Guidelines to Schools for the Management of Hazardous Materials & Equipment and the Disposal of Hazardous Waste

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Caenwood Centre
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Kingston 4
Jamaica
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1 Introduction

1.1 Overview

The proper storage and use of hazardous materials and equipment in educational institutions, and the safe disposal of hazardous wastes generated in such institutions, must be executed in keeping with the laws and regulations as stipulated by the National Environment Planning Agency (NEPA).

The National Environment and Planning Agency (NEPA), is the lead agency with responsibility for ensuring the safety of the natural environment, and it ensures that environmental safety and protection laws and regulations meet international standards. With regards to the safe management of the storage and use of hazardous materials and equipment, and hazardous waste generated in businesses, schools and other organisations, its national goals are:

- Regulating and protecting human health and the environment from the potential hazards of waste disposal.
- Conserving energy and natural resources.
- Reducing the amount of hazardous wastes generated.
- Ensuring that hazardous wastes are managed in an environmentally-sound manner.

This issue has become a national concern because of the potential danger to human health and the environment. It has been clearly established that safe environmental practices result in the health and wellness of persons who operate in such environments, and that proper disposal of hazardous wastes results in a healthy nation and preserves human lives. As a result, laws and regulations have been put in place to protect human lives and the environment.

NEPA plays a major role in the development and implementation of programmes to enforce these laws and regulations, in order to maintain a safe environment and preserve human health.

The Ministry of Education (MOE), provides policy statements to outline its position on the issues of the safe management of the storage and use of hazardous materials and equipment, and hazardous waste generated in educational institutions.

The MOE also provides publications with guidelines for specific areas of the school environment where hazardous materials, equipment and substances are stored and used and hazardous wastes are generated. These publications give specific procedures that should be followed for implementing and complying with the laws and regulations stipulated by NEPA and other environmental protection agencies to ensure the maintenance of a healthy school and community environment.

This handbook "Guidelines for the Management of Hazardous Materials and Equipment and the Disposal of Hazardous Waste in Educational Institutions" is one of these publications. It covers Science as well as the Technical and Vocational Education areas of:

- Agricultural Science
- Business Education
- Home Economics
- Industrial Education
- Visual Arts.

The purpose of this handbook is to:

- Identify hazardous materials, equipment and substances commonly used in educational institutions.
- Outline safety standards for the use of hazardous materials in educational institutions.
- Outline safety guidelines for the treatment of hazardous waste generated in educational institutions.
- Provide guidelines for the storage, where unavoidable, of hazardous materials and equipment used in educational institutions.
- Provide guidelines for the disposal of hazardous waste materials used or generated in educational institutions.
- Sensitise educators to the laws and regulations, as stipulated by the government of Jamaica, governing the storage, use and disposal of hazardous materials, substances and equipment.
- Provide guidelines for implementing and complying with regulations stipulated by NEPA.

- Provide a policy statement to outline its position on the management of hazardous materials in educational institutions, and the specific procedures that should be followed to ensure the maintenance of a healthy school environment.

Due to the uniqueness of the context in each school environment, this handbook will not identify all hazardous material used, or generated in educational institutions. The users of this handbook may access additional information from NEPA, or the National Solid Waste Management Agency (NSWMA), or any other agency concerned with safety of the environment.

Educators should also analyse and classify substances used in their schools. This will help to:

- Determine their characteristics.
- Identify safe ways of handling or disposing of these substances.
- Educate students about these substances.
- Assist in embarking on projects to inform the school community about managing these materials and substances to make the learning environment safe.

1.2 Hazardous Chemical Wastes

Hazardous waste has properties that makes it dangerous or potentially harmful to human health and the environment. The universal set of hazardous waste is large and diverse. Hazardous wastes can be liquids, solids, contained gases, or sludges. They can be the by-products of manufacturing processes, or simply discarded commercial or household products such as cleaning fluids or pesticides.

There are four main categories of hazardous wastes:

1.2.1 Flammable/ Ignitable

A flammable/ignitable waste is any liquid or non-liquid that meets the point of combustion or chemical change through friction, absorption or compression.

A flammable/ignitable waste has the potential to ignite readily, that is, it is spontaneously combustible and burns in air. The important properties of a flammable/ignitable waste are its flash point and ignition temperature.

The flash point of a material is the temperature at which a liquid (or volatile solid) gives off vapour in quantities significant enough to form an ignitable mixture with air. The ignition temperature is the minimum temperature required to initiate self-sustained combustion independent of a heat source.

A flammable/ignitable waste has a flash point of less than 60 °C (140 °F).

Flammable/ignitable wastes include epoxies, rubber cement solvents, solvent-based paint and ink, isopropyl alcohol and adhering fluids, waste oil and used solvents.

1.2.2 Corrosive

Corrosive wastes can injure body tissue, and dissolve or wear away metal containers such as storage tanks, drums, and barrels. Major classes of corrosive substances are:

- Strong acids (Nitric, hydrochloric and sulphuric acids).
- Strong bases (Sodium hydroxide and potassium hydroxide).
- Oxidising agents (Hydrogen peroxide, chlorine and bromine).
- Dehydrating agents (Sodium hydroxide and calcium oxide).

Corrosive liquids are responsible for the most common types of corrosive external injury. The primary sites of attack by corrosive liquids are the skin and the eyes.

Corrosive solids are the least hazardous of the corrosive substances. The effects of corrosive solids are largely dependent on their solubility.

The most serious hazard associated with corrosives is from material in the gaseous state. In this state, corrosives are readily absorbed into the body, by dissolution in skin moisture and by inhalation.

A waste has the characteristic of corrosivity if it is:

- An aqueous waste with pH 2 or less, **or** pH 12.5 or greater.
- A liquid that corrodes steel at a rate greater than 6.35mm or 0.25 inches per year.

In photography, acid and alkaline chemicals, such as sodium hydroxide and potassium carbonate are used. In print-making, large amounts of acids, such as nitric hydrochloric and phosphoric acids are used. These are corrosive in nature. Battery acid is another example.

1.2.3 Reactive/Oxidising

Reactive waste/Oxidisers include chemicals that can explode, violently polymerise, form explosive peroxides or react violently with water or atmospheric oxygen.

Reactives: Reactives include materials that are flammable solids (pyrophoric), water reactive or form explosive peroxides.

Oxidisers: An oxidising agent is any material that initiates or promotes combustion in other materials, either by causing fire itself or by releasing oxygen or other combustible gases.

Reactive wastes/Oxidisers are unstable under normal conditions. They can cause explosions, toxic fumes, gases, or vapors when heated, compressed or mixed with water. Examples include some kinds of batteries and explosives.

1.2.4 Toxic

Toxic wastes are poisonous and harmful substances or gases. They can injure living tissues even in small amounts.

A waste is considered to be “toxic” if:

- The container that the chemical came in identifies it as a toxic or poisonous material, or
- The chemical is a known or suspected carcinogen or mutagen.

Toxins can be found in art materials such as paints, paint thinners, turpentine, paint removers, lacquers and their thinners, varnishes, inks plastic resins or solvents. Constant exposure to these materials in a poorly ventilated room or laboratory can be harmful.

Toxic wastes are harmful or fatal when ingested or absorbed because they may contain mercury or lead. When toxic wastes are land disposed, contaminated liquid may leak from the waste and pollute ground water.
Toxic materials can enter the body in three ways:

1.2.4.1 Inhalation

This is the major route of entry for airborne chemicals. The chemicals can have a direct effect on the nose, upper respiratory tract and the lungs, or they can enter the blood stream and affect the blood, bone, heart, brain, liver, kidneys or bladder. Graphite, charcoal and chalk pastel can be harmful if the dust is inhaled in excessive quantities.

1.2.4.2 Ingestion

This is not normally a direct route of entry from exposure except by willful or accidental ingestion. Materials can also enter the stomach through indirect means. This can result in exposure to most of the internal organs or even in a local action on the stomach wall.

1.2.4.3 Skin Contact

Some materials are absorbed through the skin and, therefore, when they enter the blood stream they can be transported throughout the body and accumulate in or affect the most sensitive areas of the body. Skin contact can also result in allergic reaction, the removal of protective skin oil, or dermatitis. In some cases, the chemical contact may result in cancerous lesions.

Hazardous wastes are usually regulated or classified according to four hazardous waste lists:

1. F-List – Non-specific source wastes.
2. K List – Source-specific wastes.
3. P List – Discarded commercial chemical products.
4. U List – Discarded commercial chemical products.

1.2.5 F List

This list identifies wastes from common manufacturing and industrial processes, such as solvents used in cleaning and degreasing operations. The process of producing these wastes can occur in different areas, or sectors and as such are classified as wastes from non-specific sources.

1.2.6 K List

This list includes certain wastes, such as sludges and wastewater from specific industries, such as petroleum refining or pesticide manufacturing.

1.2.7 P List and U List

These lists include specific commercial chemical products in an unused form. Some pesticides and pharmaceutical products become hazardous wastes when discarded.

1.3 Management of Hazardous Wastes

The management of hazardous wastes includes the storage, use, transportation and disposal of such wastes according to the laws and regulations stipulated by NEPA. They are as follows:

- Hazardous wastes MUST NOT be put in the garbage or poured down the drain.
- They CANNOT be disposed of in the ground, or in local landfills, or septic tanks and MUST NOT be disposed of by open burning.
- Hazardous wastes must be disposed, recovered, recycled, or reclaimed or disposed through an appropriately licensed agency. The names of such approved firms can be accessed from NEPA, NSWA or the local health authority. Storage will be required where alternative management options are unavailable.

Institutions using, storing or generating hazardous materials, substances or equipment are encouraged to have a hazardous waste determination conducted to ascertain the amount of hazardous waste generated monthly, or stored on site in order to assess status.

The status of an institution provides direction to such agencies in determining guidelines that should govern such institutions in the disposal of wastes; the duration of time that hazardous substances and wastes may be kept in storage, and also the nature of the storage which varies with quantity. The following are the classification used:

- CESQG - Conditionally Exempt Small Quantity Generator of hazardous wastes: 2.2 pounds or less per month, or 2,200 pounds.
- SQGs - Small Quantity Generator: 220 – 2,200 pounds.
- LQGs - Large Quantity Generator: Over 2,200 pounds.

It is most likely that a school facility will be classified as CESQG and would be governed by the following guidelines. The school:

- Must identify all the hazardous wastes generated.
- Must NOT accumulate more than 2,200 pounds of hazardous wastes at any time.
- Must ensure that hazardous waste is delivered to a person or facility that is authorised to manage it.
- Must keep written documentation for three years.

It is important to note that the department or school is responsible for hazardous materials stored, used, or generated, therefore, contracting an illegal or unapproved company to dispose of waste will render the institution liable for any injury to human life or damage to property. The department or school should also keep a record of the companies used and their method of disposing of the waste.

Failure to comply with hazard waste regulations can result in significant fines and penalties.

1.4 Regulatory Framework for the Use, Storage, Transportation and Disposal of Hazardous Materials

There is no legislation specific to hazardous waste. However, there are permitting measures that are undertaken by NEPA for some activities related to hazardous waste.

Guidelines established by NEPA for the use, storage and disposal of hazardous materials and wastes are established under the following Acts, which are based on universal waste rule guidelines and regulations:

- The Natural Resources Conservation Authority Act

- The Wild Life Protection Act
- The Beach Control Act
- The Watersheds Protection Act
- The Town and Country Planning Act
- The Land Development and Utilisation Act
- The Ozone Layer Protection Act.

Agricultural Science

2.1 Background

Many of the chemicals used on farms can be hazardous if there is improper storage, usage or disposal of residues or excesses. Improper handling of hazardous chemicals may result in either acute or chronic illness to personnel.

Acute conditions occur soon after over-exposure to hazardous materials, and include burns, rashes, respiratory distress, convulsions and possibly death. Chronic conditions develop after long-term exposure to hazardous materials and may include cancers, nervous system disorders and damage to other organ systems. Because of the slow action of these substances, warnings are often ignored.

Improper disposal of hazardous agricultural waste may result in far-reaching economic and environmental consequences. These include:

- Contamination of water sources, thus increasing the cost of water systems.
- Poor worker safety.
- Exposure to residents.
- Loss of biodiversity.
- Exposure to children coming in contact with farms.
- Pressure on threatened or endangered species.
- Damage to recreational or fishing resources.

2.2 Hazardous Materials used in Agricultural Waste

The need for increased productivity in agriculture has resulted in the increased use of chemicals, many of which may produce hazardous effects. These chemicals include:

- Fertilisers

- Pesticides (herbicides, insecticides and fungicides)
- Hormones or plant growth regulators
- Veterinary pharmaceuticals
- Cleaning reagents or sterilisers (fumigants).

In order to properly handle hazardous materials, it is important to know the dangers of such materials, for example, whether they are ignitable, corrosive, reactive, or toxic.

The World Health Organisation (WHO), has classified materials based on the severity of the hazard, which it may cause. These are:

- Extremely hazardous
- Highly hazardous
- Moderately hazardous
- Slightly hazardous
- Unlikely to present acute hazard in normal use.

2.2.1 Fertilisers

Most fertiliser mixtures contain nitrogen, phosphorous and potassium. Some fertilisers are manufactured from hazardous waste and may contain heavy metals, which may be from source material or added as trace elements. These include:

- Lead
- Arsenic
- Cadmium
- Cobalt
- Mercury
- Molybdenum

- Nickel
- Selenium
- Zinc.

When hydroponics or greenhouse production is practised, trace elements must be added to plant nutrients to ensure optimum growth and production. Most fertiliser mixtures are usually highly corrosive and if not properly stored will cause significant damage to buildings and equipment.

2.2.2 Pesticides

Agricultural pesticides include powders, liquids, aerosol sprays or any other form of chemical used for the control of agricultural pests.

These may exhibit varying degrees of hazard based on their uses and the way in which they affect people, other living organisms, property or the environment. Some pesticides may be toxic if allowed to make contact with the skin. Others may be hazardous through inhalation or if ingested orally. Many pesticide residues will have an environmental impact.

2.2.3 Veterinary Pharmaceuticals

This group includes antibiotics, vaccines, wormers and other substances used in animal care. Careful use of these substances is required as many disease-causing organisms develop resistance to a particular substance over time. Misuse of pharmaceuticals may result in difficulty in the control of animal or human diseases.

2.3 Storage of Hazardous Materials

Storage of farm chemicals is important for economic and safety reasons. The following guidelines should be followed:

- All containers must be properly labelled with contents and associated hazards.
- It is important to follow the manufacturers' instructions for storage of all agricultural materials.

- Avoid storage of materials near heat or ignition sources.

- Avoid storing incompatible materials together. For example, herbicides, insecticides, etc, should not be stored with animal feeds.

- Chemicals should be stored in well-ventilated areas.

- Fertilisers in plastic bags should be stored in dry areas and should be raised above floor level and kept away from walls. Moisture will cause melting, which will cause corrosion and damage to buildings and equipment.

- Chemicals should not be stored in rooms used as office areas because occupants may be affected by fumes from these chemicals.

2.4 Usage of Hazardous Materials

It is important to ensure that the use of all agricultural chemicals is consistent with the manufacturers' recommendations. These include the purposes for which they are used, time of application, rate of application, withdrawal period before harvest and safety precautions.

Some basic safety measures are:

- Before mixing or applying any chemical, ensure that instructions on the label are read and followed.

- When handling or applying chemicals, ensure that the appropriate personal protective equipment (PPE) is being used. These include plastic or rubber gloves, overalls, rubber boots, goggles, respirators and helmets or hats.

- Where spraying of crops or animals is being done, all associated safety measures must be observed. These include:

    - Mixing chemicals to the correct concentration for the purpose intended.

    - Ensuring that while spraying, the wind is blowing from behind the person spraying.

    - Ensuring that the mixture does not blow in the direction of other persons working in the field.

2.5 Recommended Protocols for Disposal of Hazardous Agricultural Wastes

Some manufacturers of hazardous materials place proper disposal techniques on their labels. These instructions should be followed in disposing of excess material or empty containers:

- Never burn or dump hazardous waste on the ground.
- Do not pour hazardous waste down the sink.
- Avoid burning any container or left-over chemicals.
- Do not mix hazardous wastes to be disposed of as there may be chemical reactions, which could increase hazards.
- Contain liquid waste spills by using absorbent material such as sawdust, paper towels or rags to soak up liquid hazardous materials. The solid material should then be contained in an appropriate container for authorized disposal.
- Non-aerosol containers should be cut open with scissors or wire cutters. The container should then be allowed to air dry, or while wearing gloves, swab the inside before disposal. Allow rags or paper towels to air dry then dispose of them. Aerosol cans should be emptied of their contents and the pressure reduced by turning the can upside-down and depressing the button while pointing the nozzle towards paper towels or an absorbent surface. The can should then be wrapped in several layers of newspaper prior to disposal.
- Pesticides, herbicides, oil paints, paint cleaners and oils should never be flushed down a toilet, or disposed of on the ground, or put in household refuse.

Where disposal of hazardous wastes present a challenge, the preferred solution is to:

- Purchase only the required amount of hazardous material, which can be used before the expiration date of such material.
- Use the hazardous material only for the purpose intended.
- Determine if someone else in the institution or community has a legitimate need for and can use any excess material.

NB. Disposal of all hazardous material must be done in accordance with Operational Health and Safety (OHS), and environmental requirements.

2.6 Classification of Agricultural Chemicals

Pesticide/Material	Uses	Active Ingredient	Formation	Toxicity
METH-O-GAS 100	Fumigant	METHYL DROMIDE	Gas	Class I
CHAMPION 77 WP	Fungicide	COPPER HYDROXIDE	Wettable Powder	Class III
DITHANE M-45	Fungicide	MANCOZEB	Wettable Powder	Class IV
KOCIDE 2000	Fungicide	COPPER HYDROXIDE	Wettable Powder	Class II
PHYTON	Fungicide	COPPER SULPHATE PENTAHYDRATE	Liquid Suspension	Class IV
2, 4-DAMIDE 480 G/L	Herbicide	2, 4-D	Soluble	Class II
FUSILADE 2000 EC	Herbicide	FLUAZIFOP – BUTYL	Emulsifiable Concentrate	Class III
GLYPHOSATE	Herbicide	GLYPHOSATE	Emulsifiable Concentrate	Class III
GROMOXONE SUPER		Paraquart	Emulsifiable Concentrate	Class III
REGLONE	Herbicide	DIQUAT (DIBROMIDE)	Soluble Concentrate	Class III
ACTARA 25 WG	Insecticide	THIAMETHOXAM	Water Dispersible Granules	Class III
ASUNTOL	Insecticide	COUMAPHOS	Wettable Powder	Class II
DANITOL	Insecticide	FENPROPTHORIN	Emulsifiable Concentrate	Class II
DDVP 48 EC	Insecticide	DICHLORVOS	Emulsifiable Concentrate	Class I
DECIS	Insecticide	DELTAMETHRIN	Emulsifiable Concentrate	Class II
DIMETHOATE 40 EC	Insecticide	DIMETHOATE	Emulsifiable Concentrate	Class II

Pesticide/Material	Uses	Active Ingredient	Formation	Toxicity
KARATE ZEON	Insecticide	LAMBDA-CYHALTHRIN	Capsule Suspension	Class II
LANNATE SP	Insecticide	METHOMYL	Water soluble Powder	Class I
MALATHION	Insecticide	MALATHION	Emulsifiable Concentrate	Class III
NEWMECTIN	Insecticide	ABAMECTIN	Emulsifiable Concentrate	Class IV
PEGASUS 500 SC	Insecticide	DIAFENTHIURON	Suspension Concentrate	Class III
SELECRON 500 EC		PROFENOFOS	Emulsifiable Concentrate	Class II
SEVIN 80 S		CARBARYL	Wettable Powder	Class II
TRIATIC		AMITRAZ	Emulsifiable Concentrate	Class II
PLANTGUARD SLUG & SNAIL PELLETS	Molluscicide	METALDEHYDE	Pellets	Class II
FURADAN 10 G	Nematicide	CARBOFURAN	Granule	Class II
MOCAP 15 G	Nematicide	ETHOPROPHOS	Granule	Class II
SINCOCIN	Nematicide	PLANT EXTRACTS	Soluble Concentrate	Class IV
VYDATEL	Nematicide	OXAMYL	Soluble Concentrate	Class I
GLADIATOR BAIT BLOCK OR PELLETS	Rodenticide	BROMEHALIN	Bait or Block	Class III

3 Business Education

3.1 Background

Technology is changing rapidly, causing equipment, such as computers, printers, audio-visual devices, fax machines and other devices that use circuit boards, to become obsolete very quickly.

Electronic equipment used in the Business Education Department, such as computers [monitors, central processing units (CPUs), keyboards], computer peripherals, scanners, printers, telephones, wireless devices, fax and copying machines are made up of different heavy metals and plastics. Many of the components of these electronic equipment contain hazardous or toxic constituents. These include:

- Lead
- Mercury
- Cadmium
- Chromium
- Silver
- Antimony
- Zinc
- Tin
- Copper
- Iron
- Aluminum
- Nickel
- Cobalt
- Lithium

Some of these constituents are found on the circuit boards or in the glass component of electronic equipment, which also often contains batteries and sometimes mercury switches, sensors and relays. The primary materials of concern are lead, cadmium, chromium and mercury as these toxic materials can cause kidney, cardiovascular and central nervous system damage.

3.2 Examples of Hazardous Electronic Waste

The following components of electronic waste may be classified as hazardous waste:

(a) **Traditional computer monitors and television sets** contain cathode ray tubes (CRTs), which always exceed the 5.0 mg/L limit for lead; hence most computers and television sets will require careful disposal. Some monitors may also contain barium, mercury and cadmium.

(b) **Circuit boards/printed wiring boards** may contain various metals including lead, silver and gold.

(c) **Batteries, switches, sensors and relays** may contain mercury, cadmium and palladium, rhodium and platinum, which are likely to be hazardous waste if not managed properly.

(d) **Central Processing Units (CPUs),** also contain a battery with nickel-cadmium, lithium or sealed lead acid. These constituents are not a concern while the equipment is in use, but if disposed of in a landfill, harmful chemicals could leak out and contaminate groundwater and soil.

3.3 Storage of Electronic Waste

(a) Label electronic waste properly indicating the date on which the equipment is being put in storage and keep a log or inventory. **Store for no longer than one year.**

(b) Electronic waste should be stored and handled to minimise breakage (during normal use). If electronic devices are accidentally broken, causing spills, such as mercury, the following steps should be adhered to:

- Have persons evacuate the area, making sure that shoes, clothing and other articles have not been soiled with the mercury.
- Lower the temperature to lessen the mercury vapours that will be released in the air.
- Turn off air conditioning systems that could circulate air from the spill area to other parts of the building.
- Ventilate the area where the breakage occurred.
- Inspect the spill spot and clean up visible spills.

- Remove and dispose of contaminated articles, for example, carpeting.

(c) Place materials in a closed container to avoid generating dust.

3.4 Disposal Options for Electronic Waste

Before selecting a method of disposal, all-important data should be permanently removed from the equipment or storage device.

3.4.1 Recycling

Non-working or older electronic equipment may have valuable parts that could be used to repair other systems.

Workable parts can be re-used, refurbished, disassembled or disposed of.

3.4.2 Disposal

When electronic equipment is no longer working and is to be replaced with more modern or new equipment, these should be stored in a safe place for a period of six months to one year, or until a large amount has been accumulated.

Equipment to be disposed of should be stored in a secure room rather than behind a door.

The institution should contract technical services to disassemble machines, store hazardous components and send non-hazardous for regular disposal with the NSWA or a private disposal company.

The disposal of electronic waste attracts a cost for the service.

Computer media, for example, floppy disks, tape media, CDs and DVDs rendered unreadable or unusable should be disposed of by cutting of the floppy disks and tapes, or physically breaking the CD and DVDs.

Discarded computer media should then be placed in appropriate disposable bags and labelled. These should be disposed of by a solid waste company.

4 Home Economics

4.1 Hazardous Substances used in Home Economics Departments

The following is a partial list of hazardous substances used in Home Economics Departments:

- Acids
- Adhesives and glues
- Ammonia
- Acetones and nail polish
- Textile, art and hobby paints
- Batteries, household, dry cell or lead acid
- Bleach
- Floor wax and cleaners
- Fertilisers (used in potting plants)
- Lighter fluids
- Chlorine
- Disinfectants
- Bathroom chemicals:
    - Toilet bowl cleaners
    - Bath tub and tile cleaners
- Mirror cleaners
- Wall paints
- Floor cleaners
- Chemicals used for testing fabrics (formic acid)
- Fabric dyes
- Furniture polish and wax
- Fluorescent lightbulbs
- Gas cylinders
- Insecticide and insect repellent
- Kerosene and fuel oils
- Lubricating oils (sewing machine oils)
- Mothballs

- Organic solvents (used for stain removal)
- Oven cleaners
- Stain removers
- Paint or water-based solvents
- Paint strippers (alkaline, solvents or water based)
- Pet sprays
- Rat and mouse poisons
- Septic tank cleaners
- Shoe polish
- Spot removers
- Salts of lemon
- Laundry products
- Accumulated fats and oils
- Dry cleaning chemicals
- Lye solutions
- Iodine
- Varnishes
- Wood preservatives wood stain.

4.2 Organisation of Home Economics Departments

The Home Economics Department consists of laboratories for:

- Food Preparation
- Clothing and Textiles
- Home Economics Management

4.2.1 Operations of Food Preparation Laboratories

In these laboratories students are engaged in food preparation under the guidance of their teachers.

Hazardous materials usually used in Food Preparation Laboratories are similar to those used in the food preparation areas of the home chiefly for handling and preparing foods under hygienic conditions, cleaning exterminating, such as:

- Bleaches used for the general cleaning of surfaces.

- Acids and other substances used for food testing.
- Adhesives and glues used for food labelling.
- Aerosol sprays used for insect repellant, and greasing of pots and pans.
- Poisons for rats and pellets from extermination exercise.
- Disinfectants, strippers, polishes and other substances used for cleaning.
- Oven cleaners.

4.2.2 Operations of Clothing and Textiles Laboratories

In the Clothing and Textiles Laboratories students are exposed to the use of hazardous materials such as:

- Acids and other chemicals used for testing fabric sources and composition.
- Broken needles and pins that result from the sewing of articles and use of sewing machines.
- Fabric dyes used for dying textile products.
- Textile arts and hobby paints used for applying designs to textile fabrics.
- Mothballs used in the storage of articles.
- Lubricating oils used for maintaining equipment such as sewing machines.
- Spot removers and dry cleaning fluids used for clothing maintenance.
- Cleaning materials for maintaining floors and windows of laboratories.

4.2.3 Operations of Home Economics Management Laboratories

Major concepts taught in Home Economics Management are directly related to concepts done in Clothing and Textiles and Food and Nutrition, such as:

- Principles of meal preparation.

- Maintenance of areas of the home, such as bedrooms, kitchen, bathrooms.
- Cleaning of surfaces such as paint work, floors, mirrors, furniture, maintenance of household articles, such as:
    - Furniture (re-staining and polishing).
    - Clothing (laundering, stain removal).
    - Household linens (curtains, drapes, towels, tablecloths, napkins).

In the Home Economics Laboratories students are exposed to all the hazardous materials that are used in Clothing and Textiles and Food and Nutrition.

4.3 Recommended Standards

Most schools contract the services of exterminators during the summer holidays to rid areas of pests and rodents. Care should be taken to access from these persons the names, classifications and nature of the chemicals used; their methods of disposing of empty containers, and the amount of residual material that may be left after extermination. Extra care should be taken to do thorough cleaning after an extermination exercise to ensure that any residual pellets are thoroughly cleaned away.

Unfortunately, some Home Economics Departments lack a good supply of clean, fresh, and safe water for regular class activities. Where this is so, teachers are asked to desist from allowing students to collect water, especially from school farms where the possibility of contamination from insecticides and pesticides exists.

Jamaica has signed the Montreal Protocol, which is an agreement between countries to protect the ozone layer. Under the Ozone Protection Act it is illegal to vent or discharge ozone-depleting substances (ODSs) in the atmosphere to dispose of them.

Schools should not purchase or accept gifts of refrigerators or freezers that contain chlorofluorocarbons (CFCs). Older equipment purchased before this Act came into existence would probably contain CFCs. Any repairs done to this equipment should be done by certified persons from the local refrigeration industry who would have known about the national standards for dealing with ODSs and CFCs. Old refrigerators and freezers should not be thrown about or handled in such a way as to damage cylinders containing gases, as these may contain CFCs.

Home Economics Departments should conduct and document an Existence, Value, Ownership (EVO) Audit of all equipment and appliances that are no longer functional. The EVO Audit is as follows:

E: Place, registration number and year of manufacture.

V: Value on equipment.

O: Ownership, whether government, donation from private enterprise, past students' association, or parent teachers' association. A copy of this document should be sent to the Chief Procurement Officer of the organisation through the Regional body responsible for the school. Personnel from the Central Procurement Section of organisation can remove items from a school's inventory and then make arrangements for a certified company to dispose of these item(s).

The following guidelines should also be followed:

- Teachers MUST NOT use containers in which hazardous materials, such as cleaning materials or agricultural chemicals were purchased or stored, to transport water.

- All school development plans should contain targets for hazardous waste management in the school.

- All schools should organise a team for monitoring the management of hazardous materials and wastes. This team should monitor the storage, use and disposal of such materials. Teachers of technical and vocational subjects and science should be members of this team.

- Check all labels before purchasing cleaning products to ensure that chemicals used are environmentally friendly.

- Products used should be free of CFCs.

- All fire extinguishers purchased for Home Economics Departments should be Halon-free.

- The use of all chemical-cleaning agents should be according to the manufacturer's guidelines for safety.

- Where the purchasing of chemicals, such as cleaning agents is done in bulk for cost effectiveness, every effort should be made to purchase them in individual packages or containers instead of in large drum jugs or canisters. Where this is unavoidable materials should be carefully packaged into smaller units and placed into containers with appropriate caps, carefully labelled, and safely stored. Care should also be taken when choosing containers to avoid corrosion of such containers or caps of these containers.

- All chemicals used in this department should be carefully analysed to determine hazardous properties.

- Teachers should use the opportunity to teach and rehearse each time, the importance of reading labels and carefully following safety guidelines for use before chemicals are issued.

- Teachers should guide students in the use of chemical cleaning agents to ensure safety.

- Students should know that as a rule chemical cleaning agents should never be mixed since the reaction of chemicals may release dangerous fumes or cause fires.

- Every Home Economics Department should keep a record of hazardous materials used and hazardous waste generated.

- The quantity of hazardous waste listed should be measured and documented

- A record of the period of time hazardous materials are kept in the facility before recycling or disposal should also be documented.

- Hazardous waste materials should be packaged and transported away from the facility or placed directly in a regulated treatment or disposal unit at the facility.

5 Industrial Education

5.1 Categories and Examples

Some materials, chemicals, equipment or processes used in Industrial Education will generate hazardous waste, represented in one of the four categories.

Ignitable	Corrosive	Reactive	Toxic
Compressed Gases: • Acetylene, oxygen and others • Epoxies • Aerosol spray cans • Rubber Cement **Solvents:** • Thinner, petroleum based oils • Oil paints, varnishes • Adhesive, glue • Degreasers	**Acids and Alkalis**: • Flux used in soldering and welding rods • Glass etching liquid • Pickling baths for metals • Hydrochloric acid used in the production of aluminium • Sulphuric acid used in car batteries	**Chromic Acid:** • Organic Peroxides (catalyst in many polyester resins) • Cyanides (found in electroplating and metalwork) • Welding • Arc-welding produces ultraviolet / infra-red radiation	**Paints contains:** • Lead • Cadmium • Arsenic • Chromium • Mercury • Manganese **Welding:** • Gas bi-produce (nitrogen oxide, carbon monoxide, carbon dioxide, hydrogen chloride) • Asbestos

5.2 Handling of Hazardous Materials

When handling hazardous materials in Industrial Education the following precautions should be observed:

- Use proper ventilation.
- Avoid breathing in vapours by using a respirator.

- Wear impermeable gloves and eye protection to avoid contact with the skin. If skin comes in contact with hazardous materials wash area in large amounts of water.

- When diluting acids/alkalis always add product to water slowly.

- Prevent static electricity discharges when using solvents as they could ignite.

- Wear welding face shield, leather work gloves and protective equipment when using an arc welder.

- Use a paint spray booth when coating surfaces by spray.

5.3 Storage of Hazardous Materials

Observe the following guidelines:

- Determine storage requirements.

- Do not use the same cabinet or cupboard to store substances that can react with each other. If bottles are broken and the substances mix, there could be a dangerous reaction, including a fire. For example, do not store concentrated acids next to concentrated alkalis, or an oxidiser next to a flammable liquid such as lacquer thinner.

5.4 Management of Hazardous Waste

There are various management options available. Some are:

- Substitute less hazardous chemicals where possible.

- Minimise the volume of waste generated.

- Use existing recycling programmes.

- Set up recycling programmes in school and/or community.

- Contract the services of authorised disposal companies to remove waste generated.

6 Visual Arts

6.1 Background

The Visual Arts Department can generate substantial amount of hazardous waste in the many processes undertaken by the department. Art educators are responsible for the art materials they order and the safe use of these materials. All personnel working with art materials must be aware of the hazards associated with these supplies and should also be cognisant of how and where to dispose of the hazardous waste generated by the use of these materials.

Educators should purchase safe art materials that are available for use in place of materials identified as being toxic. Only art materials manufactured and labelled for use in the production of art projects and activities should be used in the execution of art projects within the classroom.

6.2 Examples of Hazardous Materials

Materials and Processes	Hazardous Ingredient
SOLVENTS	
Painting, Drawing, Printing	
Pigments	Lead
Paint Thinner	Chromate
Turpentine	Cadmium
Paint Removers	Mercury
	Arsenic paints & their compound
Spray Paints	
Spray Dyes	
Spray Adhesive	
Drawing Fixatives	Toxic Fumes
Lacquers	
Lacquer Thinner	
Varnishes	
Inks	
Plastic Resins	
Cleaning Fluids	Toluene, Xylene
Adhering Fluids	Acetates, Ketones, Alcohols

Materials and Processes	Hazardous Ingredient
ACIDS AND ALKALIS **Sculpture, Photography, Print Making, Ceramics** Casting Welding Developing Engraving Etching Glazing Jewelry Cleaning	Sodium Sulfite Potassium Bromide Acetic Acid Potassium Chrome Alum Chrome Alum Chlorine Gas Toxic Fumes Nitric Acid Hydrochloric Acid Phosphoric Acid Chromium Selenium Manganese

6.3 Handling of Hazardous Materials

- Wear appropriate protective gear when working in the Visual Arts Department and when handling hazardous tools, equipment and materials. These include gloves, safety glasses, ear plugs, dust masks, smocks and closed shoes (no slippers).
- Ensure there is proper ventilation when using hazardous materials.
- Substitution of nontoxic for hazardous materials should be made a priority where feasible.
- Wash hands immediately after completion of any procedure involving toxic chemicals.
- Remove from storage only the amount of hazardous material needed for a particular task or experiment.
- Open flames or hot plates should not be used to directly heat flammable liquids. Use a double boiler.
- Handle flammable materials in an area free from ignition sources.

- Never put bare hands in hazardous baths, use tongs instead.
- If hazardous solutions splash on your skin or in your eyes, immediately flush with water.
- Solvents become highly toxic through repeated skin contact. Do not wash your hands with solvents.
- Wipe up all spills and splashes promptly.
- Use aerosol spray products in properly ventilated areas.

6.4 Storage of Hazardous Materials

- Store materials safely by using clearly labelled unbreakable containers and always cover them when not in use to deter their evaporation into the environment.
- To avoid accidental ingestion, do not store hazardous materials in food containers.
- Food items should not be stored in cupboards that contain paints and/or solvents because of a high risk of contamination**.**
- Store hazardous materials in a cool, dry, well-ventilated area, out of direct sunlight.
- Protect such materials from extreme temperature and rapid temperature changes.
- Store highly toxic materials in unbreakable secondary containers and place in ventilated storage with appropriate warning.

6.5 Disposal of Hazardous Waste

- Dispose of hazardous waste in a responsible manner and always remember: NEVER pour liquids such as dyes, wax, lacquer thinner, turpentine, clay, plaster or concrete down sinks. Always place liquids in designated containers that are provided by the institutions.
- Keep special containers for the disposal of hazardous waste.

- Dispose of solvent-soaked rags in self-closing waste disposal cans that are emptied each day.

- Do not throw partially full cans in incinerators. There have been explosions due to the puncturing of spray-cans in garbage trucks and incinerators.

- Dispose of all hazardous materials according to the guidelines stipulated on the labels.

- Do not mix hazardous waste of different types.

- Try to minimise the volume of hazardous waste by substitution of less hazardous materials and setting up recycling programmes.

- Be aware of the hazardous waste collection programmes available in your area and use their services.

- Contract the services of authorised disposal companies to remove waste generated.

7 Science

7.1 Background

Users of science laboratories will encounter the four categories of hazardous chemicals (flammable/ignitable, corrosive, reactive/oxidiser, and toxic) and should, therefore, know how to treat with them. Outlined below are the procedures for storage and handling of each category of hazardous chemicals:

7.2 Handling of Flammables/Ignitables

- Use gloves and safety goggles when handling flammable liquids or vapours.
- Use a fume hood/cupboard when there is a possibility of dangerous vapours.
- Do not use water to clean up flammable liquid spills.
- Open flames or hot plates should not be used to directly heat flammable liquids. Use a water bath.
- Remove from storage only the amount of chemical needed for a particular task or experiment.
- Handle flammable chemicals in areas free from ignition sources.
- Flammable and combustible liquids must be isolated from oxidizers.
- Spontaneously flammable materials must be handled under an inert liquid such as mineral oil.

7.3 Storage of Flammables/Ignitables

- Storage of flammable materials should be kept to a minimum.

- Flammable materials should never be stored near acids.
- Storage areas should be cool enough to prevent ignition in the event that vapours mix with air.
- When possible, store flammable liquids in their original containers.
- Store flammable solids in the required oil.
- Storage areas should have spill clean up materials and a fire extinguisher nearby.

7.4 Handling of Corrosives

- Corrosive materials should be handled in a fume cupboard/hood to protect from possible exposure of dangerous or noxious fumes.
- Wear adequate protective gear. If splashing is a definite hazard, space-proof eye protection must be worn.
- Corrosive materials should be transported in unbreakable containers. Do not carry corrosives by the ring/neck on the bottle. The ring/neck is only for pouring purposes.
- When diluting corrosive reagents, use great care and add reagents slowly. Always add acid to water. Never add water to acid. Allow acid to run down the side of the container and mix by gentle rotation.
- Never pipette corrosive liquids by mouth. Use a pipetting bulb or other mechanical pipetting device.

7.5 Storage of Corrosives

- Segregate acids from bases and corrosive materials from both organic and flammable materials.
- Store corrosive materials near the floor to minimize the danger of falling from shelves.
- Store in cool, dry, well-ventilated areas, away from sunlight.

7.6 Handling of Reactives/Oxidizers

- All reactive materials must be clearly labelled with the correct chemical name. Chemical formulae and abbreviations are not acceptable.
- Date all containers upon receipt as well as when opened.
- Never return excess chemicals to the original container. Small amounts of impurities may be introduced into the container, which may cause a fire or explosion.
- Many reactive materials will liberate hydrogen when they react with water or acids. The use of a fume cupboard is recommended to prevent the build up of combustible gases.
- Before opening glass bottles, look for the presence of solids (crystals) or viscous liquid at the bottom of the bottle. If either is present do not open.

7.7 Storage of Reactives/Oxidisers

- Store in a cool, dry, well-ventilated area, out of direct sunlight. Protect from extreme temperatures and rapid temperature changes.
- Store in amber glass, preferably unbreakable. Containers should be tightly sealed.
- Do NOT use corks or rubber stoppers to cap containers.
- Store pyrophorics in an isolated part of the lab and in a clearly marked cabinet.
- Store water reactive chemicals in an isolated part of the lab. A cabinet far removed from any water sources is an appropriate location. Clearly label the cabinet “Water-Reactive Chemicals”.
- Discard opened containers of peroxidisable compounds after one month.

7.8 Handling of Toxins

The concept of toxicity is unique because it can be applicable to all chemical substances used in the laboratory. The important point to keep in mind is that over-exposure to a material can cause effects which range from headache or nausea to more severe disabilities.

- Wash hands immediately after completion of any procedure involving toxic chemicals.
- Mechanical pipetting aids are to be used for all pipetting procedures.
- Gloves should be worn when handling highly toxic chemicals.
- Use fume cupboard/hood to reduce exposure to an absolute minimum.

7.9 Storing of Toxins

- Store and label toxic chemicals to ensure users are alerted to the potential hazard.
- Store in non-breakable, tightly sealed containers.
- Store highly toxic chemicals in unbreakable secondary containers and place in ventilated storage with appropriate warnings.

7.10 Disposal of Hazardous Chemical Waste

All laboratory work with chemicals eventually produces chemical waste. Everyone associated with the science laboratory shares the responsibility to minimise the amount of waste produced and should dispose of chemical waste in a manner that has the least impact on the environment. Teachers should be aware of the potential hazards of the materials used in the lab and the appropriate method of disposal. Hazardous waste should not be disposed of in the trash can or down the drain.

All schools should, therefore, establish a management policy and abide by the following guidelines:

- Become familiar with the materials that are considered hazardous.

- Designate an isolated area in the lab for the storage of chemical waste.
- Use containers that are appropriate for the waste. DO NOT put liquid waste in plastic containers, and DO NOT put acid waste in metal containers.
- NEVER mix waste.
- Always keep containers closed.
- Store waste with secondary containment. In the event a container is accidentally broken the secondary container prevents reactions from starting and contains the spill.
- DO NOT completely fill waste bottles, leave several inches of space at the top of each waste container.
- Ensure that all containers used for chemical waste are labelled '**Waste**' or **'Hazardous Waste'** and carry the name of the chemical. Abbreviations should not be used.
- Ensure that containers holding hazardous waste are **ALWAYS** kept closed during storage, except when it is necessary to add or remove waste.
- Separate and protect ignitable waste from ignition sources.
- Dispose of all chemicals according to the guidelines stipulated on the labels.
- Seek advice from the relevant environmental agency whenever there is doubt about procedures on how to handle and dispose of any chemical product.

As a general rule:

- When ordering chemicals order minimum quantities that are consistent with the rate of use.
- Maintain a running inventory of chemicals present in the lab. An inventory will prevent over-ordering of chemicals.
- Order reagents, if possible, in polyethylene bottles or plastic coated glass bottles to minimise breakage, corrosion and rust.

- Keep a bag of sawdust near the storage area to soak up any spilled chemicals from broken or leaking containers.

- Keep a broom and dustpan handy for chemical clean-ups and DO NOT use them for any other purpose.

7.11 Supervision of students in practical areas

Adequate supervision must be provided by staff, for students engaged in practical activities, particularly those involving machinery, equipment and chemicals.

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Appendix A Glossary

Acid:	Traditionally considered as any chemical compound.
Corrosive:	A substance that will destroy or irreversibly damage a substance, including living tissue, by chemical action.
Electronic Waste:	Any electronic equipment or peripheral that has become obsolete, and its inherent substances or compounds have the capability of adversely affecting the health and safety of humans.
Hazardous Substances:	Those substances exhibiting one or more of four characteristics.
Ignitable:	Capable of being set afire, burning, or causing a fire.
Policies and Procedures:	There are policies and procedures guided by the laws governing use of chemical substances and protection of the environment. These may be obtained at the documentation Centre of NEPA Jamaica.
Reactive:	Materials that chemically react violently, to form explosive mixtures or produce toxic gases or vapour with water.
Recycle:	Identifies discarded materials, which can be reused or investigates substitute materials which can be reused.
Recycling:	Recovery and reuse of materials from consumed products.
Solvent:	A liquid used to dissolve a solid (such as a paint resin) so that it is brushable; usually volatile; evaporates from the paint film after application; a **thinner.**
Toxicity:	A measure of the degree to which something is toxic or poisonous.