incinerator is stationed at the EPG 490 Site for the thermal destruction of small quantities of program-generated waste, hazardous liquids,

UNCLASSIFIED

13

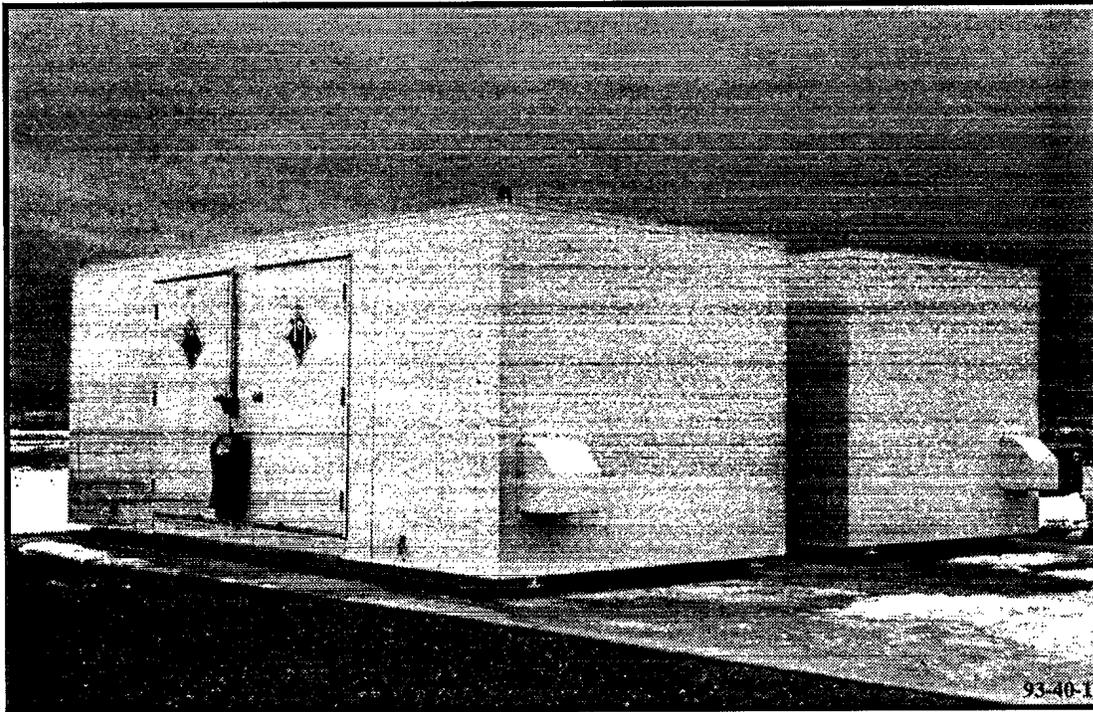


Figure 2: DRES Hazardous Materials Storage Modules

UNCLASSIFIED

solids and contaminated scrap which cannot be disposed of commercially. Such waste includes non-explosive ordnance items with chemical fills, contaminated protective clothing, decontaminated laboratory waste, used respirator filters and shelf-life expired combustible chemicals.

The major components of the incinerator, shown in Figures 3 and 4, include:

- a Westland Cyclonator CY-50-CA two-stage incinerator with solids batch loading capacity of approximately 50 kg;
- a Turbotak SQC92-206 Acid Gas Scrubbing system;
- a Westland-designed emergency bypass and vent cap system to allow the incinerator to operate independently should the scrubber system fail;
- a Sierra Sentry Stack Gas Monitor equipped with sulphur dioxide and carbon monoxide monitors;
- integrated control panel for operation and system failure warnings.

The operating temperature of the incinerator can be set in the range 400°C - 1200 °C for both the primary and secondary combustion chambers. Both chambers, as well as the bypass ducting, are refractory-lined to withstand temperatures of 1500 °C.

The scrubber contains a caustic (e.g. sodium hydroxide) solution tank and a water recirculating tank. A pH control mechanism automatically maintains a pre-set pH value of scrubber water within the range 2 -12 pH units through the controlled addition of the caustic solution. Normally, the system is operated in the 7 - 9 pH unit range. Recirculated scrubber water which eventually becomes high in salt content is discharged to a holding tank located on-site. The water in this tank is periodically pumped out into a tanker truck for transport and discharge to the Cameron Centre lagoons.

Concentrations of sulphur dioxide and carbon monoxide are continuously monitored in the stack to ensure stack emission limits set by Environment Canada are not exceeded during waste incineration. Recordings of stack gas concentrations may be printed out in the form of status reports. The sensors may be calibrated automatically at periodic intervals using a system which delivers calibration gases to the sensor modules.

The operation and maintenance of the incinerator, as well as scheduling of waste disposal, is the responsibility of the Technical Services Section. The DRES Environmental Officer provides advice as to the types and quantities of waste which may be incinerated with this unit.

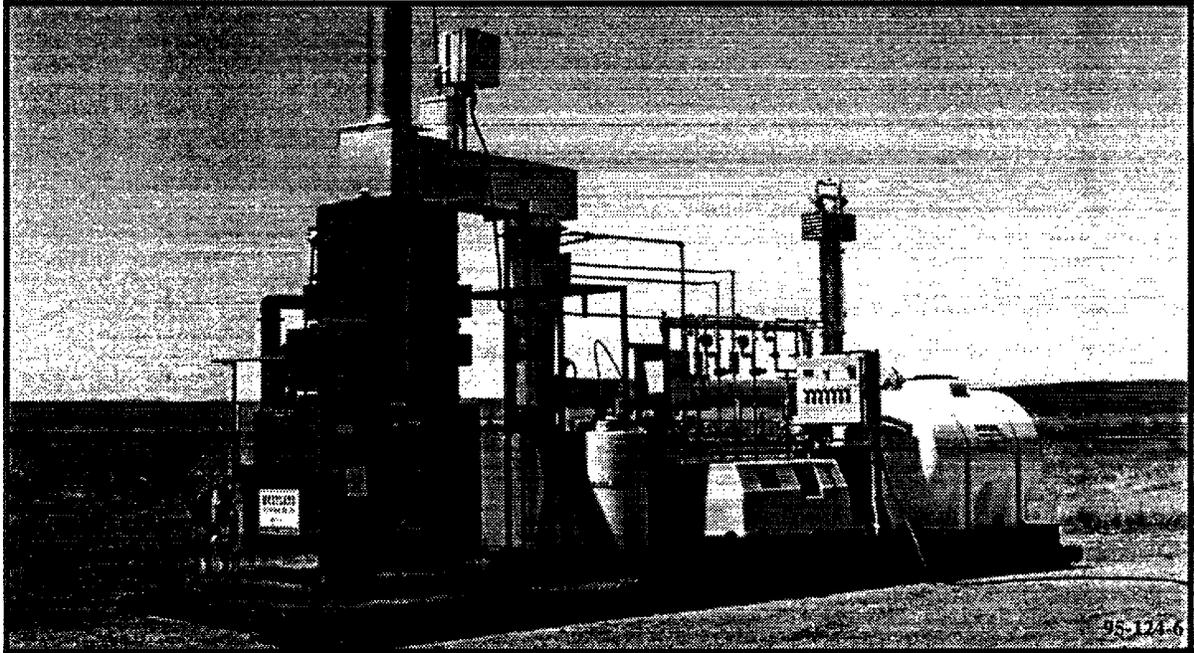


Figure 3: DRES Mini-Incinerator (Front View)

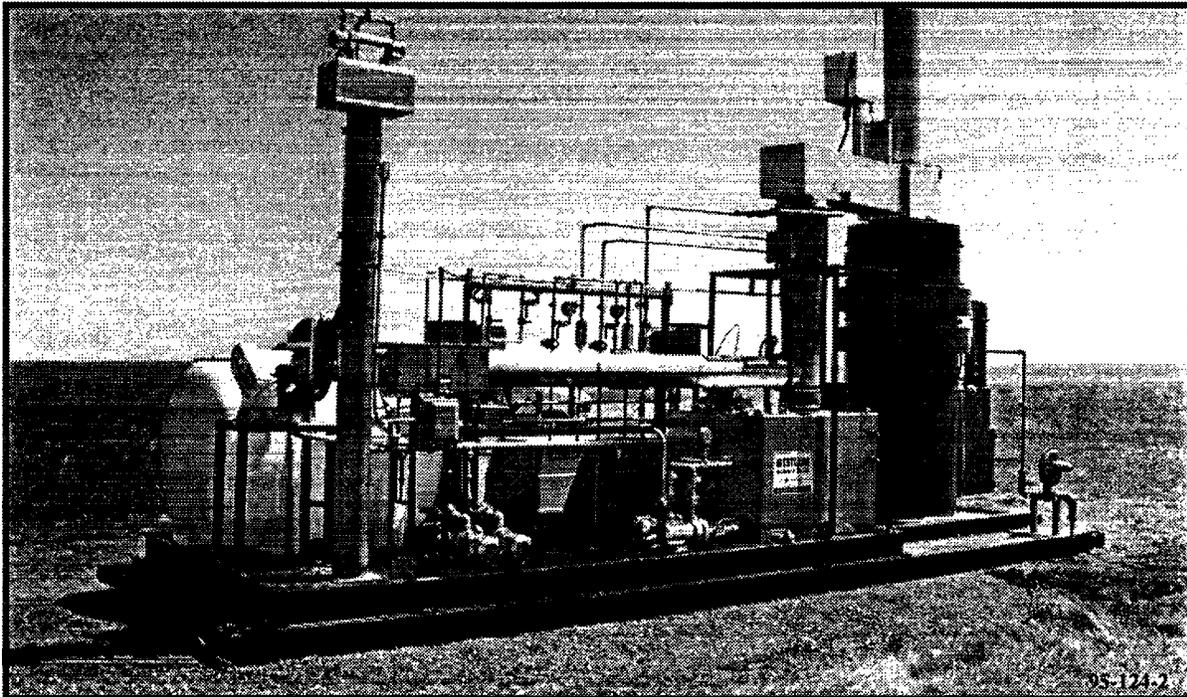


Figure 4: DRES Mini-Incinerator (Side View)

CFB Suffield Repair and Disposal Unit

The CFB Suffield Base Supply Section operates a Repair and Disposal Unit which receives and disposes of Base-generated waste at commercial facilities through a standing offer contract. The types of waste accepted by this Unit include, for example, commercial solvents, paints, bulk chemicals, cleaners, degreasers, used batteries, and petroleum oils and lubricants (POL).

DRES waste, provided it is similar in nature to that generated by the Base, may be accepted for disposal through this Unit at no cost to DRES. Normally, the Head of the Decontamination Group, in consultation with the Environmental Officer, selects appropriate batches of waste from the inventory in storage at the Cameron Centre and delivers these to the Repair and Disposal Unit on a pre-arranged basis.

In the future, it is expected that DRES will pay proportionately for the waste disposal service provided by the Repair and Disposal Unit as the Base completes its downsizing and re-organization.

CFB Suffield Sanitary Landfill

CFB Suffield operates a sanitary landfill located within a fenced and signed area on Coyote Road, near the entrance to the Experimental Proving Ground. DRES access to this landfill is arranged through Technical Services. The landfill, which comes under the responsibility of the Base Operations Branch, is classified as a municipal landfill site and governed by strict regulations as to the types of materials which may be accepted. For example, the landfill accepts typical household, office or construction waste which is non-hazardous. Such waste may also be placed in any of the large dumpsters located throughout the Base Administration Area or the village of Ralston, as these are emptied at the landfill site. Materials not allowed include hazardous materials such as asbestos, chemicals, radioactive material, metal products, liquids, ammunition, biological or pathological waste, grease, oils and paints. Such materials and items of residual value such as metal pipe or unserviceable equipment are returned through the Base Repair and Disposal Unit for disposal. CFB Suffield also operates three other special sites which are used specifically for asbestos disposal, construction waste disposal or bioremediation of POL-contaminated soil.

Dumping at the landfill is limited to normal working hours at which time the access gate will be open. A military heavy equipment operator is usually present to operate a bulldozer to compact and cover the waste and to maintain a waste ledger. For after-hours dumping, access to the sanitary landfill is strictly controlled through issue of a sign-out key available at the CFB Suffield Range Control building.

UNCLASSIFIED

17

The following information is recorded in the sanitary landfill ledger:

- date and time of dumping;
- name of vehicle operator;
- vehicle license number;
- waste-generating source or organization;
- description and amount of waste;
- potential or confirmed dumping violations, and
- remarks or recommendations, if any.

MSDS Data Bases

Material Safety Data Sheets (MSDSs) often provide useful information on precautions to be taken in the storage and handling of chemicals and on disposal procedures. Two software packages have been installed on the DRES Building 1 Library computer to provide staff with readily-accessible MSDS information. Both packages are in Compact Disc-Read Only Memory (CD-ROM) format and are updated quarterly by the suppliers. In addition, the same software packages are available on the office computer located near Room 308, Building 1. The Environmental Officer or the Librarian can provide assistance in accessing and operating the software.

The software available is as follows:

◆ MSDS (Material Safety Data Sheets): This package, supplied by Sigma-Aldrich, contains over 42,000 MSDSs, most with information on chemical structures, material properties and safety information. The data base relates primarily to the products available through Sigma-Aldrich.

◆ CCINFO (Chemical Occupational Health and Safety): DRES subscribes to Core Series A1 and A2 packages supplied by the Canadian Centre for Occupational Health and Safety. The software incorporates over 50 data bases which describe, for example, chemical hazards, transportation of dangerous goods information, a chemical evaluation search and retrieval system (CEASARS), and information on occupational health and safety regulations. MSDS information on more than 80,000 products from 450 manufacturers/suppliers can be accessed through a simple query approach.

Inventory Tracking

In 1992, an inventory of all DRES chemical holdings was taken to establish a data base for reference purposes as well as to provide readily-accessible information to assist response to laboratory emergency situations. At the same time, a separate inventory was taken of all waste materials in storage in DRES facilities and at Experimental Proving

Ground sites. The two inventories were tabulated separately under the Paradox™ relational data base. The waste inventory information was used initially to establish the scope of contracts which were then awarded to remove and dispose of stockpiles of chemical, pesticide and radioactive wastes.

The Chemical Inventory is routinely updated by the DRES Environmental Officer who, in conjunction with the Workplace Hazardous Materials Information System (WHMIS) Coordinator, reviews purchase orders submitted by DRES staff. Information added to the chemical inventory data base includes chemical names, quantities, originating DRES purchaser and laboratory locations where the chemicals are to be stored and used. Currently, only those chemicals which are subject to WHMIS requirements are listed (i.e. regulated hazardous substances).

The Waste Inventory is routinely updated from information supplied on Hazardous Materials Disposal requisition forms (see Procedures, below), disposal records and inventory inspections carried out by the Head of the Decontamination Group.

The Chemical Inventory and Waste Inventory lists can be reviewed by downloading the appropriate files from the DRES Local Area Network into a Paradox™ V3.0 (or higher) data base. The lists may be accessed at chipmunk: /usr/disc2/cheminv. Alternatively, the DRES Environmental Officer, local 4635, can provide assistance in viewing the listings, locating chemicals and updating the data bases.

Environmental Assessment

Environmental protection and compliance at federal facilities such as DRES are governed by the Canadian Environmental Protection Act (CEPA), and the associated Canadian Environmental Assessment Act (CEAA). For example, the CEPA has provisions to control all aspects of the life cycle of toxic/hazardous substances from their development, manufacture or importation, transport, distribution, storage and use, their release into the environment as emissions at various stages of their life cycle, to their ultimate disposal as waste.

In general, an environmental assessment of waste disposal activities is not required when wastes are disposed of through commercial contract at an approved waste disposal facility (e.g. Alberta Special Waste Treatment Centre, Swan Hills). With respect to DRES on-site waste disposal activities, the CEAA requires environmental assessments to be carried out for the following:

- ◆ the incineration, disposal or recycling of toxic chemicals and their precursors as defined by the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Chemical Weapons

UNCLASSIFIED

19

Convention - CWC);

- ◆ the incineration, disposal or recycling of microbial or other biological agents or toxins referred to in the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological and Toxin Weapons and on their Destruction (Biological Weapons Convention - BWC);

- ◆ physical activities related to the testing, construction, operation or disposal of a military weapons platform.

Although not specifically required by CEAA regulations, DND policy in environmental protection management recommends that assessments be carried out for projects which include the proposed construction, operation, modification, decommissioning or abandonment of equipment where the use, generation, or disposal of significant quantities of hazardous material or waste is involved. This includes the proposed introduction of a new or replacement product, technique or process.

DRES has conducted the necessary environmental assessments for those projects associated with on-site hazardous waste disposal activities. All assessments were completed and registered with National Defence Headquarters under the Environmental Assessment Review Process Guideline Orders which preceded the CEAA and remain valid under this latter Act. A listing of the appropriate environmental assessments is given in Table II.

Generally, these environmental assessments show that the proposed waste disposal activities are not expected to produce detrimental environmental impacts, as any potential impacts can be mitigated or eliminated through the proper use of appropriate technology, operating practices and management controls. Environment Canada permits DRES to operate the mini-incinerator without a license, as the batch capacity of the unit and frequency of operation are well below limits applied to commercial incinerators. Alberta Environment allows similar incinerators to burn petroleum products without a license and with no scrubbing unit. Nonetheless, the DRES Environmental Officer periodically supplies Environment Canada with sulphur dioxide and carbon monoxide stack monitoring data to verify that regulatory emission limits are met.

UNCLASSIFIED

UNCLASSIFIED**TABLE II****DRES WASTE DISPOSAL ENVIRONMENTAL ASSESSMENTS**

DATE	REFERENCE No.	TITLE
Oct 94	1267-1445-9402	Arsenic-containing Waste Disposal
May 94	1267-1445-9404	EPG Waste Disposal Methods Upgrade ¹
May 94	1267-1445-9403	EPG Environmental Baseline Study
July 93	1267-1445-9301	Low-Level Radioactive Waste Disposal

¹ The EPG Waste Disposal Methods Upgrade assessment covered all aspects of field waste disposal operations using such methods as incineration, explosive demolition, chemical decontamination, waste stabilization, and recycling.

Inspection Programs

In accordance with environmental audit recommendations and DRES policy, quarterly safety inspections are carried out of DRES facilities, including laboratories and EPG field sites. These inspections are carried out by Section Heads in conjunction with the Establishment General Safety Officer and the results are reported to the Establishment Joint Occupational Safety and Health (JOSH) Committees. Action to correct noted deficiencies and safety infractions are then undertaken through the normal chain of command. A checklist [9], as shown in Annex A, has been designed to assist in the inspection of hazardous materials and waste storage areas.

With respect to safety and waste management programs, laboratory staff who purchase chemicals are required to date the container label when the chemical is received into the laboratory. In this manner, potential hazards related to stored, shelf-life expired chemicals can be noted during laboratory safety inspections. Normally, such chemicals would be considered obsolete and no longer suitable for quality experimental work. These chemicals are then scheduled for removal and disposal (see Procedures below).

UNCLASSIFIED

DRES-SSP-178

UNCLASSIFIED

21

PROCEDURES

Purchase and Transfer of Chemicals

The following approach is utilized under the Hazardous Waste Management Program when purchasing chemicals or other hazardous materials:

- ◆ Before submitting a purchase order, staff should consult the DRES Chemical Inventory data base to determine whether a suitable quantity of the required chemical or material may already exist in DRES laboratories. If so, the laboratory supervisor is contacted to determine whether the required chemical can be spared in the amount needed. If the chemical can be acquired in this manner, then the DRES Environmental Officer is informed and the Chemical Inventory data base is updated to reflect the new location for the chemical.

- ◆ The DRES Waste Inventory data base should also be consulted to determine if the required chemical is in storage awaiting disposal. In this case, the Head of the Decontamination Group, local 4888, should be contacted to retrieve the chemical from storage.

- ◆ For purchases of WHMIS-controlled chemicals, the Environmental Officer adds the requester's name, chemicals purchased and laboratory location to the Chemical Inventory data base when the order is processed through the DRES Purchasing Group. In general, only the minimum quantity of chemical needed to meet project requirements should be ordered.

- ◆ When a filled or partially-filled chemical container is permanently transferred from one laboratory to another, the laboratory supervisor should contact the Environmental Officer to ensure the Chemical Inventory list is updated.

- ◆ When a chemical is received in a DRES laboratory, the laboratory supervisor or technician marks the container label with the date of receipt.

Laboratory Waste Disposal

Chemical Warfare Agents

Small quantities of chemical warfare agents used in the DRES chemical containment laboratories are generally destroyed by chemical reaction (decontamination) following the completion of experiments, rather than returning any unused agent to secure storage. In accordance with protocols developed for a particular experiment, any unused agent is treated using an appropriate decontaminant such as potassium hydroxide/methanol

UNCLASSIFIED

solution, peroxide, etc. The resulting solution may be analyzed to verify the absence of agent if decontamination effectiveness is uncertain. The decontamination solution, along with decontaminated, disposable laboratory items such as gloves, are then placed in sealed and labelled 1-gallon glass jars and disposed of as normal laboratory waste (see below).

Unused Chemicals

The Hazardous Materials Disposal Requisition form, as shown in Figure 5, is used to initiate the pick-up and disposal of unwanted chemicals or other hazardous materials from DRES laboratories. Blank forms are held on file in Section offices; the form can also be accessed on the DRES Local Area Network at beaver: /disk0/ftp/dres/wp_forms.

The requester completes a brief description of the material including its location and forwards the form to the DRES Environmental Officer (who also acts as the Hazardous Material Coordinator) for action. The Environmental Officer records the request and arranges with the Head of the Decontamination Group for pick-up of the material. Usually, the material is stored temporarily in one of the Cameron Centre HazMat Storage Modules while awaiting disposal. While in interim storage, the Head of the Decontamination Group assigns a Hazardous Waste Inventory number to the material for tracking purposes. The material is also listed on the DRES Waste Inventory data base until removed for disposal. In this manner, interested laboratory users may still recover or reclaim the material until such time as disposal actually occurs.

If the chemical or hazardous material is suitable for transfer to the Base Repair and Disposal Unit, arrangements for transfer are made directly by the Head of the Decontamination Group. After transfer, these DRES-generated wastes are then disposed of through standing offer contracts administered by the Base Supply Officer.

For unused chemicals which the Base Repair and Disposal Unit does not accept, these are either disposed of in-house using an appropriate method or are stockpiled until sufficient quantity is on hand to warrant commercial disposal under contract. Such contracts have been funded previously through the CRAD Environmental Program or from DRES Operations and Maintenance budgets. CRAD Environmental Program funding will no longer be available to support waste disposal contracts.

Laboratory Waste

Glass waste bottles (1 gallon) and caps which are available from Stores are used to contain laboratory waste such as used solvents and solutions, used disposable glassware, gloves, tissue paper, chemical residues, etc. Separate bottles are used to segregate radioactive waste from other forms of waste. In each case, the bottle is labelled as to its contents (generic) and source location using the appropriate label available from

UNCLASSIFIED

23

**REQUISITION
HAZARDOUS MATERIALS DISPOSAL**

To: DRES HAZMAT Co-Ordinator
4635

From:	Section:
Project No.	Phone:

- PART A: Please**
1. list waste materials to be removed for disposal
 2. include Material Safety Data Sheets (MSDS) where possible
 3. ensure all items are labelled
 4. indicate if the waste requires special handling precautions (e.g. leaking, damaged container, explosive properties)

Material	Container Size	No.	MSDS √
Notes:			

PART B: For HAZMAT Co-ordinator Use

Request Received	Arrange Pick-up	Storage Location	HAZMAT Job No.

Figure 5: Hazardous Materials Disposal Requisition Form

UNCLASSIFIED

stores, and as supplied by the waste storage cabinet located on the 5th floor of Building 1. Examples of container labels are shown in Figure 6. Normally, waste bottles are stored in the laboratory fume hood where the waste is being generated.

When full, waste bottles are removed to the Building 1 - 5th Floor waste storage cabinet using a cart or safety transport container. Keys to the storage cabinet are provided to each Defence Sciences section office as well as to the Head of the Decontamination Group and the DRES Radiation Safety Officer.

The Head of the Decontamination Group normally arranges to pick up waste bottles from the storage cabinet on a monthly basis, unless a report of a full cabinet is received by the Section office. Emergency pick-up of unusual waste items can be arranged by calling the Decontamination Group Head directly (4888).

The following precautions should be taken with respect to laboratory waste:

- ◆ Do not overfill waste bottles;
- ◆ Ensure that no closed or sealed containers are put into the waste bottles. These may constitute an explosive hazard depending on the disposal method or otherwise present difficulties in ensuring complete decontamination. Waste Bottles containing closed containers will be returned to the originator;
- ◆ Waste chlorinated solvents such as dichloromethane or chloroform should be segregated from other types of laboratory waste and stored separately, if possible;
- ◆ Syringes or pipettes should be first rinsed out with appropriate decontaminant or cleansing solution before being placed in waste bottles;
- ◆ Do not use bleach solutions for decontamination unless absolutely necessary;
- ◆ Do not dispose of more than one type of radioactive isotope per waste bottle;
- ◆ Bottles containing radioactive waste should be placed on those storage cabinet shelves which are marked for radioactive waste. Do not mix radioactive and non-radioactive waste bottles on the same shelf. Ensure that all bottles containing radioactive waste are marked with the radiation trefoil symbol;
- ◆ The storage cabinet is intended for temporary storage of non-radioactive or low-level radioactive wastes only. Contact the DRES Radiation Safety Officer (4687) to determine waste disposal requirements for highly radioactive items;

RADIOACTIVE WASTE

Room # _____ Originator _____ Date _____

Isotope _____ Amount of active material _____

Type of Waste (check applicable)

<input type="checkbox"/> Detoxified Toxic Waste (Indicate agent(s) decontaminated)	<input type="checkbox"/> General Lab Waste <input type="checkbox"/> Flammable <input type="checkbox"/> Nonflammable
--	--

CHEMICAL WASTE

Room # _____ Originator _____ Date _____

Type of Waste (check applicable)

<input type="checkbox"/> Detoxified Toxic Waste (indicate agent(s) decontaminated)	<input type="checkbox"/> Heavy Metals _____ <input type="checkbox"/> General Lab Waste <input type="checkbox"/> Flammable <input type="checkbox"/> Nonflammable
--	--

Figure 6: Hazardous Waste Container Labels

- ◆ Do not use the storage cabinet for biohazardous or biomedical waste.

Non-radioactive laboratory waste is usually placed in overpack barrels located at the EPG 490 Site and stored prior to incineration using the mini-incinerator. Generally, the entire bottle and its contents are incinerated together, with any glass slag and ash residues disposed of in the CFB Suffield landfill as non-hazardous waste. Disposal activities using this equipment are scheduled by the Technical Services Manager, depending on the availability of field personnel and other factors.

Low-level radioactive waste, e.g. contaminated tissue, laboratory gloves, etc., which is combustible is overpacked separately and disposed of by contained burning (Kimbell Cooker apparatus) using methanol fuel. This disposal method has been approved by the Atomic Energy Control Board (AECB), based on radioactivity monitoring results forwarded by DRES to AECB which verify that this method does not create a detrimental environmental impact. Any residual ash is subjected to monitoring to ensure the material meets radioactivity limits for disposal as non-hazardous waste.

Biomedical Waste

Some of the waste which is generated in the laboratories of the Medical Countermeasures Section (Biotechnology, Therapy and Animal Resources Groups) can be considered biomedical and/or biohazardous waste. This waste is disposed of as follows, using either of the following in-house methods:

- ◆ **Incineration:** The Building 10 incinerator is licensed to burn solid organic waste such as animal bedding, carcasses and wastes. In addition, all sharps containers are incinerated using this equipment. Personnel shall ensure that all needles, syringes, scalpel blades and any other disposable items which present a sharps hazard are placed in proper sharps containers regardless of the purpose(s) the item has been used for. One exception to this general procedure is for those items which pose a toxic chemical hazard. These items are dealt with through the chemical laboratory waste disposal procedures, as described above. The Head/Animal Resources Group (4875) should be contacted to schedule incineration requirements.

- ◆ **Autoclaving/Inerting:** This procedure is employed for biohazardous waste. Waste is placed inside a clear, unlabelled autoclave bag which is then placed inside a biohazard-labelled autoclave bag. When the inner bag is full, the two bags are autoclaved together under sufficient conditions to destroy any biohazardous material. Detailed autoclaving procedures are given in the DRES Safety Manual, Volume II [8]. When autoclaving is complete, the inner bag containing the detoxified waste is removed from the biohazard bag and placed in a regular garbage bag for regular collection and disposal

UNCLASSIFIED

27

through the contractor collection bins located outside of the DRES laboratories. Normally, such collected waste is landfilled at the CFB Suffield landfill located on the DRES EPG. If possible, the biohazard bag is re-used; otherwise, the biohazard bags are re-autoclaved and incinerated if contamination is suspected.

Field Waste Disposal

Technical Services staff hold weekly Monday morning meetings with R/D program officers to discuss field trials support requirements and scheduling. These meetings also provide the venue to schedule EPG waste disposal activities. Waste disposal is normally assigned a lower priority compared to field trials which are covered by Field Trial Plans (FTPs).

Standing Operating Procedures (SOPs) have been developed by the DRES Technical Services Section [6] as follows to safely carry out the in-house disposal of hazardous items and wastes:

- SOP 06/83: Demolition of Hazardous Ordnance
- SOP 07/83: Removal of Agent From Projectiles
- SOP 08/83: Destruction of Non-Serviceable Chemicals
- SOP 16/88: Unexploded Ordnance - Unknown Item Disposal
- SOP 14/89: Projectile Drill and Tap Neutralization System
- SOP 18/90: Fuzed/Toxic Chemical Agent-Filled Ordnance with Explosive Burster Disposal Operation
- SOP 26/91: Destruction of Surplus, Obsolete or Deteriorating Ammunition by Detonation or Burning
- SOP 29/91: Destruction of Chemical Agent Stocks
- SOP 30/92: Disposal by Incineration using Kimbell Cookers
- SOP 52/95: Mini-Incinerator and Scrubber Operating Procedures

In general, regulations covering the destruction of ammunition and explosive are covered in the following publications which are held in the Technical Services Section:

- ◆ Canadian Forces Explosive Safety Manual. Vol I. CFTO C-09-153-001/TS-000;
- ◆ Destruction of Surplus, Obsolete and Deteriorated Ammunition. CFTO C-09-008-001/FP-000;
- ◆ Destruction of Dud and Misfired Ammunition. CFTO C-09-008-002/FP-000
- ◆ Range Clearance Handbook. CFTO B-GL-304-003/TS-003, and

◆ CIL Blasters Handbook - 6th Edition.

Disposal of explosive materials is carried out by Explosive Ordnance Disposal (EOD) specialists in the Technical Services Hazardous Materials Group using the appropriate SOP. Field disposal activities involving chemical agents or chemical-filled ordnance items are strictly controlled by Technical Services Section Field Trials Officers and involve the support of chemical specialists from the C/B Defence program. Other than demolition of explosive ordnance at EPG Demolition Area A, or in-situ detonation of found items which are too dangerous to handle and transport, most field disposal activities are now carried out at the EPG 490 Site. A field laboratory located at the Willis Centre site has been used in the past for chemical agent destruction by chemical neutralization.

Reporting Requirements

Field waste disposal activities are documented in Technical Services Section Disposal Records in accordance with SOP 3/88 -Reporting/Disposal Procedures. An example of a Disposal Record is shown in Figure 7. Such disposal records contain detailed information on the date/time of the disposal activity, the types of waste involved, disposal method used, prevailing conditions and personnel involved. These records, which date back to 1970, are maintained by the Technical Services Section for reference.

When waste is removed from storage for disposal, the Head of the Decontamination Group informs both the DRES Environmental Officer and the Technical Services Manager and updates the Waste Inventory data base accordingly. The Technical Services Manager maintains and updates the waste disposal records as required. The DRES Environmental Officer keeps an updated version of the Waste Inventory data base in order to pursue possibilities for recycling the remaining stocks of used chemicals to laboratory staff.

Although not strictly required, stack emissions monitoring data (sulphur dioxide, carbon monoxide), acquired during waste burning using the mini-incinerator, is provided periodically to Environment Canada to confirm current regulatory standards for these emissions are met. The ambient environment and ash residues produced when low-level radioactive waste is burned in the Kimbell Cooker equipment are surveyed. The results are reported by the DRES Radiation Safety Officer to AECB to confirm allowable residual radioactivity levels are not exceeded.

UNCLASSIFIED

29

PROTECTED A (when completed)DRES/FIELD OPERATIONS SECTION MATERIEL DISPOSAL/TRANSFER RECORDDISPOSAL DISPOSAL RECORD NO. _____ DATE: _____TRANSFER TRANSFER RECORD NO. _____ MATERIEL SERIAL # _____

1. Item Description (Name or Type of Chemical/Ordnance; Quantity): _____

2. Site Location: _____ Grid Ref: E _____ N _____

3. Date Located/Reported: _____ DUD LOG BOOK ENTRY: _____

4. Authority for Disposal/Transfer: _____

5. Disposal/Transfer Performed by: see attached list of personnel.

6. Disposal Method: Burning ___ Chemical Decontamination ___ Explosives ___

7. Zero Start Time: _____ hrs End Time: _____ hrs

8. Length of Chemical Decont. Time: _____ Length of Burning Time: _____

9. Weather Conditions: Temp: _____ °C Wind Direction: _____

Wind Speed: _____ mps/Kph (or attach daily MET Report)

10. Materials Used for Disposal: See Attached list of Explosives and
Decontaminant Expended.

11. Chemical Readings (Cam, Detectors, Samplers) _____

12. Remarks: (see reverse side) _____

13. Final Location (Transferred Item or Waste) _____

Grid Ref: E _____ N _____

FIELD TRIALS OFFICERDISTRIBUTION LIST

H/FOS (Disposal Record Book/Transfer Record Book)

H/HMG, FTO's

Figure 7: Technical Services Section Disposal Record

EMERGENCY RESPONSE TO WASTE SPILLS AND LEAKS

DRES has an Emergency Response Plan [10] which gives coordinated emergency response procedures to ensure consistently safe and effective response to all emergency situations which may arise in DRES facilities in the main Base area of CFB Suffield. This plan includes emergency response procedures for the Cameron Centre Complex where hazardous wastes are stored.

A separate emergency response plan has been developed for Experimental Proving Ground fixed facilities and trial sites [11]. This plan provides procedures to respond and handle emergency situations involving hazardous materials and chemical spills in explosive, chemical, flammable fuel storage sites and experimental trial sites. In the case of the EPG, a separate emergency response plan is necessary due to the distances of facilities from Base emergency responder units and the nature of field operations vs the types of laboratory operations carried out in DRES facilities located in the main Base area.

Laboratory Spills

The DRES Emergency Response Plan [10] provides detailed response procedures in the event of a hazardous chemical spill or release of toxic agents within laboratories. Waste solutions which leak or spill are to be considered as a hazardous chemical spill.

Generally, the area in which the spill occurs is immediately isolated. If the spill is sufficiently large or produces emissions which cannot be dealt with using local containment/clean-up or if any toxic agents have been released, the building alarm system is activated to evacuate personnel and summon Base emergency response units (Base Fire Hall). The on-scene controller then directs the emergency response capability back to the scene of the spill or release; the on-scene controller will normally be from the Base Fire Hall unless toxic agents are involved. DRES (Head/Physical Protection Section or Head/Medical Countermeasures Section) assumes on-scene control for this latter type of emergency. The spill will be cleaned up by appropriately trained individuals wearing the proper personal protective equipment. The DRES Decontamination Team may provide assistance as directed by the on-scene controller.

Adsorbent materials used for hazardous spill containment will normally be packaged for eventual disposal by incineration. Decontaminants will be used to de-toxify spills and affected surfaces in cases involving toxic agent spills.

UNCLASSIFIED

31

Stored Waste Leaks

Detailed emergency response procedures for chemical spills and fires at chemical/waste storage sites are given in the EPG Emergency Response Plan [11]. All personnel working at EPG sites or travelling within the EPG must have a portable or vehicle-equipped radio for communication and emergency response purposes.

In the event of an observed emergency during normal working hours, contact is made immediately with the DRES Radio Net Operator (call-sign "ALPHA"). The Radio Operator is then responsible for contacting a Field Trials Officer who, if not already at the scene of the emergency, will go to the site and act as on-scene controller. Various Base and DRES emergency responder units and the Technical Services Manager will also be contacted immediately. For chemical spills, the DRES Decontamination Team will respond with various containment and decontamination materials suitable for cleaning up spills. Any absorbent materials used for spill containment of hazardous materials are normally packaged for subsequent disposal by incineration.

For observed emergencies occurring after normal working hours, either the CFB Suffield Range Control Operations Centre, which is manned on a 24 hour basis, or the DRES Duty Commissionaire is contacted by radio or telephone. Range Control or the Commissionaire is then responsible for contacting the DRES and Base emergency response teams.

Reporting

Local spills, leaks or observed safety or environmental hazards involving hazardous materials are reported using one of the following forms:

- ◆ DRES Hazard Observation Report
- ◆ Accident/Incident Report
- ◆ Environmental Incident Report

These reports are forwarded to the Establishment General Safety Officer (hazard observations, accidents/incidents) or to the Environmental Officer (environmental incidents) for coordinating follow-up action through the appropriate committee structure and line management.

Hazardous materials incidents which involve serious physical injury, loss or damage to DND property, are cause for public concern or media interest, or may subject the Minister of National Defence to questions in the House of Common or cause NDHQ to receive ministerial queries shall be reported in accordance with CFAO 4-13 - Unusual Incidents.

MANAGEMENT AND STAFF RESPONSIBILITIES

In keeping with NDHQ Policy Directive P5/92, management and staff at DND installations are to adopt a Code of Environmental Stewardship which integrates environmental concerns with operational activities and the normal day-to-day decision making processes. With respect to hazardous materials, this Code requires that environmentally responsible practices be applied to the acquisition, handling, storage, safety in use, transportation and disposal of such materials. This includes seeking cost-effective ways to reduce the consumption of raw materials, toxic substances, energy, water and other resources as well as reducing the amount of waste generated through program activities. Policy Directive P5/92 also calls for all personnel to exercise due diligence in carrying out their duties and exercising their responsibilities in order to avoid personal and departmental liability which can occur under current environmental legislation and associated regulations.

Canadian Forces Administration Order 36-55 describes the general responsibilities for the management of hazardous materials; this CFAO is applied in concert with CFAO 36-50, Environmental Protection Management and CFAO 36-31, Annex H, Disposal of Hazardous Chemicals. In general, life-cycle hazardous materials management is recognized as an essential element in all program planning.

At DRES, hazardous materials management responsibilities are included within the mandate of established committees on general health and safety (JOSH and GHS committees) and environmental protection (Environmental Management Committee). The hazardous materials management program is a responsibility of and is implemented by line management and their technical support staff. The DRES Environmental Officer acts as a Hazardous Materials Coordinator and represents the Establishment at these and the corresponding CFB Suffield committee meetings to coordinate hazardous material and waste management programs. The DRES Technical Services Manager is responsible for controlling the storage and disposal of wastes which involve the use of EPG facilities or sites. For DRES special wastes, the Environmental Officer provides technical advice on chemical properties, technology selection and protective equipment requirements.

REFERENCES

1. Canadian Forces Base Suffield Environmental Management System, Report 1266-1 (B Env O), August 1994.
2. MIACC Lists Of Hazardous Substances. The Major Industrial Accidents Council Of Canada. Pre-Print 1994. ISBN No. 1-895858-05-4.

UNCLASSIFIED

33

3. Hazardous Waste Management Handbook 1983, Chapter IX - Institutional Chemical Wastes. Corpus Information Services, Don Mills, Ontario. ISSN 0711-7140.
4. W.H. Barton, Research, Development And Training In Chemical And Biological Defence Within The Department Of National Defence And The Canadian Forces. DND Publication, Catalogue No. D2-79/1989E, 31 December 1998. Canadian Government Publishing Centre, Ottawa, Ontario, K1A 0S9.
5. DRES Safety Manual - Volume I. General Workplace Safety. Suffield Special Publication No. 133. Certified updated version 1993 (G.K. Briosi, ed.).
6. DRES Safety Manual - Volume IV. PSD Specialist Workplace Safety. Suffield Special Publication No. 133. Certified updated version 1991 (B.G. Laidlaw, ed.).
7. Chief of Research and Development, Environmental Action Plan, prepared by HRDTS, 4 October 1994.
8. DRES Safety Manual - Volume II. DSD Specialist Workplace Safety. Suffield Special Publication No. 133. Certified updated version 1992 (P.A. Lockwood, ed.).
9. National Defence General Safety Program. Volume 4. Hazardous Materials Safety. A-GC-040-004/AG-001. Annex C, Chapter 9.
10. DRES Integrated Emergency Response Plan. Suffield Special Publication No. 176. Certified updated version 1995 (J.M. McAndless, ed.).
11. R.E. Martin and V.G. Fedor, DRES Standing Operating Procedure 024-93. Emergency Response Plan. Program Support Division (PSD). EPG Emergencies. July 1993.

UNCLASSIFIED

ANNEX A
SAFETY INSPECTION CHECKLIST

UNCLASSIFIED

**INSPECTIONS FOR THE SAFE STORAGE
and
HANDLING OF HAZARDOUS MATERIALS**

REF: A-LM-187-004/JS-001

The checklist below is designed to help YOU inspect your hazardous materials storage areas. Mark each statement with an "X". An "X" in the Yes column indicates a proper storage/handling condition. An "X" in the No column shows where improvement can be made for safe storage and handling of hazardous materials.

YES NO

- | | | |
|--------------------------|--------------------------|---|
| <input type="checkbox"/> | <input type="checkbox"/> | HMGSs/MSDSs in place and valid |
| <input type="checkbox"/> | <input type="checkbox"/> | Employees trained re hazardous substances |
| <input type="checkbox"/> | <input type="checkbox"/> | Emergency procedures known and practiced |
| <input type="checkbox"/> | <input type="checkbox"/> | Adequate PPE available and used |
| <input type="checkbox"/> | <input type="checkbox"/> | Employees familiar with equipment used |
| <input type="checkbox"/> | <input type="checkbox"/> | Accidents and spills reported promptly |
| <input type="checkbox"/> | <input type="checkbox"/> | Emergency showers and eye wash facilities available |

HOUSEKEEPING

- | | | |
|--------------------------|--------------------------|--|
| <input type="checkbox"/> | <input type="checkbox"/> | Floors and stairways slippery, are there spills? (water, oil, chemicals) |
| <input type="checkbox"/> | <input type="checkbox"/> | Tripping hazards present |
| <input type="checkbox"/> | <input type="checkbox"/> | Treads on stairs or floor mats defective |
| <input type="checkbox"/> | <input type="checkbox"/> | Cleanliness and order are maintained in the storage areas
AT ALL TIMES |
| <input type="checkbox"/> | <input type="checkbox"/> | Proper disposal of unlabelled, contaminated or used hazardous materials |

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous materials and containers in storage are inspected on a regular basis for decomposition and leakage
<input type="checkbox"/>	<input type="checkbox"/>	Inspection logs are being maintained
<input type="checkbox"/>	<input type="checkbox"/>	Packaging material and empty containers are immediately removed from the storage area
<input type="checkbox"/>	<input type="checkbox"/>	Waste receptacles are properly marked and easily located
<input type="checkbox"/>	<input type="checkbox"/>	Separate containers for the disposal of broken glass are available
<input type="checkbox"/>	<input type="checkbox"/>	A "recouping" area is being used for damaged/leaking hazardous materials worth keeping
<hr/>		
STORAGE AREAS		
<input type="checkbox"/>	<input type="checkbox"/>	Storage areas are well lighted and have two or more clearly marked exits
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous storage areas are well ventilated
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous materials that require cool/dehumidified conditions have such conditions
<input type="checkbox"/>	<input type="checkbox"/>	Open flame, smoking or any type of localized heat are not permitted in the hazardous areas
<input type="checkbox"/>	<input type="checkbox"/>	Mixing or transfer of hazardous materials is done outside the storage areas and in authorized "recouping" areas
<hr/>		
STORAGE CONTAINER		
<input type="checkbox"/>	<input type="checkbox"/>	Authorized CTC/MIL/FED specification containers are being used
<input type="checkbox"/>	<input type="checkbox"/>	Containers are inspected for rust, corrosion, and leakage
<input type="checkbox"/>	<input type="checkbox"/>	Damaged containers are removed immediately or repackaged properly
<input type="checkbox"/>	<input type="checkbox"/>	Safe stacking heights are being observed

YES NO

Containers being stored at corners are protected from MHE contact

LABELLING OF CONTAINERS

Approved hazard labels and identification system are used for labelling all hazardous materials

All containers are clearly and properly labelled as to their contents

Labels are readable, durable and bilingual

Labels are firmly attached to the packages

GAS CYLINDERS

All gas cylinders are secured against falling

Gas cylinders are stored away from direct localized heat, open flames, and sparks

Gas cylinders are stored in a cool, dry place away from corrosive materials or highly flammable substances

Empty cylinders are marked "empty" and stored separate from full cylinders

Flammable or toxic gases are stored at or above ground level, and not in basements

Valves of empty cylinders are closed

When storing or moving cylinders, THE VALVE CAP is securely in place to protect the valve stem and the valve

A hand truck is available for transporting gas cylinders

FIRST AID and SAFETY EQUIPMENT

Adequate eye wash stations are available, stocked and inspected

Adequate safety showers are available and functional

YES NO

- Adequate spill control equipment is available and serviceable
- Fire extinguishers are at fire points with properly dated inspection tags
- Smoke/fire sensors, automatic alarms and vapor alarms are available, working and properly inspected
- Adequate ventilation equipment is available and functional
- First aid kits are available, stocked and inspected
- First aid cabinets are clearly marked
- Sufficient personnel are trained in first aid with required number of first aid qualified personnel available on each shift
- Emergency response numbers are posted, telephone location(s) known and telephone(s) working
- Hand washing facilities are readily available

HAZARDOUS MATERIALS STORAGE

- Hazardous materials are stored to prevent exposure to direct sunlight or localized heat
- Hazardous materials are stored by hazard class
- Incompatible materials are physically separated from each other in accordance with the applicable regulations
- Information on the incompatibility of materials is available for consultation for safe storage arrangement
- Incompatibility charts are posted

ACIDS

- Large bottles of acid are stored on a low shelf or in approved cabinets

YES NO

Oxidizing acids are segregated from organic acids, flammables and combustible materials

Acids are kept separate from bases and alkaline metals such as sodium or potassium

Spill control plans and equipment are available for acid spills

BASES

Bases are stored away from acids

Solutions of inorganic hydroxides are stored in polyethylene containers

Spill control plans and equipment are available for caustic spills

OXIDIZERS

Oxidizers are stored away from flammable and combustible materials and reducing agents such as zinc, alkaline metals and formic acid

WATER REACTIVE MATERIALS

Materials are kept in a cool, DRY place

A dry chemical fire extinguisher system is used

FLAMMABLES

All flammable liquids are kept in approved storage areas in approved containers

Flammables are kept away from any source of ignition, flames, heat or sparks

All electrical service equipment is explosive-proof

Firefighting equipment is readily available

When dispensing flammable liquids into a metal container, a static bonding line is used to connect the drum and receptacle (decanting)

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	All storage containers larger than 5 gallons are properly grounded to an approved grounding point
<hr/> TOXIC MATERIALS <hr/>		
<input type="checkbox"/>	<input type="checkbox"/>	Toxic material, carcinogens and teratogens are kept in a secure area accessible only to authorized personnel
<input type="checkbox"/>	<input type="checkbox"/>	Emergency response actions are posted
<hr/> SPECIAL IN-HOUSE PROBLEMS <hr/>		
<input type="checkbox"/>	<input type="checkbox"/>	Identify protective requirements and add to this list
<hr/> MATERIALS HANDLING EQUIPMENT (MHE) <hr/>		
<input type="checkbox"/>	<input type="checkbox"/>	MHE is grounded
<input type="checkbox"/>	<input type="checkbox"/>	MHE is checked daily for defective operation
<input type="checkbox"/>	<input type="checkbox"/>	The right type of MHE is being used around hazardous materials
<input type="checkbox"/>	<input type="checkbox"/>	Moving (electrical) parts are guarded
<input type="checkbox"/>	<input type="checkbox"/>	Wiring, switches, and fuses are free of defects
<hr/> STORAGE AREAS <hr/>		
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous storage areas are properly and prominently marked or identified
<input type="checkbox"/>	<input type="checkbox"/>	Hazardous areas are secured at all times when not in use with access only to authorized personnel
<input type="checkbox"/>	<input type="checkbox"/>	Emergency response drills are known by all and have been practiced

UNCLASSIFIED
 SECURITY CLASSIFICATION OF FORM
 (highest classification of Title, Abstract, Keywords)

DOCUMENT CONTROL DATA

(Security classification of title, body of abstract and indexing annotation must be entered when the overall document is classified)

<p>1. ORIGINATOR (the name and address of the organization preparing the document. Organizations for who the document was prepared, e.g. Establishment sponsoring a contractor's report, or tasking agency, are entered in Section 8.)</p> <p>DEFENCE RESEARCH ESTABLISHMENT SUFFIELD PO BOX 4000 MEDICINE HAT, ALBERTA, CANADA</p>	<p>2. SECURITY CLASSIFICATION (overall security classification of the document, including special warning terms if applicable)</p> <p>UNCLASSIFIED</p>		
<p>3. TITLE (the complete document title as indicated on the title page. Its classification should be indicated by the appropriate abbreviation (S, C or U) in parentheses after the title).</p> <p>HAZARDOUS WASTE MANAGEMENT AT DRES</p>			
<p>4. AUTHORS (Last name, first name, middle initial. If military, show rank, e.g. Doe, Maj. John E.)</p> <p>McANDLESS, JOHN M.</p>			
<p>5. DATE OF PUBLICATION (month and year of publication of document)</p> <p>MARCH 1996</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;"> <p>6a. NO. OF PAGES (total containing information, include Annexes, Appendices, etc)</p> <p>46</p> </td> <td style="width: 50%;"> <p>6b. NO. OF REFS (total cited in document)</p> <p>11</p> </td> </tr> </table>	<p>6a. NO. OF PAGES (total containing information, include Annexes, Appendices, etc)</p> <p>46</p>	<p>6b. NO. OF REFS (total cited in document)</p> <p>11</p>
<p>6a. NO. OF PAGES (total containing information, include Annexes, Appendices, etc)</p> <p>46</p>	<p>6b. NO. OF REFS (total cited in document)</p> <p>11</p>		
<p>7. DESCRIPTIVE NOTES (the category of the document, e.g. technical report, technical note or memorandum. If appropriate, enter the type of report, e.g. interim, progress, summary, annual or final. Give the inclusive dates when a specific reporting period is covered.)</p> <p>SUFFIELD SPECIAL PUBLICATION</p>			
<p>8. SPONSORING ACTIVITY (the name of the department project office or laboratory sponsoring the research and development. Include the address.)</p>			
<p>9a. PROJECT OR GRANT NO. (If appropriate, the applicable research and development project or grant number under which the document was written. Please specify whether project or grant.)</p> <p>061PL</p>	<p>9b. CONTRACT NO. (If appropriate, the applicable number under which the document was written.)</p>		
<p>10a. ORIGINATOR'S DOCUMENT NUMBER (the official document number by which the document is identified by the originating activity. This number must be unique to this document.)</p> <p>SUFFIELD SPECIAL PUBLICATION No. 178</p>	<p>10b. OTHER DOCUMENT NOs. (Any other numbers which may be assigned this document either by the originator or by the sponsor.)</p>		
<p>11. DOCUMENT AVAILABILITY (any limitations on further dissemination of the document, other than those imposed by security classification)</p> <p><input checked="" type="checkbox"/> Unlimited distribution <input type="checkbox"/> Distribution limited to defence departments and defence contractors; further distribution only as approved <input type="checkbox"/> Distribution limited to defence departments and Canadian defence contractors; further distribution only as approved <input type="checkbox"/> Distribution limited to government departments and agencies; further distribution only as approved <input type="checkbox"/> Distribution limited to defence departments; further distribution only as approved <input type="checkbox"/> Other (please specify):</p>			
<p>12. DOCUMENT ANNOUNCEMENT (any limitation to the bibliographic announcement of this document. This will normally corresponded to the Document Availability (11). However, where further distribution (beyond the audience specified in 11) is possible, a wider announcement audience may be selected).</p> <p>UNLIMITED</p>			

UNCLASSIFIED
SECURITY CLASSIFICATION OF FORM

13. **ABSTRACT** (a brief and factual summary of the document. It may also appear elsewhere in the body of the document itself. It is highly desirable that the abstract of classified documents be unclassified. Each paragraph of the abstract shall begin with an indication of the security classification of the information in the paragraph (unless the document itself is unclassified) represented as (S), (C) or (U). It is not necessary to include here abstracts in both official languages unless the text is bilingual).

DRES HAS DEVELOPED A WASTE MANAGEMENT PROGRAM TO ADDRESS THE ISSUE OF HAZARDOUS WASTE GENERATED BY ESTABLISHMENT RESEARCH AND DEVELOPMENT ACTIVITIES. THE TYPES OF WASTE GENERATED ARE TYPICAL OF INDUSTRIAL OR UNIVERSITY CHEMICAL LABORATORIES BUT INCLUDE SEVERAL TYPES OF SPECIAL WASTE STREAMS SUCH AS RADIOACTIVE TRACERS, CHEMICAL WARFARE AGENT RESIDUES, BIOLOGICAL MATERIALS AS WELL AS OLD CHEMICAL-FILLED ORDNANCE ITEMS FOUND ON THE DRES EXPERIMENTAL PROVING GROUND.

THIS REPORT OUTLINES THE KEY ELEMENTS OF THE DRES HAZARDOUS WASTE MANAGEMENT PROGRAM AND DESCRIBES PROCEDURES FOR THE PROPER COLLECTION, STORAGE AND DISPOSAL OF SPECIFIC TYPES OF HAZARDOUS WASTE.

14. **KEYWORDS, DESCRIPTORS or IDENTIFIERS** (technically meaningful terms or short phrases that characterize a document and could be helpful in cataloguing the document. They should be selected so that no security classification is required. Identifies, such as equipment model designation, trade name, military project code name, geographic location may also be included. If possible keywords should be selected from a published thesaurus, e.g. Thesaurus of Engineering and Scientific Terms (TEST) and that thesaurus-identified. If it is not possible to select indexing terms which are Unclassified, the classification of each should be indicated as with the title.)

HAZARDOUS MATERIALS
MILITARY CHEMICAL AGENTS
CHEMICAL LABORATORIES
WASTE MINIMIZATION
WASTE MANAGEMENT
WASTE TREATMENT
WASTE DISPOSAL

UNCLASSIFIED

497181

NO. OF COPIES NOMBRE DE COPIES	COPY NO. COPIE N°	INFORMATION SCIENTIST'S INITIALS INITIALES DE L'AGENT D'INFORMATION SCIENTIFIQUE
1	1	
AQUISITION ROUTE FOURNI PAR	► DBES	
DATE	► 17 Apr 96	
DSIS ACCESSION NO. NUMÉRO DSIS	► 96-01723	

DND 1158 (6-87)



**PLEASE RETURN THIS DOCUMENT
TO THE FOLLOWING ADDRESS:**

DIRECTOR
SCIENTIFIC INFORMATION SERVICES
NATIONAL DEFENCE
HEADQUARTERS
OTTAWA, ONT. - CANADA K1A 0K2

**PRIÈRE DE RETOURNER CE DOCUMENT
À L'ADRESSE SUIVANTE:**

DIRECTEUR
SERVICES D'INFORMATION SCIENTIFIQUES
QUARTIER GÉNÉRAL
DE LA DÉFENSE NATIONALE
OTTAWA, ONT. - CANADA K1A 0K2

UNCLASSIFIED