



UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvenoot • your knowledge partner

HAZARDOUS WASTE MANAGEMENT



OPERATIONAL MANUAL
2010

PROPERTY SERVICES

CONTACT PERSON: MEG PITTAWAY
E-MAIL: meg2@sun.ac.za



INDEX:

CHAPTER ONE:	INTRODUCTION AND GENERAL INFORMATION
CHAPTER TWO:	WASTE MINIMISATION
CHAPTER THREE:	RECORD KEEPING
CHAPTER FOUR:	BIOLOGICAL AND MEDICAL WASTE MANAGEMENT CONTAINERS AND STORAGE LABELING COLLECTION PROCEDURES
CHAPTER FIVE:	CHEMICAL WASTE COLLECTION CONTAINERS AND STORAGE LABELING COLLECTION PROCEDURES SPILL PREVENTION AND CLEAN-UP
CHAPTER SIX:	RADIO ACTIVE WASTE COLLECTION
CHAPTER SEVEN:	ASBESTOS WASTE COLLECTION
CHAPTER EIGHT:	E-WASTE COLLECTION
CHAPTER NINE:	MERCURY (BATTERIES AND FLOURESCENT BULBS)
APPENDIX A:	LIST OF INCOMPATIBLE CHEMICALS
APPENDIX B:	LIST OF POTENTIALLY EXPLOSIVE COMPOUNDS
ANNEXURE 1:	LIST OF APPLICABLE LEGISLATION AND REGULATIONS GOVERNING HAZARDOUS WASTE REMOVAL
ANNEXURE 2:	
ANNEXURE 2:	WASTE COLLECTION FORM
ANNEXURE 3:	COLLECTION SHEET

CHAPTER ONE: INTRODUCTION AND GENERAL INFORMATION

Our vision at Facilities Management on the Stellenbosch University campus is to ensure a functional and safe infrastructure and facilities service that will have a significant contribution to a positive student and workplace experience.

Stellenbosch University recognizes its responsibilities to reduce and minimize waste and impacts on resources and the environment through following the correct procedures and practices.

Various legislative changes have taken place since 2000 due to global agreement on the impacts of waste on human and environmental health. Parliament adopted the “white paper on Integrated Pollution and Waste management for South Africa” in 2000 as the national policy on pollution and waste management. DEAT is currently introducing draft legislation related to holistic, integrated waste management. These statutory reforms and a declaration at Polokwane in 2000, adopted by DEAT with the targets that require the country to conform to global practice, are aimed at minimizing environmental impacts and waste landfill to achieve a long term “zero-waste” goal.

The overall aim of SU’s waste management strategy is in line with that of National Waste Management Strategy, *inter alia*:

*To reduce generation of waste and the environmental impacts of all forms of waste, so that the socio-economic development of South Africa, the health of the people and the quality of the environment resources are no longer affected by the effects of waste.
(NWMSI Report, 2004, p.1)*

Waste must be managed through various processes that will ensure a safe, healthy and a sustainable environment to ensure the rights of individuals are protected as enshrined in S.24 of the Constitution. The right requires that all stakeholders must accept co-responsibility for minimizing waste impacts optimally, to ensure environmental sustainability.

Hazardous Waste is waste that has the potential, even in low concentrations, to have a significant adverse effect on public health and the environment because of its inherent toxicological, chemical and physical characteristics.

Hazardous waste requires stringent control and management, to prevent harm or damage and hence liabilities. It may only be disposed of on a hazardous waste landfill.

Since the Precautionary Principle is applied, a waste must always be regarded as hazardous where there is any doubt about the potential danger of the waste stream to man or the environment.

A hazardous waste is defined as “An inorganic or organic element or compound that, because of its toxicological, physical, chemical or persistency properties”, may exercise detrimental acute or chronic impacts on human health and the environment. It can be generated from a wide range of commercial, industrial, agricultural and domestic activities and may take the form of liquid, sludge or solid. These characteristics contribute not only to degree of hazard, but are also of great importance in the ultimate choice of a safe and environmentally acceptable method of disposal.”

Further to this, a hazardous waste can be defined as a waste that directly or indirectly represents a threat to human health or the environment by introducing one or more of the following risks:

- Explosion or fire
- Infections, pathogens, parasites, or their vectors
- Chemical instability, reactions or corrosion
- Acute or chronic toxicity
- Cancer, mutations or birth defects
- Toxicity, or damage to the ecosystems or natural resources
- Accumulation in biological food chains, persistence in the environment, or multiple effects to the extent that it requires special attention and cannot be released into the environment or be added to sewage or be stored in a situation which is either open to air or from which aqueous leachate could emanate.

To the extent that it requires special attention and cannot be released into the environment or be added to the sewage or be stored in a situation which is either open to the air or from which aqueous leachate could emanate.

Currently we have identified the following general hazardous waste streams that are been generated at Stellenbosch University:

- Biological waste
- Medical waste
- Chemical waste
- Radioactive waste
- Asbestos waste
- Mercury waste (batteries and fluorescent bulbs)

Property Services, through its Integrated Waste Management program, provides comprehensive waste services to Stellenbosch University. These services include hazardous waste management, waste stream identification, collection, and disposal. Property Services coordinates with off-site waste management contractors for pick-up and disposal of hazardous waste.

All generators of hazardous waste need to have a clear understanding of the legislation and regulations that govern hazardous waste, the potential penalties and all environment and safety risks.

Property Services is currently managing the removal of the waste but the responsibility of the waste remains with the primary generators. This responsibility lays with the department head.

The responsibility of this waste starts with the correct labeling and storage of chemicals to the final accumulation of waste for removal. This needs to be managed within the regulations and codes of practice as stipulated in various legislature which governs these processes. Anybody not adhering to the standard practices as set out below will not have their waste collected. This puts the University at a huge risk. It is essential that these practices are understood at all levels of operation and not left to the lab assistants.

Training of staff in correct procedures will be done by selected consultants in consultation with Property Services and Protection Services.

To be sure that any waste generated meets all applicable university and government legislation, please contact Property Services before work with any hazardous materials begins.

Direct your questions and concerns to Property Services
Tel: 021 808 3776, Fax: 021 808 4669, or E-mail: meg2@sun.ac.za.

CHAPTER TWO: WASTE MINIMISATION

SU need to minimize and manage waste minimization in a sustainable, effective, equitable and efficient manner that will minimize environmental and economic impacts as far as possible.

All generators of hazardous waste are bound by the practices as listed below as to facilitate and encourage effective waste minimization as per the NWMS Waste Management hierarchy to:

- Encourage waste avoidance that will reduce waste generation at source
- Re-use waste in its original form as far as possible. Investigate the possibility of suppliers taking back excess chemicals for re-use. In 2001 some 28 countries had "take-back" mandates for packaging, another 16 had battery recovery laws, and 12 planned to implement electronics recycling laws (Business for Social Responsibility, 2001). The extension of producer responsibility to end-of-life products has been enacted or is under serious consideration in the European Union, Japan, Taiwan, Korea, Brazil, Peru, and Canada. The range of products and waste streams targeted under these emerging policies includes packaging, paper goods, consumer electronics, office machinery, cars, tyres, furniture, electrical appliances, buildings and construction materials, batteries, and household hazardous waste.
- Promote the separation of waste into different streams at source prior to collection for recovery and recycling purposes.
- Implement waste diversion away from landfill by processing or treatment of hazardous waste in an economical and environmentally sustainable way that may exist for the neutralization of various chemicals that renders them environmentally safe. E.g. the neutralization of ethidium bromide using a charcoal filter.

SU is currently investigating several initiatives for the minimization of hazardous waste by looking at a central cyber store to processes that may render waste environmentally safe. This would also save money by reducing waste treatment and disposal costs and subsequently reduce raw material purchases.

Experience from other international universities has shown that there are two essential components for any successful waste minimization programme:

- The technologies used must be "elegant in their simplicity".
- The production personnel (laboratory personnel, office workers and general maintenance personnel) must be strongly motivated to implement and maintain the necessary changes.

Any ideas or suggestions are welcome; please e-mail Meg Pittaway at meg2@sun.ac.za.

CHAPTER THREE: RECORD KEEPING

Stellenbosch University uses outside contractors to collect transport and dispose of all hazardous waste. SU remains responsible for ensuring that the contractor disposes of the waste correctly (cradle to grave) but we rely on the contractor to use the correct disposal methods and that requires that we receive the correct documentation from the contractor as proof.

Each department needs to have a departmental person who co-ordinates the removal of the waste and the keeping of all necessary records. (Annexure 2: List of current responsible people)

RESPONSIBLE	ACTION
GENERATOR OF WASTE	Member of staff appointed as person responsible for controlling waste collection, handling and disposal for a specific department or section. Please inform Property Services of the particulars of this person for communication purposes.
	Full inventory of all chemicals that are ordered must be kept, what is used in the environment and stored and eventually what is removed. This must also include the expiry date of all chemicals and hazardous compounds.
	Labeling of all waste containers correctly Coding system that describes the service. Quantity and costs of waste removal.
	Storage of all waste containers correctly.
	Submit waste collection sheet to Property Services Complete the chemical/ biological waste pick-up request form in full. Send the fully completed form to Property Services at fax: 021 808 4669, E-mail: meg2@sun.ac.za.
PROPERTY SERVICES	Compile comprehensive collection sheet for all generators.
	Generate a task and order number.
	Submit collection sheet and order number to contractor.
CONTRACTOR	The contractors will then collect the waste on a specified day and replace the containers with empty containers.
	Generate a waste manifest sheet giving details of

	what was collected and what was delivered to the generator.
	To be signed by responsible person from generator to confirm.
	Waste manifest sheet is stamped at disposal site as proof of safe disposal and safe disposal certificate issued.
	All safe disposal certificates with the invoices are submitted to Property Services for payment.
PROPERTY SERVICES	All documents are reconciled.
	Property Services to keep a full copy of all documents.

The budget for waste management is administered by Property Services. Costs are allocated to each environment using building codes and room numbers.

Any deviations from the normal waste streams for the forthcoming year need to be communicated to Property Services by the end of June, in preparation for the following year's budget. For example, if you know of research that will generate large quantities of waste, Property Services needs to be notified so that it can be budgeted for.

An annual internal safety audit, which is coordinated by Protection Services, will focus on processes and physical work place safety aspects. All environments to do ongoing risk audits which include identifying potential hazardous waste streams, the risk in respect of the danger of storing such chemicals, and identification of suitable storage areas until contractors remove waste.

All record keeping must be audited and generators that have waste removed must keep records of collection notices and proof of collection.

Property Services will do random checks to ensure that waste is being stored correctly and to verify that each generator is maintaining a correct set or records.

CHAPTER FOUR: BIOLOGICAL AND MEDICAL WASTE MANAGEMENT

The purpose of this section is to provide information, requirements, guidelines and procedures for the handling and disposal of hazardous biological and medical waste for all departments and units on the Stellenbosch University campus.

WHAT IS BIO-HAZARDOUS WASTE?


“BIO-HAZARDOUS WASTE” means any solid or liquid biological waste that is hazardous because of its physical and/or biological nature. All waste that contain infectious material, or which, because of its biological nature may be harmful to humans, animals, plants or the environment is bio-hazardous waste.

- This includes:
- waste from infectious animals;
 - bulk human blood
 - blood products;
 - microbiological waste;
 - pathological waste;
 - sharps;
 - hazardous products of recombinant DNA bio-technology and genetic manipulation.

CONTAINERS AND STORAGE FOR BIO-HAZARDOUS WASTE

	<p>SHARPS</p> <p>4 LITRE SHARPS 5 LITRE SHARPS 7,6 LITRE SHARPS</p>
	<p>SHARPS</p> <p>20 LITRE LOCK LID ROUND BUCKET</p>
	<p>NON SHARPS WASTE</p> <p>70 LITRE RE-USABLE BIN WITH PRINTED LINER</p>

 <p>5. & 6.</p>	<p>NON SHARPS WASTE</p> <p>PRINTED MEDICAL WASTE LINER</p> <p>50 LITRE – 100 MICRON 140 LITRE – 100 MICRON</p>
	<p>ROTO MOULDED RE-USABLE ROUND BINS</p> <p>50 LITRE (TAKE 50 LITRE LINER) 100 LITRE (TAKE 140 LT LINER)</p>
	<p>PEDAL BINS</p> <p>50 LITRE</p>
 <p>7.</p>	<p>ANATOMICAL WASTE</p> <p>5 LITRE RECTANGULAR WHITE CONTAINER WITH RED LID (FOETUS AND PLACENTA)</p>
 <p>8.</p>	<p>PHARMACEUTICAL WASTE</p> <p>EXPIRED MEDICATION 25 LITRE GREEN METAL DRUM</p>

	<p>25 LITRE BIO-HAZARDOUS GLASS AND HEAVY WET WASTE BUCKET</p>
---	--

General lab safety

1. Bio-hazardous waste must be separated from all other waste.
2. Any waste that could produce laceration or puncture injuries must be disposed of as “sharps”. Sharps must be segregated from other waste.
3. Waste that is to be incinerated should not be combined with glass or plastics.
4. Biological waste should not be combined with chemical waste or other laboratory waste.
5. All waste must be securely packaged and specifically labeled to indicate method of treatment.
6. Containers must: be appropriate for the contents; not leak; be properly labeled; maintain their integrity. Containers of bio hazardous material should be kept closed.
7. Where possible waste can autoclaved before being placed in medical waste boxes.

STORAGE FACILITIES

Biological waste may be held temporarily under refrigeration, prior to disposal, in a manner that does not create aesthetic (visual or odour) problems. Bio-hazardous waste should be disposed of promptly and not allowed to accumulate.

Temporarily holding areas for bio-hazardous waste must be clean and orderly with no access to unauthorized persons (warning signs should be posted).

LABELING

As per legislation the contractor will accept responsibility for the correct labeling and transport of biological and medical waste.



COLLECTION

This is contracted out to a private company as transport of bio-hazardous is controlled by legislation.

The Generator is to ensure that all containers are secure and that all the liners have been sealed with cable ties. It is best not to over fill the bags, it is best to seal the $\frac{3}{4}$ full bio-hazardous waste liners.

1. Complete the chemical/biological waste pick-up request form in full.
2. Send the fully completed form to Property Services at fax: 021 808 4669, E-mail: meg2@sun.ac.za

CHAPTER FOUR: CHEMICAL WASTE COLLECTION

The purpose of this section is to provide information, requirements, guidelines and procedures for the handling and disposal of hazardous chemical and pharmaceutical waste for all departments and units on the Stellenbosch University campus.

WHAT IS CHEMICAL WASTE

“**CHEMICAL WASTE**” includes solids, liquids or gases containing or contaminated with any of the following:

- flammable solvents (*e.g., acetone, alcohols, acetonitrile*);
- leachate toxic materials (*e.g., heavy metals, pesticides*);
- corrosives (*e.g., hydrochloric acid, potassium hydroxide pellets*);
- reactives such as oxidizers, cyanides, sulphides, explosives, unstable materials and water-reactive materials (*e.g., sodium metal, benzoyl peroxide*);
- toxic materials including mutagenic, carcinogenic, acute or chronic toxicity materials (*e.g., chloroform, ethidium bromide*);
- polychlorinated biphenyls (> 50 ppm concentration);
- Non-returnable gas cylinders.

Each lab needs to have a file with lists of waste streams, disposal methods and copies of material safety data sheets as well as spill prevention protocols for each chemical. Drums need to be stored in the labs as per legislation. Do not leave hazardous containers open or with a funnel in it. Containers must be kept closed when not used. **NO CHEMICAL WASTE MAY BE THROWN DOWN THE DRAIN.**

Hoarding and stock piling of chemical waste will remain the responsibility of the generators head. This activity increases the risk in the faculty for both its people and the environment. Generators will remain responsible for the costs involved with disposing of chemical waste that has been collected and hoarded over time.

Each lab should have its own storage facilities under the control of the lab manager as central storage facilities may increase the potential risk as personnel responsible for the store are often not trained in identifying the source, concentration, and best handling practices for each different waste chemical.

We are currently investigating the possibility of a central data base system, which stores all the information regarding the chemicals on campus as well as the availability of those chemicals on campus. This can promote the possible transfer of chemicals between depts. reducing the chemical waste generated from unused chemicals.

CONTAINERS AND STORAGE FOR CHEMICAL WASTE

Generators of chemical waste are to ensure that waste is removed regularly and no large amounts of chemical waste are stored on site. If there are existing stock piles of old chemicals then this waste will be dealt with as a once off clean up and the generator will remain responsible for the costs related to disposing of this waste.

Proper storage of chemical waste in the laboratory is important because of safety. The use of proper containers and procedures during storage will simplify the process when you wish to have the waste disposed.

STORAGE FACILITIES

Guidelines for chemical storage:

1. Separate drums are needed for each different type of chemical waste. These chemical waste streams have been recorded at the Vissershok disposal site and any deviation from these will not be accepted and returned to the Department concerned at their cost.
2. All containers must be identified and correctly labeled. Each drum must be coded and all waste, which will go into the particular drum, must be listed, as well with the name of the contents and the quantity / percentage of its constituents.
3. Liquid waste should be packed in their original containers, rather than be poured together (may be incompatible) resulting in a possible reaction. The containers should be well cushioned with vermiculite. Annexure 1 gives a list of known incompatible chemicals.
4. Care must be taken to ensure that if a chemical is decanted into another container that the containers themselves are compatible with the specific chemical stored in them.

Chemicals	Incompatible Containers
Hydrofluoric acids Strong alkali	Glass (will dissolve the glass container)
All chemical waste	Plastic milk or juice bottles
Nitric acid	Wood and some metal containers
Pechloric acid, organic peroxides	Wood and some metal containers

5. Solids may also be packed together in there original containers with liquids where applicable and well cushioned with vermiculite.

6. Encapsulation waste must be packed in appropriate sized metal drums and well cushioned with vermiculite. All containers must be in a good condition especially the thread of the lid and well sealed.
7. Solvent waste will be accepted if mixed within the drums, however the chlorinated/non-chlorinated solvents must be separated.
8. Use an appropriate container size to match the amount of waste generated and care should be taken not to make the containers too heavy. Enviroserv may refuse to pick up waste containers that are too heavy.
9. If a new waste stream is identified, a new waste profile sheet needs to be completed and sent to meg2@sun.ac.za for registration at the Vissershok disposal site. If this becomes a permanent waste stream a drum number will be allocated to that waste stream.
10. If you have an unidentified chemical waste stream, please notify Property Services. This chemical waste will need to be sampled by an outside contractor and the contents of the waste declared at Vissershok for disposal. This is costly and the costs will be for the department that generated the waste. Please do not pour unknown chemicals down the drain, or mix them with other chemicals. These undeclared chemicals will not be collected by any outside contractor until they have been sampled and a waste profile sheet completed.
11. All waste containers must not leak and be tightly capped. Containers must be kept closed except when being filled.

SPECIAL OR 'PROBLEM' CHEMICALS

1. Shock sensitive and peroxide forming chemicals, explosives:
Dry picric acid is explosive. Picric acid is soluble in water and various solvents. When in solution, picric acid becomes non explosive and is safe to transport.

Peroxidizable compounds such as ethers, dioxanes and Tetrahydrofuran, absorb and react with oxygen to form potentially explosive compounds over time. Peroxides are shock-sensitive compounds that can explode if subjected to mechanical shock, intense light, rapid changes in temperature, or heat.

All peroxidizable compounds should be stored away from heat and light. They should be protected from physical damage and ignition sources. A warning label should be affixed to all peroxidizable compounds as illustrated below to indicate the date of receipt and the date the container was first opened.

PEROXIDIZABLE COMPOUND	
Date Received	Date Opened
<input style="width: 90%; height: 20px;" type="text"/>	<input style="width: 90%; height: 20px;" type="text"/>
Discard or test within _____ months after opening.	

Table 3.3: Common Peroxide Forming Chemicals*	
LIST A	
Severe Peroxide Hazard on Storage with Explosive to Air	
<i>Discard within 3 months</i>	
Diisopropyl ether (isopropyl ether)	Potassium amide
Divinylacetylene (DVA) ^a	Potassium amide (sodamide)
Divinyl ether	1,1- Dichloroethylene
Potassium metal	
LIST B	
Peroxide Hazard on Concentration: Do Not Distill or Evaporate without First Testing for the Presence of Peroxides	
<i>Discard or test for peroxides after 6 months</i>	
Acetaldehyde diethyl acetal	Diethylene glycol dimethyl ether (diglyme)
Cumene (isopropyl benzene)	Furan
Cyclohexane	Methyl acetylene
Cyclooctene	Methylcyclopentane
Cyclopentene	Tetrahydrofuran (THF)
Diacetylene (butadiene)	Tetralin (tetrahydronaphthalene)
Dicyclopentadiene	Vinyl ethers
Diethyl ether (ether)	
LIST C	
Hazard of Rapid Polymerization Initiated by Internally Formed Peroxides^a	
<i>Discard or test for peroxides after 12 months</i>	
Acrylic acid	
Acrylonitrile	Tetrafluoroethylene (TFE) ^b

Butadiene ^b	Vinyl acetate
Chloroprene (2-chloro-1, 3-dibutadiene) ^b	Vinyl acetylene
Chlorotrifluoroethylene	Vinyl chloride
Methyl methacrylate	Vinylidene chloride
Styrene	Vinyl pyridine
^a polymerizable monomers should be stored with a poli	

Decontamination of empty containers

LABELING

Stickers are supplied by waste disposal contractor and all information needs to appear on the label. The labels must be accurate, legible and fully explained. The name of the department, lab group, contact person details, and date must appear. Each drum must be coded and all wastes, which will go into the particular drum, must be listed as well with the name of the contents and the quantity/percentage of its constituents.

COLLECTION

The off-site waste disposal contractors will only pickup waste that is properly packaged and labeled.

A suitable container for transport is necessary.

The off-site waste disposal contractors will pick up their waste containers as well as other suitable containers (such as properly labeled 25L plastic drums).

HANDLING OF DONATIONS OF CHEMICAL PRODUCTS

US committed to reuse and optimal use of chemical products.

Donations of chemicals from other departments and donations from external parties for research purposes must only be accepted if they can be used for research or teaching before the expiry date of the chemical. Packaging, labeling and storage of chemical must be in accordance as per regulation and the receiving department must have the correct storage facility for that type of chemical. The recipient must accept full responsibility for the chemical product.

Dean of the faculty must in writing accept chemical donations once all relevant information has been received and must guarantee that no extra pressure will be put onto the waste generated.

Any extra costs that are incurred for the removal of donated chemicals will be carried by the department that has accepted the waste.

SPILL PREVENTION AND CLEAN-UP

Chemical spills can be broken down into two basic types: simple spills, which you can clean up yourself, and life threatening spills, which require outside assistance.

If your spills meet any of the following conditions of a complicated spill, call USBD and the Stellenbosch Fire Department immediately. The Stellenbosch University Risk and Protection Services will secure the affected room or building where spill occurred and are responsible for emergency procedures during an accidental spill or emergency evacuation.

A spill is considered life threatening when:

- A person is injured; or
- Identity of the chemical is unknown; or
- Multiple chemicals are involved; or
- The chemical is highly toxic, flammable or reactive; or
- The spill occur in a “public place” such as corridors; or
- The spill has the potential to spread to other parts of the building such as through the ventilation system; or
- The clean up procedures are not known or appropriate materials are not readily available; or
- The spill may endanger the environment such as reaching waterways or outside ground.

If none of the above is met, the spill is defined as a simple spill. You may clean up simple spills as describe in section.

Preventing Spills

Listed below, and on the following pages, are some basic spill prevention steps that apply to storage, transportation, and transfer of chemicals.

General precautions

- reduce clutter and unnecessary materials in your work areas
- eliminate tripping hazards and other obstructions
- have all needed equipment readily available before starting work

Storage precautions

- use sturdy shelves
- larger containers should be stored closer to the floor
- containers on shelves should be stored back from the edge to reduce the danger of falling
- storage shelves should have lips to further reduce the danger of falling
- chemicals should be stored by compatibility first, then alphabetically
- inspect the storage area regularly for leaking or defective containers
- use appropriate storage containers
- periodically check containers under hoods, sinks, and lab benches for signs of deterioration

Transportation precautions

- use carts/ trolleys, where appropriate
- use safety containers, where appropriate
- use straps or chains to secure gas cylinders, where appropriate
- think about potential hazards before transporting chemicals
-

Preparing for Spills

It is best to proceed in an organized manner for spill response. Establishing protocols and evaluating potential hazards in advance will be well worth the initial effort.

I. Establish spill response protocols

Before working with chemicals you should determine what could go wrong and how you might respond to a spill. As a result of this evaluation, you should prepare written protocols for use in the event of a spill these protocols need to be communicated to all persons who might be affected by a spill. This should be part of the chemical file in each lab.

In addition, you should have basic spill cleanup material readily available should anything go wrong. Prior to starting any work with chemicals, make sure that you have all the necessary personal protective equipment/ clothing, safety equipment, and containment/clean up materials readily available. Each individual who may be involved in spill response or clean up must know the purpose and limitations of all personal protective equipment, safety equipment and clean up materials.

II. Evaluate the hazards

When spills occur, a quick appropriate response can prevent serious consequences. However, the wrong response can make things worse. In order to respond promptly and appropriately, you should evaluate the potential hazards in advance of using the chemicals. The first source of information to consult would be your Material Safety Data Sheet (MSDS).

Of most concern in spill situations are chemicals, which are:

- Air reactive
- Water reactive
- Flammable
- Polymerizable
- Corrosive
- Highly toxic

Based on these hazards, you can then determine:

- Appropriate personal protective equipment for spill response
- (e.g. gloves, respirators, etc.)
- Types of fire suppression equipment
- Appropriate cleanup materials
- First aid procedures

Response procedures during a spill

Simple Spills

- ☞ Prevent the spread of fumes.
- ☞ Control the spread of liquids.
- ☞ Neutralize acids and bases.
- ☞ Absorb liquids.
- ☞ Collect and contain the clean up residues.
- ☞ Decontaminate the area and affected equipment.
- ☞ Dispose of the waste.

Life threatening spills

- ☞ Evacuate the area.
- ☞ Confine the spill area.
- ☞ Report the spill.
- ☞ Secure the area.
- ☞ Clean up the spill.

Special precautions for flammable liquids

- ☞ Remove all potential sources of ignition, when possible. If, however, the vapors from a flammable spill are in the vicinity of an ignition source, such as a pump, it may be advisable to shut off the power from a remote circuit breaker box (DB board), instead.
- ☞ Use appropriate respiratory protection.
- ☞ Use spill pillows or absorbent towels. Contain spill clean up materials in a sturdy plastic bag and label “[Chemical Name] Spill Cleanup Debris.”
- ☞ Never use a vacuum cleaner to collect flammable liquids.
- ☞ Thoroughly ventilate the area when done.

Special precautions for acids

- ☞ Special precautions should be taken when cleaning up hydrofluoric acid (HF). Wear appropriate personal protective equipment. Use a chemical absorbent specifically designed for HF, such as 3M™ Chemical absorbent. Do not use silica [sand] based products with hydrofluoric acid.
- ☞ Protect skin and eyes from direct contact with the acid.
- ☞ Use appropriate respiratory protection.
- ☞ Neutralize the spill with carbonate or bicarbonate of sodium or potassium. The neutralization reaction is sometimes vigorous, so be on the alert for splashes.
- ☞ Use pH paper to verify that the acid has been neutralized.

Special precautions for powder spills

- ☞ Before starting, close windows and doors to cut down on drafts that could increase dust formation.
- ☞ Carefully sweep up the powder to minimize generation of dust. Put all residues in a sealed container.
- ☞ If needed, protect your respiratory system from dust by wearing a dust mask or respirator, as appropriate.

Spill control kits

It is good safety practice to have spill control materials available at all times. You may buy pre-packaged spill kits from various vendors.

CHAPTER FIVE: RADIO ACTIVE WASTE COLLECTION

What is Radioactive Waste?

Radioactive waste is any material that contains a concentration of radionuclides greater than those deemed safe by national authorities, and for which no use is foreseen. Because of the wide variety of nuclear applications, the amounts, types and even physical forms of radioactive waste vary considerably - some waste

remain radioactive for hundreds or thousands of years, while others may require storage for only a short period, while they decay, prior to conventional disposal. (International Atomic Energy Agency).

Types of Radioactive Waste

High-level waste includes the spent fuel from nuclear power generation, or the residual waste from reprocessing the spent fuel. The military also produce high-level waste.

Low and intermediate level waste includes items that have come into contact with some radiation. This may be at nuclear power plants, hospitals, dentists, research laboratories and other commercial operations. Both the volume and the level of radioactivity have to be considered - a large volume of waste with a low-level of radioactivity presents less danger than a smaller amount of waste with a high-level of radioactivity. For example, spent fuel (elements that have been removed from a reactor after use) makes up less than 1% of the volume of radioactive waste, but contains almost 95% of the total radioactivity. (Office of Civilian Radioactive Waste Management).

Disposal of Radioactive Wastes: Changes in Legislation

In 2005 changes were made to the standards used for defining a radioactive waste.

Radioactive wastes (SANS Class 7) are covered by the Atomic Energy Act, 1967, (Act 90 of 1967) and the Hazardous Substances Act, 1973 (Act 15 of 1973). There has been considerable controversy, since the 1990s, over the standards used by the Council for Nuclear Safety (now the National Nuclear Regulator) for Naturally Occurring Radioactive Materials (NORM) wastes, as the Mining Industry considered the level set too low and out of line with international standards. In addition, the standard used for the management of non-nuclear radioactive waste by the Department of Health, Directorate Radiation Control and, hence, the Minimum Requirements, was different.

New Standard

A new standard definition that applies both to NORM wastes and Non-nuclear radioactive wastes has been set.

The new definition is included in the draft 3rd edition of the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, which states the following:

Class 7, Radioactive Wastes: Disposal in a landfill is PROHIBITED.

- Only those wastes defined as "inactive wastes", i.e., with a specific activity less than 100 becquerels per g (Bq/g) and total activity less than 4 kBq, may be disposed as normal waste.
- Radioactive Substances with specific activity < 100 Bq/g, total activity < 4 kBq, are to be incinerated or landfilled.
- Disposal of a Radioactive Substance with specific activity > 100 Bq/g, total activity > 4 kBq, is PROHIBITED: consult the Department of Health.

Two important documents have been published (copies are included):

- Department of Health: Directorate Radiation Control, "Code of Practice for the Management and Disposal of Non-nuclear Radioactive Waste", May 2005; and
- Department of Minerals and Energy, Radioactive Waste Management Policy for the Republic of South Africa, 2005.

Non-nuclear Radioactive Waste

The document from the Directorate Radiation Control covers wastes that are generated by hospitals, clinics, industry and research, e.g. Carbon-14, Iodine-129, etc. The only difference in this new version is the definition. Disposal of low level non-nuclear radioactive waste by incineration and discharge to sewer are regulated.

Naturally Occurring Radioactive Materials

The most important wastes, which are potentially radioactive due to the occurrence of uranium, thorium and other heavy radioactive elements, are from mining activities. Uranium occurs naturally at a number of the gold mines in the Witwatersrand and Free State and is in fact being recovered in at least two cases and thus the tailings and other wastes associated with these mines, e.g. coal ash, can show reasonably high levels of radiation.

The definitions of all types of NORM waste is given in the document in the appendix to this memorandum. However, the most important for our purposes is NORM-L, i.e. potential radioactive waste containing low concentrations of NORM - long lived radio nuclide concentration <100 Bq/g.

Waste Type and Origin

- Mining and Minerals Processing
- Fossil Fuel Electricity Generation

- Bulk Waste: un-irradiated uranium (Nuclear Fuel Production)

Disposal/Management Options

- Re-use as underground backfill material;
- Extraction of economically recoverable minerals, followed by disposal in any mine tailings dam or other sufficiently confined surface impoundment; and
- authorised disposal, e.g. to a permitted landfill as given in the 3rd edition of the Minimum Requirements.

Useful Websites

1. <http://www.iaea.org>
2. <http://www.epa.gov/rpdweb00/source-reduction-management/sources.html>

CHAPTER SIX: ASBESTOS WASTE COLLECTION

INTRODUCTION

Asbestos is the name for a group of naturally occurring minerals that separate into strong, very fine fibres. These fibres are heat and fire resistant and extremely durable. Because of these qualities, asbestos has been used in insulation products, building materials, paints and protective clothing.

Asbestos tends to break down into tiny fibres. A single fibre of asbestos magnified 1000 times looks slightly larger than a strand of human hair. Because of the size and shape, these tiny fibres remain suspended in the air for long periods. When inhaled or ingested the fibres can easily penetrate the body tissues. Because of their durability, these fibres can remain in the body for many years and can cause a number of different diseases.

Exposure to asbestos fibres and dust can cause asbestosis, a disease of the lungs caused by the inhalation of asbestos particles, and after a latent period of up to 30 years and more, various cancers, especially lung cancer and mesothelioma, which is an inoperable cancer of the chest and abdominal lining.

The use, storage, manufacture, transports and disposal of asbestos and waste containing asbestos is strictly regulated by the State. The regulations controlling this are found in the Occupational Health and Safety Act 85 of 1993 and are contained in the Asbestos Regulation 2001 and the Regulations for the prohibition of the use, manufacturing, import and export of asbestos and asbestos containing materials 2008.

The aim of these regulations is two-fold. Firstly to prevent any asbestos from causing environmental damage and secondly to ensure that exposure to asbestos fibres do not cause illness in employees or harm to the public.

DEFINITIONS FOUND IN THE ASBESTOS REGULATIONS

- ◆ **Approved asbestos inspection authority** means an approved inspection authority for the monitoring of asbestos concentrations in the air.
- ◆ **Asbestos** means any of the following minerals:
 - Amosite
 - Chrysotile
 - Crocidolite
 - Fibrous actinolite
 - Fibrous anthophyllite; and Fibrous tremolite, or any mixture containing any of these minerals.
- ◆ **Asbestos dust** means airborne or settled dust, which contains or is likely to contain asbestos fibres.
- ◆ **Asbestos waste** means an undesirable or superfluous asbestos-containing byproduct, emission or residue of any process or activity that has been:
 - discarded by any person;
 - accumulated and stored by any person with the purpose of eventually discarding it with or without prior treatment connected with the discarding thereof; or
 - stored by any person with the purpose of recycling, re-using or extracting a usable product from such matter.
- ◆ **Asbestos work** means work that exposes or is likely to expose any person to asbestos dust.
- ◆ **Exposed to asbestos** means exposed or likely to be exposed to asbestos dust while at the workplace and "exposure" has a corresponding meaning.
- ◆ **Measurement programme** means a programme according to the monitoring strategy as contemplated in OESSM and HSG 173.
- ◆ **Monitoring** means the planning and carrying out of a measurement programme and the recording of the results thereof.
- ◆ **Occupational exposure limit or OEL** means a limit value set by the Minister for a stress factor in the workplace.
- ◆ **Occupational exposure limit for asbestos** means an occupational exposure limit of 0,2 regulated asbestos fibres per milliliter of air averaged over any continuous period of four hours measured in accordance with MDHS 39/4.
- ◆ **Regulated asbestos fibre** means a particle of asbestos with a length-to-diameter ratio greater than 3 to 1, a length greater than 5 micrometres and a diameter less than 3 micrometres.

- ◆ **Respiratory protective equipment** means a device worn over the mouth and nose to prevent the inhalation of air that is not safe, and which device conforms to a standard approved by the Minister.
- ◆ **Respirator zone** means a respirator zone contemplated in regulation 10(a).
- ◆ **SANS 10228** means the Code of Practice for the Identification and Classification of Dangerous Substances and Goods.
- ◆ **SANS 10229** means the Code of Practice for Packaging of Dangerous Goods for Road and Rail Transportation in South Africa.
- ◆ **Short term exposure limit for asbestos** means an exposure limit of 0,6 regulated asbestos fibres per milliliter of air averaged over any 10 minutes.

SUMMARY OF THE ASBESTOS REGULATIONS

REGULATION 3: NOTIFICATION OF ASBESTOS WORK

The company shall not carry out any asbestos work unless it has notified the provincial director (Department of Labour) in writing thereof prior to the commencement of work.

REGULATION 4: EXPOSURE TO ASBESTOS

The company shall not permit any person to work in an environment in which he or she would be exposed to asbestos in excess of the prescribed occupational exposure limit.

REGULATION 5: INFORMATION AND TRAINING

1. Before any employee is exposed to asbestos dust, the company shall, after consultation with the health and safety committee, ensure that the employee is adequately and comprehensively informed and trained, on both practical aspects and theoretical knowledge, with regard to-

- the contents and scope of the Asbestos Regulations;
- the potential sources of exposure;
- the potential health risk caused by exposure to asbestos, including the health risks to employees' families and others, which could result from taking home asbestos contaminated equipment and clothing, and the dramatically increased risk of lung cancer for asbestos workers who smoke;
- the measures taken by the employer to protect an employee against any risk from exposure;
- the precautions to be taken by the employee to protect himself or herself against the health risks associated with the exposure, which include the wearing and use of protective clothing and respiratory protective equipment;

- the necessity, correct use, maintenance and limitations of protective equipment, facilities and engineering control measures provided;
 - the assessment of exposure, the purpose of air sampling, the necessity for medical surveillance and the long term benefits and limitations thereof;
 - the occupational exposure limit and its meaning;
 - the importance of good housekeeping at the workplace and personal hygiene;
 - the safe working procedures regarding the use, handling, processing, and storage of any material containing asbestos;
 - procedures to be followed in the event of an accidental spillage or any other similar emergency situation likely to result in the release of asbestos dust;
 - procedures for reporting and correcting defects likely to result in the release of asbestos dust;
 - safe disposal of asbestos waste; and
 - procedures for record keeping.
2. Refresher training shall be given at least every year or at more frequent intervals that may be recommended by the health and safety committee. Training should be given more frequently than once a year if-
 - work methods change;
 - the type of work carried out changes significantly; or
 - the type of equipment used to control exposure changes.
 3. Training shall be provided by somebody who is competent to provide it and has adequate personal practical experience and theoretical knowledge of all aspects of the work being carried out by the employer.
 4. The company shall ensure that contractors or any person other than employees who may be exposed to asbestos at the workplace are given adequate information, instruction and training.
 5. The company shall keep a record of any training, both practical and theoretical, that was given to an employee.
 6. The company shall give instructions regarding the accidental spillage of Asbestos in writing to the drivers of vehicles carrying asbestos or asbestos-containing material that has the potential of causing environmental pollution or affecting human health.

REGULATION 6: DUTIES OF PERSONS WHO MAY BE EXPOSED

Any person who is exposed to asbestos in the workplace, shall obey any lawful instruction given by or on behalf of the company, regarding-

- the prevention of asbestos dust from becoming airborne;
- the wearing and use of personal protective equipment and clothing;
- the wearing of monitoring equipment to measure personal exposure to asbestos;
- the reporting for medical surveillance;
- the cleaning up and disposal of any material containing asbestos;
- housekeeping at the workplace, personal hygiene, good environmental and health, practices, including eating, drinking and smoking in designated places provided; and
- Information and training received.

REGULATION 7: ASSESSMENT OF POTENTIAL EXPOSURE

1. The company shall cause the undertaking to be assessed within six months after the commencement of the asbestos regulations, and thereafter at intervals not exceeding two years, to determine if any person may be exposed to asbestos, and the assessment results are to be recorded.
2. Before an assessment is made the company shall consult with the relevant health and safety representative, or health and safety committee and inform them in writing of the arrangements made for the assessment, give them reasonable time to comment thereon and ensure that the results of the assessment are made available to them for comment.
3. When making the assessment, the employer shall take the following into account:
 - The presence of any material containing asbestos being used, processed, handled or stored;
 - where asbestos may be present, the ease with which the asbestos dust may be released and the extent to which a person may be exposed;
 - the nature of the work, process and any likely deterioration in or failure of any control measures;
 - the details of expected exposures, in particular-
 - whether the expected exposure is above the OEL for asbestos, so that the appropriate respiratory protective equipment can be selected pending the implementation of engineering control measures;
 - whether exposures are intermittent, including the frequency and duration of exposures;

- the number of employees exposed and any other person who may be exposed, and their expected exposure values; and
 - where applicable, results which may be available from any previous monitoring performed at that workplace;
 - the steps to be taken to reduce exposure to the lowest level and the steps to be taken to reduce the release of asbestos dust into the environment;
 - procedures for dealing with emergencies; and
 - Procedures for the removal of asbestos waste from the workplace, and the disposal thereof.
4. If the assessment indicates that any person is likely to be exposed to asbestos, the company shall ensure that the exposure is adequately controlled.
5. The company shall review the assessment if- there is reason to believe that the previous assessment is no longer valid; control measures are no longer efficient; technological or scientific advances allow for more efficient control methods; or there has been a significant change in-
- work methods;
 - the type of work carried out; or
 - the type of equipment used to control exposure;

REGULATION 8: AIR MONITORING

Where exposure is in excess of half the OEL for asbestos, the company shall ensure that a measurement programme of the concentration of airborne regulated asbestos fibres to which an employee is exposed, is-

- carried out only after informing the health and safety committee or relevant representative;
- carried out by an approved asbestos inspection authority or a person whose ability to do the measurements is verified by an approved asbestos inspection authority;
- Representative of the exposure of employees to the airborne asbestos fibres and verified.

The company shall ensure that measurements are carried out at least every 12 months.

REGULATION 9: MEDICAL SURVEILLANCE

1. The company shall ensure that an employee is under the medical surveillance of an occupational medical practitioner if-
- an employee is exposed to asbestos dust exceeding the OEL for asbestos; or

- an occupational medicine practitioner certifies that the relevant employee should be under medical surveillance.
2. The company shall, as far as possible, ensure that a structured medical surveillance programme be drawn up by an occupational medicine practitioner who shall include at least the following:

An initial health evaluation, carried out by an occupational health practitioner immediately or within 14 days after a person commences employment, which comprises-

- an evaluation of the employee's medical and occupational history;
 - medical examinations and tests which should include chest X-rays, pulmonary function testing and an appropriate physical examination; and
 - any other essential medical examination which in the opinion of the occupational medicine practitioner is necessary in order to enable such practitioner to do a proper evaluation; and
 - Subsequent to the initial health evaluation, evaluations of the employee shall be conducted at intervals not exceeding two years, or at shorter intervals specified by an occupational medicine practitioner.
3. The company shall not permit an employee who has been certified unfit for work, to work in a place in which he or she will be exposed to asbestos dust. The employee may be permitted to return to work if he or she is certified fit by an occupational medicine practitioner.

REGULATION 10: RESPIRATOR ZONE

The company shall ensure that-

- any workplace where the concentration of regulated asbestos fibres in the air is, or may be, such that the exposure of persons exceeds the OEL for asbestos without the wearing of respiratory protective equipment, is zoned as a respirator zone;
- a respirator zone is clearly demarcated and identified by notice indicating that the area is a respirator zone and that respiratory protection must be worn there;
- no person enters a respirator zone unless he or she wears the required respiratory equipment and protective clothing; and
- The reason why the OEL for asbestos is exceeded is identified and action is taken.

REGULATION 11: CONTROL OF EXPOSURE TO ASBESTOS

The company shall ensure that the exposure of a person to asbestos is either prevented, or, where this is not practicable, adequately controlled. The control of the exposure shall be regarded as adequate if the level of exposure is at or below the OEL for asbestos.

REGULATION 12: CLEANLINESS OF PREMISES AND PLANT

The company shall take steps to ensure that:

- workplaces are maintained in a clean state and are free of asbestos waste and, whenever asbestos is accidentally spilled or asbestos dust is accidentally released into the workplace, that remedial measures are taken immediately before work is resumed;
- machinery, plant and equipment, as well as external surfaces of ventilation equipment and internal surfaces of buildings, are kept free of asbestos dust;
- cleaning is carried out by vacuum-cleaning equipment with a filtration efficiency of at least 99 per cent for particles one micrometer in size, or in such other manner that asbestos dust neither escapes nor is discharged into the air to such an extent that it contaminates any workplace or the environment;
- the vacuum-cleaning equipment is regularly serviced and its external surfaces are kept in a clean state and free from asbestos dust; and
- Where the use of vacuum-cleaning equipment is impracticable, the relevant surfaces are first dampened and that persons undertaking such cleaning are wearing appropriate protective clothing and respiratory protective equipment.

REGULATION 13: CONTROL OF EXPOSURE TO ASBESTOS OF PERSONS OTHER THAN EMPLOYEES

The company shall ensure that the release of asbestos dust into any environment or water system complies with the provisions of the Atmospheric Pollution Prevention Act, 1965 (Act No. 45 of 1965), the Environment Conservation Act, 1989 (Act No. 73 of 1989), the National Water Act, 1998 (Act No. 36 of 1998), and the National Environmental Management Act, 1998 (Act No. 107 of 1998). The company shall ensure that appropriate measures are taken to prevent the release of asbestos dust into the environment arising from the transport of asbestos.

REGULATION 16: RECORDS

An employer shall-

- Keep records of the results of all assessments, air monitoring, medical surveillance reports and the asbestos inventory. Personal medical records shall only be made available to an occupational health practitioner;
- allow any person, subject to formal consent in writing of an employee, to peruse the records with respect to that particular employee;
- make the records of all assessments and air monitoring, and the asbestos inventory available for perusal by the relevant health and safety representative or relevant health and safety committee, and Department of Labour inspector;
- keep all records of assessments and air monitoring, and the asbestos inventory for a minimum period of 40 years;
- keep all medical surveillance records for a minimum period of 40 years and, if the company ceases activities relating to asbestos work, shall hand over or forward by registered post all these records to the Department of Labour: Provided that those records contain at least the following information:
 - Surname, forenames, gender, date of birth, name of spouse or closest relative and where available, permanent address and postal code;
 - a record of types of work carried out with asbestos and, where relevant, its location, the starting and ending dates of exposure and average duration of exposure in hours per week;
 - a record of any work with asbestos prior to this employment; and
 - dates of medical surveillance reports;
- keep a record of the tests and investigations of control systems and of any repairs resulting from the relevant tests and investigations, and keep that record for at least three years; and
- Keep a record of training given to an employee for as long as the employee remains employed at the workplace in which he or she is being exposed to asbestos.

REGULATION 17: PERSONAL PROTECTIVE EQUIPMENT AND FACILITIES

1. The company shall provide all persons exposed to asbestos at the workplace with suitable protective clothing; and with suitable respiratory equipment to ensure that the person's exposure is adequately controlled.
2. Where respiratory equipment is provided, the company shall ensure that it is capable of keeping the exposure level at or below the OEL for asbestos, the equipment is correctly and properly used, information, instruction, training and supervision that are necessary with regard to the use of the equipment is

provided to the persons, and the equipment is kept in good condition and efficient working order.

3. The company shall-

- Issue no personal protective equipment to a person, unless such equipment is cleaned, decontaminated and, where appropriate, sterilised;
- provide separate containers or storage facilities for personal protective equipment when not in use; and
- ensure that all personal protective equipment not in use is stored only in the place provided.

4. The company shall ensure that all personal protective equipment contaminated with asbestos dust is cleaned and handled in accordance with the following procedures:

- Where the equipment is cleaned on the premises, care shall be taken to prevent contamination during handling, transport and cleaning;
- Where the equipment is sent off the premises to a contractor for cleaning purposes;
- the equipment shall be packed in impermeable containers;
- the container shall be tightly sealed and clearly, labeled in the form of Annexure 1; and
- the contractor shall be informed of these Regulations and the precautions to be taken for the handling of the asbestos contaminated equipment; and
- water that is used for decontamination or cleaning of equipment shall be filtered before being released into any water system.

5. The company shall ensure that no person removes dirty or contaminated personal protective equipment from the workplace.

6. Where personal protective equipment contaminated with asbestos dust has to be disposed of, it shall be treated as asbestos waste.

7. The company shall provide employees who use personal protective equipment with-

- washing facilities which are readily accessible and located in an area where the facilities will not become contaminated;
- two separate lockers labelled "protective clothing" and "personal clothing" respectively, and shall ensure that the clothing is kept separately in the lockers concerned; and

- separate change rooms labelled "clean change room" and "dirty change room", with suitable barrier and bathing facilities between to prevent the contamination of personal clothes with asbestos dust.

REGULATION 18: MAINTENANCE OF CONTROL MEASURES

The company shall ensure that all control equipment and facilities are maintained in good working order, and examinations and tests of engineering control measures are carried out at intervals not exceeding 24 months by an approved inspection authority.

REGULATION 19: LABELLING, PACKAGING, TRANSPORTATION AND STORAGE

In order to avoid the spread of asbestos dust, the company shall take steps to ensure that-

- the asbestos in storage or being distributed is properly identified, classified and handled in accordance with SABS 0228;
- a container or a vehicle in which asbestos is transported is clearly identified, classified and packed in accordance with SABS 0228 and SABS 0229; and
- any article or substance which contains asbestos is clearly labeled with the correct signage.

REGULATION 20: DISPOSAL OF ASBESTOS

The company shall ensure that-

- all asbestos waste is placed in containers that will prevent the likelihood of exposure during handling;
- all vehicles, re-usable containers or any other similar articles which have been in contact with asbestos waste are cleaned and decontaminated after use, in such a way that they do not cause a hazard inside or outside the workplace;
- all asbestos waste which can cause exposure, is disposed of only on sites specifically designated for this and in such a manner that it does not cause a hazard inside or outside the site;
- all persons involved in the collection, transport and disposal of asbestos waste, who may be exposed to that waste, are provided with personal protective equipment; and
- where the services of a contractor for the disposal of asbestos waste are used, a provision is incorporated into the contract stating that the contractor shall also comply with the provisions of the Asbestos Regulations.

REGULATION 21: PROHIBITION

No person shall use compressed air to remove asbestos dust from any surface or person, smoke, eat, drink or keep food or beverages in an area not specifically designated for it or apply asbestos by means of spraying or any other similar process.

ASBESTOS WASTE CLASSIFICATION

According to the SANS 10228 - The identification and classification of dangerous substances and goods, Asbestos is classified in Class 9: Miscellaneous dangerous substances and goods, and depending on the type of Asbestos, falls into Danger Group II: Substances or goods that present a serious risk, and Danger Group III: Substances or goods that present a relatively low risk. The U.N. number changes according to the type of Asbestos.

There is a special provision when transporting asbestos. The following asbestos commodities are considered non-dangerous:

- a. Asbestos that is immersed or fixed in a natural or artificial binder, that no escape of hazardous quantities of respirable fibres can occur during transportation, and
- b. Manufactured articles that contain asbestos and do not satisfy the requirement of (a) above provided that they are packed so that no escape of hazardous quantities of respirable fibres can occur during transportation.

PACKAGING, TRANSPORT, STORAGE, LABELLING AND INFORMATION

Packaging

The SANS 10229: Packaging of dangerous goods for road and rail transport in SA, details the packaging criteria for dangerous goods. It is the responsibility of the waste generator to ensure that the waste is packaged properly. The criteria for Asbestos waste or waste containing asbestos is stipulated in regulation 19: Labeling, packing, transportation and storage.

This regulation stipulates the following:

to avoid the spread of asbestos dust asbestos in storage or being distributed is properly identified, classified and handled in accordance with SANS 10228;

- a container or a vehicle in which asbestos is transported is clearly identified, classified and packed in accordance with SANS 10228 and SANS 10229; and
- any article or substance which contains asbestos is clearly labeled with the correct signage.

Storage

Asbestos can be spread by air, water and living persons. For this reason, all asbestos which has the potential to contaminate, must be:

- under strict control;
- kept in containers or a similar suitable manner of containment that makes it unlikely to be spread to other areas of the work place, or to other premises by wind or by air;
- contained during transport and clearly marked to be able to identify that it contains asbestos. It also has to carry a health warning in the form of Annexure 1; and
- the manner of containment or the type of container to be used will depend on the kind of material being packaged, transported or stored.

Transport

Asbestos waste must be disposed of safely by ensuring that:

- Asbestos dust is not released during transportation to the landfill site. Instead, use tightly sealed containers;
- asbestos sludge is put in tightly sealed containers for it can easily be spilled or dried out during transportation;
- asbestos waste must be disposed of only on an approved landfill site specifically designated for this purpose in terms of the Environmental Conservation Act;
- all employees involved in the transportation and disposal of asbestos waste are provided with the required personal protective equipment (respirators and clothing);
- all equipment used during the disposal of asbestos waste is thoroughly cleaned thereafter; and
- all incidental spillage of asbestos waste be cleaned up immediately. The driver of the vehicle carrying asbestos waste must have the necessary training and be conversant with the instructions as to how to handle such cases.

Labelling and information

The intention here is to prohibit the sale of any article which contains asbestos and is likely to release regulated asbestos fibres when used, handled, stored or processed, unless:

- it is clearly labelled with a warning label in the form of Annexure 1 and
- it is accompanied by a material safety data sheet (MSDS).

THE FOLLOWING LABEL IS TO BE AFFIXED TO ALL ASBESTOS WASTE.



**WARNING: ASBESTOS
INHALATION OF ASBESTOS DUST IS DANGEROUS TO HEALTH.
FOLLOW THE SAFETY INSTRUCTION**

COMMERCIAL NAME
ASBESTOS WASTE
PROPER SHIPPING NAME
ASBESTOS FIBRE
UN NUMBER
2590
WEIGHT (kgs)
21000 KG/40 FT CONTAINER



Property Services are committed to phase out all asbestos products and to replace it with safer products.

Property Services needs to identify responsible persons for the training of people who are exposed to asbestos products, assessment monitoring limiting of exposure, air monitoring, supply and control of safety equipment, support and record keeping as specified in Regulation 155 of 2001.

Campus health is responsible for the medical observation and testing of exposed personnel.

CHAPTER SEVEN: E-WASTE COLLECTION

This includes computers, computer monitors and batteries that contain hazardous materials and present an environmental risk must be disposed of correctly.

The IT Department remains responsible for safe disposal of e-waste on all campuses and that it is correctly recycled.

Each environment on campus that generates e-waste is to ensure that nothing is hoarded in storage areas as IT must be contacted to move all waste to a central store for where correctly handled and recycled.

CHAPTER EIGHT: MERCURY (BATTERIES AND FLOURECSCENT BULBS)

Batteries

There are an estimated 50 million batteries sold in South Africa each year. Approximately 2,500 tons of batteries are disposed of in general landfill sites annually. Although some alkaline batteries can be disposed of as domestic waste, rechargeable batteries and silver oxide batteries can contain heavy metals such as mercury and cadmium which are classified as hazardous substances and may present an environmental threat when disposed of to landfill.

In implementing the waste hierarchy, the key challenges are to reduce this waste stream through recycling, and where recycling is not possible, to separate this waste from the general waste stream so it can be disposed of safely. The Waste Classification System provides for seven sub categories of batteries, and appropriate waste management measures need to be applied to each sub-category.

Currently, there are no regulations or official EPR initiatives in place for the domestic battery industry. One international supplier of domestic batteries has begun a battery recycling initiative, with collection bins placed at selected outlets. These batteries are then sorted and the recyclable batteries are sent to France as there are currently no domestic batteries recycling facilities in South Africa. Non-recyclable domestic batteries are encased in concrete and sent to landfill.

Lead-acid batteries used in cars are considered a hazardous waste. There is an established recycling industry for certain types of batteries (e.g. lead-acid batteries used in cars).

The South African Battery Manufacturers Association manages a scrap loading charge, or levy, on motor vehicle batteries, which are considered toxic due to the lead and sulphuric acid content. Battery retailers will generally take back one battery for every new battery bought from them, and will return the levy in exchange. The levy ranges from approximately R10 for motorbike batteries, to R100 for motor car batteries. Breakthroughs in technology have resulted in the components of these batteries becoming almost 100% re-useable or recyclable, and the levy has assisted in high levels of motor vehicle battery recycling.

At The US we aim to decrease the number of batteries going to landfill, and promoting the use of rechargeable batteries as well as the recycling of batteries. To do this battery need to be separated from the general waste at the source. Each user is asked to have separate containers for the batteries used in there departments for collection. The possibility of recycling and supplier responsibility are currently been investigated.

Fluorescent Lamps

Fluorescent lamps contain a small amount of mercury which is used in the illumination process. Mercury is a neurotoxin that can be harmful in even small amounts. The promotion of compact fluorescent lamps (CFLs) by government and Eskom as an energy saving measure has significantly increased the numbers of CFLs that require disposal when expired. Although Fluorescent lamps can be successfully recycled and the mercury recovered, no such facilities are currently available in the country. Currently there are no facilities to collect and manage CFLs separately and they are disposed of with domestic waste. In terms of implementing the waste hierarchy, the immediate focus for this waste stream is on preventing the unsafe and environmentally harmful disposal of CFLs.

Safe disposal of fluorescent lamps

Up to 300 tons of mercury waste is released from crushed fluorescent tubes in South Africa each year. This excludes many other mercury waste sources such as batteries, etc. Mercury is highly carcinogenic. Small amounts can cause serious and permanent nerve and kidney damage.

Although Government has rules about the safe disposal of toxic waste, most people dispose of it illegally, ignorant of the great danger posed by mercury. Tubes and lamps are dumped in waste or skip bins to be thrown in domestic dumping sites, ignoring safety and environmental regulations.

Lighting equipment is considered a sub type of Waste Electric and Electronic Equipment (WEEE) according to the Waste Categorisation System. Whilst WEEE or

eWaste is considered as a waste stream within this strategy, due to the nature of the industry and consideration of the existing IndWMP, lighting equipment is considered separately.

Crush all types of spent fluorescent lamps in a sealed container. By adding chemicals, the mercury is broken down and the vapour neutralised. This makes disposing of these lamps safe, easy and less dangerous when supervised by workers wearing protective clothing.

The acceptable risk level for mercury is 0.9 ppb (0.0009 mg/kg or mg/l) for disposal on a H:H waste site, and even if the concentration in the waste is lower than this, it may only be disposed of on a H:h landfill site if the concentration in the waste is less than 0.009 ppb (9×10^{-6} mg/kg or mg/l) AND the mercury component is less than 1% of the total waste stream.

Fluorescent tubes collected in large quantities are considered **extremely hazardous waste**, since it contains approximately 2 mg/kg of mercury, which is a known carcinogen. It may therefore **only be disposed of on a H:H waste disposal site**, and only after treatment. This treatment involves the addition of a 50% sodium sulphide – 50% sulphur solution in a – 50% Sulphur solution in a 1:10 (vol/ vol) ratio to the tubes crushed under controlled condition in drum.

Currently all fluorescent tubes are collected and crushed by an outside contractor organized by Property Services. However this function needs to be brought to the attention of all lab managers as fluorescent tubes used in lab equipment have not previously been collected for the correct disposal.