

OHS Act services

- Audits
- Plans
- Tender Specifications
- Safety Manuals
- Inductions

Environmental Services

- Audits
- Plans
- Enviro Files

Management

- Training Centre
- Construction

Contractor

- Development
- Mentorship
- CCO2

Training

- LIC
- Basic business skills
- Supervisory
- Drainage and services
- Shuttering
- Water reticulation
- Road works
- Building and related
- Tourism opportunities
- HIV/AIDS awareness
- Road safety
- Basic management of the environment
- First aid
- Basic fire fighting
- Safety representative
- Plant operator
- Assessment
- Moderation

Material development

- Training material
- Assessment instruments
- Operating and Maintenance Manuals

# Vegetation Control 2-day Workshop

Health and Safety  
Services and  
training

Construction and  
Building Training

Environmental  
Services

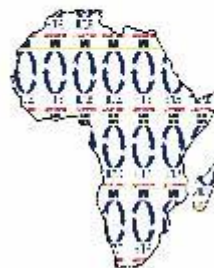


**HEALTH  
AND  
SAFETY**

**TRAINING**

**AND**

**ENVIRONMENTAL  
SERVICES**



**A QUALITY FUTURE**



# INDEX

	<u>PAGE</u>
1. Identify the obstructions and hazards	3
2. Identify and procure protective clothing, road signs and traffic control devices.	5
3. Calculate material quantities, procure material and store	8
4. Execute the work	12

Zec 4:6b; Not by might, nor by power, but by my Ruach, said YHVH Tseva'ot.

לא בחיל ולא בכח כי אם ברוחי אמר יהוה צבאות:

© Copyright By Jan Hartzler: All rights reserved. No part of this prospectus may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copy write holder.

## 1. Identify the obstructions and hazards

### 1.1 Inspect the area to be treated with herbicides and identify the obstructions and hazards.

The best way to identify hazards and obstructions is to do a hazard analysis. Table A is an example of a hazard analysis you can do.

- On the left side is the hazard classification column. This column contains information of the classification code and activities or situations that might be a hazard or an obstruction.
  - H=high - this is a high risk or very serious hazard / obstruction.
  - M=Medium - this is a medium risk or serious hazard / obstruction.
  - L=Low - this is a low risk or not so serious hazard / obstruction but still needs attention.
  - The activity or work to be performed, the hazard or the obstruction is written into this column and the classification code is written next to it.
- The next five columns are the PPE, barriers, tools, equipment and documentation columns.
  - Note the "Other:" column. This is for any other item you want to add that is not listed.
  - These columns are for the equipment, tools, PPE, barriers and documentation needed to handle the hazard or obstruction.

Possible hazards and obstructions may include:

Hazards:

- Inhalation
- Ingestion
- Skin absorption
- Fire hazards

Obstructions:

- Trees
- Shrubs
- Old rusted or burnt out vehicles
- Etc.

Remove hazards and obstructions.

Hazards should be removed according to company and road authority policy procedures and project specification. All traffic control devices should be used and in place as describe in learning activity 2 of this learning material.

Table A. Identify hazards and obstructions

HAZARD CLASSIFICATION		PERSONAL PROTECTIVE EQUIPMENT (PPE)					BARRIERS					TOOLS					EQUIPMENT					DOCUMENTATION										
CLASSIFICATION CODE: H=HIGH M=MEDIUM L=LOW	CLASSIFICATION	Safety Boots	Eye Protection	Respirator/Mask	Gloves	Overalls	Other:	Handrails	Gates	Screens	Guards	Other:	Brooms	Shovels	Picks	Other:	Other:	Hazard Tape	Warning lights	Pictograms/signs	Traffic control devices	Fire Extinguisher	First aid	Other:	Safety work procedure	Register	Induction	Designation	Instruction	Training	Certificate	Other:
	Activity/Situation																															

## 2. Identify and procure protective clothing, road signs and traffic control devices.

### 2.1 Identify and procure protective clothing

Protective clothing is needed to protect workers from injury and disease. Injury can be caused by vehicles, machines, equipment, tools, falling and other incidents. Disease may be contracted in the workplace by working in wet places or in harsh weather conditions.

The task of spraying herbicides is a dangerous task, because the work is often done on the edge of throad while vehicles are driving past at high speeds (under traffic). Workers must therefore be visible to the drivers and respect the traffic rules at all times.

The drivers must be warned to change direction to avoid the working gang. They should be warned in time to expect some activity and to drive carefully in case something irregular happens.

Protective clothing needed is:

- **Footwear**  
Most of the work must be done on the hard road surface. Usually good closed leather shoes are sufficient to wear.  
  
To prevent slipping and falling on the steep slopes, boots or shoes should have soles with firm grips.
- **Legs and arms**  
Working with herbicides has the potential of contaminating the skin. Workers should work with overalls that cover the arms and legs.  
A further reason for covering arms and legs is to protect against insect and snake bites when it is necessary to work in areas covered with grass and shrubs.
- **Hands**  
Working with herbicides has the potential of contaminating the skin. Workers should wear chemical resistant waterproof gloves.
- **Head**  
No head protection will normally be needed other than protection to the sun.
- **Eyes, ears, nose, mouth**



The use of respiratory equipment is recommended at all times. The type of equipment must be compatible with the type of herbicide being sprayed. Always wear eye protection when as the chemicals may cause eye irritation.

- Whilst working on or next to the road while traffic use the road, the workers should wear safety bibs with bright colours and reflecting strips.
- Training  
Personnel should be trained adequately in the safe use of spraying herbicides.

## 2.2 Identify and procure first aid kit

A basic first aid box should contain the following medical aids for emergencies and general healing.

You will notice that no provision was made for headache tablets, stomach-ache medicine, insect sting ointment or snake bite serum. You may not include this in your first aid kit as only qualified medical practitioners are allowed to give medicine. You do not know if the person is allergic to any medicine.

When assisting a person that has been contaminated with herbicides the following should be done:

CHEMICAL	RATING	HAZARD	Use appropriate fire extinguisher and treat for burns	Wash/Flush Copiously with water for 15 minutes	Remove person from contaminated area	Take to Doctor IMMEDIATELY
Herbicide / Pesticide	2	Eyes		X		X
		Skin		X		X
		Ingestion				X
		Inhalation			X	X
		Fire	X			X

Table B

### 2.3 Identify and procure Road signs and traffic control devices

**NB! The traveling public should be made aware when herbicides are being sprayed and all safety precautions should be taken. It is very important to indicate this by the use of appropriate road signs.**

The spraying of herbicides is mobile work. It means that the work is carried out while moving forward during daytime. The traffic signs must therefore also move forward all the time.

It is the duty of the owner and supervisor to procure the traffic signs, but you should also assist and check that the necessary road signs are drawn from the store, loaded, transported and placed correctly. You may save a life by doing this.

TWO VERY IMPORTANT NOTES.

1. It is always the right thing to inform the traffic department that you are working on the road. Request them to visit your site and consult them on the correct signs and placement.
2. Always, always remove the traffic signs and cones when they are not needed anymore. Do not leave them at night or over weekends when no work is done. The road users will see the signs, but no workers and next time when you really work, they will ignore the signs.



### 3. Calculate material quantities, procure material and store

#### 3.1 Calculate material quantities

- The material which is used when spraying herbicides are:
  - Water
  - Herbicide
- When we are calculating the material quantities we are calibrating the sprayer.
- Calibration and operation

##### Important variables

The amount of spray you apply to an area will depend on four variables: your walking speed, the pressure you select, your spray swath width, and the nozzle tip you've chosen. *If you change any one of these, you change the amount of spray you apply.*

This is why, with broadcast spraying (spraying a whole, big area), it's impossible to say, "Always add 10ml of the pesticide per gallon of water." You could be spraying 10 times too much or 10 times too little, depending on your situation. You simply *must* calibrate your sprayer before adding pesticide.

Before going through step-by-step examples of calibration for broadcast, band, and spot spraying, let's discuss how walking speed, pressure, nozzles, and swath width interact.

*Walking speed.* If you double your walking speed while maintaining pressure and swath width, you'll apply half as much spray. You'd require more pesticide (that is, a greater concentration) to apply the same amount of pesticide per m<sup>2</sup>.

*Pressure.* If you change the pressure while you spray, you change output.

*Nozzle tip selection.* The proper tip will depend on the situation (see Table 1 in learning activity 4). Tips are available that cover a wide range of output volumes, spray widths, and pressures.

*Swath width/nozzle height.* Tips are designed for use within certain heights and pressures. Within these ranges, some tips deliver narrow bands; others, like flooding tips, provide swath widths up to 2 meters. The wider each swath width, the less time the operator spends walking up and down fields.

The height at which you hold the spray tip above the target influences the swath width. Suggested spray heights vary by tip type. Spraying as close to the target as is practical



minimizes drift and operator contact. The spray height you select needs to be maintained during calibration and field application- otherwise your output changes. Some operators have tried using height stakes or weighted drop strings to maintain a constant height. These aids may be useful reminders while practicing.

- **Calibration:**

Step 1 to 5 must be followed to calibrate the backpack. In other words how much water the backpack can spray in a certain period of time on a certain area. Steps 6 to 9 must be followed in order to calculate the quantity of herbicide needed for the area to be sprayed. In order to calculate the quantities the following should be done:

### BACKPACK – Sprayer Calibration

**Step 1:** Determine the area to be sprayed:

Area = \_\_\_\_\_ meters wide X \_\_\_\_\_ meters long.

**Step 2:** Spray the calibrated area uniformly with water, noting the number of seconds required:

The Time Required was = \_\_\_\_\_ seconds.

**Step 3:** Spray into a bucket for the same number of seconds.

Step 4: Measure the number of liters of water in the bucket:

Volume Sprayed = \_\_\_\_\_ liters

**Step 5:** The number of liters collected from the bucket is equal to the number of liters per square meters the sprayer is delivering:

Liters per square meter ( $l/m^2$ ) = \_\_\_\_\_ liters/ \_\_\_\_\_  $m^2$

Step 6: Determine volume of full spray tank.

Tank volume = \_\_\_\_\_ liters

**Step 7:** From the manufacturers specifications get the dosage rates for the specific weeds or grasses you are about to spray:

\_\_\_\_\_ ml /1l of water.

**Step 8:** Multiply the dosage rate with the tank volume:

\_\_\_\_\_ l X \_\_\_\_\_ ml = \_\_\_\_\_ ml this means you will need \_\_\_\_\_ ml of herbicide to add to the backpack.

**Step 9:** Divide this by the litres used on the area.

\_\_\_\_\_ ml / \_\_\_\_\_ l = \_\_\_\_\_ ml. This means you will need \_\_\_\_\_ ml of herbicide to spray the area.

### Example 1

**Step 1:** Determine the area to be sprayed:

4 meters wide x 5 meters feet long.

**Step 2:** Spray the calibrated area uniformly with water, noting the number of seconds required:

The time required was = 90 seconds.

**Step 3:** Spray into a bucket for the same number of seconds.

**Step 4:** Measure the number of liters of water in the bucket:

Volume Sprayed = 3 liters

**Step 5:** The number of liters collected from the bucket is equal to the number of liters per square meters the sprayer is delivering:

Liters per square meter (l /m<sup>2</sup>) = 3liters/20m<sup>2</sup>. This means the calibration of the sprayer is 0.15liters/m<sup>2</sup> (150ml /m<sup>2</sup>).

**Step 6:** Determine volume of full spray tank.

Tank volume = 12 liters

**Step 7:** From the manufacturer's specifications get the dosage rates for the specific weeds or grasses you are about to spray:

15ml herbicide /1l of water.

**Step 8:** Multiply the dosage rate with the tank volume:

12l X 15ml = 180ml this means you will need 180 ml of herbicide to add to the backpack.

**Step 9:** Divide this by the liters used on the area.

180 l / 3 l = 60 ml. This means you will need 30ml of herbicide to spray the area.

### 3.2 Procure material

The foreman will calculate the quantity of materials that he estimates that his team needs for the day. He will approach the store man and complete a form on which the quantity is filled in. The store man will issue the quantity of material that the foreman requested

### 3.3 Transport materials

Once the materials are issued it is loaded on a truck or LDV and transported to the site where the people are going to work. The material should be loaded in such a position that it will not, under normal circumstances get damaged by rolling, falling or being trampled. If an open vehicle is used, light weight material should be tied to prevent it from being blown off the vehicle.

Out on the road, the foreman has to control the use of materials that it does not:

- Get wasted
- Stolen
- Damaged or
- Misused

### 3.4 Store materials

In the store man's store the materials are usually stored and protected from

- Damage
- Waste
- Theft and
- Misuse/abuse

The store man will stack the material to be sheltered from rain, moisture and dust.

- He will place materials of the same kind together to make checking and finding easy.
- He will place material that may contaminate other material at a safe distance.
- He will mark poisonous material.
- He will stack material to a safe height and level.
- He will stack material in such an order that the FIFO (first-in-first-out) method of issuing can be used.

Your site agent will instruct the store man to order a sufficient quantity of material for the road markings and organise that it is delivered in time.

The store will be locked and watchmen will be instructed to keep a special watch on the storeroom.

## 4. Execute the work

### 4.1 What is a backpack sprayer? What are appropriate uses?

A backpack (or knapsack) sprayer consists of a tank, a pump, and a spray wand with one or more nozzles (Figure 1). The small size, transportability, and ease of use make the sprayer a versatile tool.

You can spray many acres with a backpack sprayer; however, the effort of carrying the spray mix and walking over each area you spray takes its toll on your strength and enthusiasm.

To provide some perspective, many backpack applicators consider 1 to 2 hectares of broadcast spraying (the entire area sprayed) as a full day's effort. A helicopter, in contrast, may spray the same area in a matter of seconds. Appropriate tasks for backpack sprayers then tend to be:

1. Small areas and spot spraying
2. Hard-to-reach locations
3. Spraying jobs where larger sprayer units (tractors, helicopters, etc.) are unavailable



Figure 1.--Backpack sprayer application.

### 4.2 Sprayer characteristics and accessories

You'll find a wide array of sprayers and accessories on the market (Figure 2). The next five sections outline some key differences among the sprayers commonly sold: types of pumps, pressure regulation, nozzles and booms, sprayer tank volume, and other features.

#### 4.2.1 Types of pumps

Both piston and diaphragm pumps are available. The piston rings on these pumps wear and lose pressure after extensive use, particularly with abrasive wettable powder herbicides.

Diaphragm pumps are simpler mechanically, which may mean less maintenance. If you use one, be sure the diaphragm material is resistant to the chemical or solvent you plan to use. Diesel oil, for example, may degrade some diaphragms.



Figure 2.--A wide variety of sprayer types are available.



### 4.2.2 Pressure regulation

Proper calibration demands a constant uniform pressure. Some sprayers have built-in valves to regulate pressure. Others have pressure gauges on the handle. Either type is acceptable as long as you maintain uniform pressure.

### 4.2.3 Booms

Spray booms increase the area you spray during each pass through the field. This saves you time and effort and can improve coverage uniformity. Booms are available in many configurations. They may be oriented vertically for spraying along the height of trees or horizontally for field spraying.

### 4.2.4 Sprayer tank volume

Sprayer capacities range from 7 to 20 liters. The tank should have an easy-to-read volume gauge printed or embossed along the side.

## 4.3 Other features

There are a number of additional features that are important in selecting a sprayer. Here are some:

1. The pumping lever should be in a comfortable position.
2. The wand and hand grip should be comfortable and easy to remove and clean.
3. The sprayer should balance comfortably and solidly on your back. The straps should be comfortable. The sprayer should be stable when it sits on the ground.
4. Hoses should be durable and reinforced, with secure attachment to the tank.
5. In-line screens/filters are available in some models (usually in the handle). These help to reduce clogging at the nozzle.
6. The filling hole should be large, with a tight-fitting lid--to prevent spray liquid from spilling on you when you bend or walk.

## 4.4 Nozzle components

Typically, a nozzle is composed of four items- spray tip, screen (strainer), cap, and nozzle body (Figure 3).

### 4.4.1 Spray tip

The spray tip is the most important nozzle accessory for your sprayer. It breaks the liquid into droplets of



Figure 3.--Typical nozzle assembly.



the correct size, forms the spray pattern, and directs the droplets. Users should pay attention to the spray tip and know about alternative tips.

Nozzle tips are designed for various uses, crops, and spray pressures. Table 1 shows some of those most useful for backpack sprayers.

Table 1.--Common backpack sprayer nozzle tips, uses, and examples.

Tip	Use	Remarks and examples
Flat tips (overlap)	Boom spraying with multiple nozzles	<p>These tapered tips are designed for at least 30 percent overlap of each nozzle in the spray pattern.</p> <p>Manufacturers include Delevan, Hardi, and Spraying Systems.</p> <p>Tips are designated (usually on the tip itself) by spray angle and gallon per minute (gpm) output at a specified pressure.</p> <p>Example: Spraying Systems Co. tip XR8002. This code has three parts:</p> <ul style="list-style-type: none"> <li>• The first two letters "XR" denote an "Extend Range" tip. These maintain spray distribution over a range of pressures (15–60 psi).</li> <li>• The first two numbers indicate the spray angle (80 = 80°). Tips are available from 25° to 150°.</li> <li>• The second two numbers indicate gpm output (02 = 0.2 gpm, at 40 psi). Tips are available from 0.06 to 2 gpm outputs.</li> </ul>
Flat tips (even)	Band spraying	<p>Tips deliver an even spray, edge to edge.</p> <p>Manufacturers: same as for overlap flat tips.</p> <p>Example: Delevan tip 95-3E. This code has three parts:</p> <ul style="list-style-type: none"> <li>• The first two numbers indicate the spray angle (95 = 95°).</li> <li>• The second number indicates gpm output (-3 = 0.3 gpm, at 40 psi).</li> <li>• The final letter(s) indicate a special feature (E = even output, edge to edge).</li> </ul>
Flooding or impact	Broadcast spraying	<p>Flooding tips are useful in situations where a wide spray swath is needed and a boom can't be used. Spray droplets often are larger than those with flat tips, and some spray uniformity may be sacrificed.</p> <p>Manufacturers: Delevan, Hardi, Imperial Chemical Co. (ICI), Spraying Systems.</p> <p>Examples: ICI makes a series of 4-color-coded nylon tips. Depending on the tip used, they provide swath widths from 2 to 7 feet when held 20 inches above the ground.</p>
Adjustable cone	Spot spraying, bark applications	<p>Adjustable cone tips can be set to spray a straight stream or coarse cone. These are especially useful in spot-spraying clumps of brush up to 20 feet away. They also have uses in straight stream or basal drench bark applications.</p>
Hollow and filled cone	Spot spraying	<p>These tips operate in the 15- to 300-psi range. There is a wide variety of tips and uses in this category.</p>

Tips are made from a variety of materials. Table 2 compares the durability of various spray-tip materials. Tips made of harder materials may cost more initially, but their longer wear life often results in lower long-run costs.

Table 2.--Wear comparison of common spray tips.

Material	Life compared to brass
Plastic or nylon	0.7 to 1 time
Stainless steel	4 to 6 times
Hardened stainless	8 to 15 times
Ceramic	70 to 120 times
Tungsten carbide	150 to 200 times

For example, tests indicate that with bronze tips, the flow rate increased by 8 percent after 50 hours of use with a herbicide that wears out the nozzle in water. More abrasive formulations, like wettable powders, will cause even more rapid wear. As a general rule, if tip output varies by 10 percent above or below rated capacity, replace it.

#### 4.4.2 Screens (strainers / filters)

Screens are needed in advance of the spray tips to reduce clogging. The smaller the tip opening, the finer the screen mesh needed to protect the tip. The manufacturer will recommend the screen mesh size you need.

Screens are available that also function as check valves. These prevent nozzle dripping when the line pressure drops below a certain level. These do cause a pressure drop, and they require careful cleaning and storage for proper functioning.

#### 4.5 Operating hints

Here are some useful operating tips:

1. **Review current label.** The product label contains a wealth of information, from safety data to application tips. Read it carefully, refer to it often, and heed the advice. Especially be aware of toxicity classification and needed protective gear.
2. **Use protective or safety clothing/gear.** In many ways, backpack sprayer users are in closer contact with the pesticide than tractor operators are. Frequent refilling and mixing, walking over sprayed surfaces, etc. means you must be very careful. Rubber boots and gloves, and eye protectors, are a must. Your product label may specify additional protection, such as respirator, rain gear, or face shield.

3. **Use liquids when possible.** Most liquids mix easier and stay mixed longer. Powders and granules tend to require more agitation and can clog nozzles and screens more easily.
4. **Wind direction:** Spray on the down - wind side.
5. **Keep a safe distance between adjacent applicators.** To minimize possible contact, it is wise to keep some distance between adjacent applicators.
6. **Investigate accessories and have a supply of tips.** Much of the versatility of backpack sprayers comes in the use of accessories such as booms, shields and the various tips available. Investigate options and consider their use where appropriate.
7. **Maintain correct boom or nozzle height.** Keeping the nozzles at the calibrated height above your target is critical. The wand or boom tends to drop as the applicator tires. This should be avoided.
8. **Agitate herbicides.** All herbicides must be mixed thoroughly and agitated in the tank to ensure uniform coverage. Some products (such as wettable powders) tend to settle. Others (such as emulsifiable concentrates) tend to separate. When you spray these products, jostle or agitate the tank with a brisk sidestep to keep the solution well mixed.
9. **Clean your nozzle(s).** Have an old toothbrush or other fine brush, clean water, gloves, and pliers handy. Clean the tip and screen after your first two tanks full, and thereafter as needed. Use only a soft brush or compressed air to clean the tip opening.
10. **Clean your tank.** Thoroughly clean and **triple-rinse** your sprayer after use. Useful cleaners are water and ammonia ( $\pm 200$  ml of household ammonia per tank), commercially prepared tank-cleaning compounds or any cleaning material prescribed by the manufacturer's specifications. Ammonia is recommended for cleaning after spraying oil-based herbicides. When you use oil-based herbicides, rinse the sprayer first with light oil (diesel oil or kerosene). Cleaning is especially critical if you plan to use the same sprayer for insecticide and herbicide sprays. In fact, many users have two sprayers - one for insecticides and one for herbicides, because total cleaning sometimes is difficult.
11. **Disposal of herbicides.** The OSH act explains the disposal of herbicides (hazardous chemical substances HCS) best:

**15. Disposal of hazardous chemical substances**

*An employer shall as far as is reasonably practicable*

- (a) *recycle all HCS waste;*
- (b) *ensure that all collected HCS waste is placed into containers that will prevent the likelihood of exposure during handling;*
- (c) *ensure that all vehicles, re-usable containers and covers which have been in contact with HCS waste are cleaned and decontaminated after use in such a way that the vehicles, containers or covers do not cause a hazard inside or outside the premises concerned;*
- (d) *ensure that all HCS waste which can cause exposure, is disposed of only on sites specifically designated for this purpose in terms of the Environmental Conservation Act, 1989 (Act No. 73 of 1989), in such a manner that it does not cause a hazard inside or outside the site concerned;*
- (e) *ensure that all employees occupied in the collection, transport and disposal of HCS waste, who may be exposed to that waste, are provided with suitable personal protective equipment; and*



- (f) ensure that if the services of a waste disposal contractor are used, a provision is incorporated into the contract stating that the contractor shall also comply with the provisions of these regulations.

#### 4.6 Conclusions

Accurate calibration is vital. The fact that your neighbour adds a certain amount of herbicide per litter and gets good results is no reason for you to expect the same. You might walk more slowly; you might have different nozzles; or you might use greater pressure. You simply must calibrate for your conditions.

*Remember:* You control these factors:

1. Pressure. If you increase the spray pressure, you increase output.
2. Walking speed. If you slow down, you increase output per m<sup>2</sup>.
3. Swath width/nozzle height. Your output may change with different nozzle tips, nozzle heights, and swath widths. It often is best to first establish walking speed and pressure and then change your tip selection to achieve a desired output.

It's critical that you clearly understand the suggested application rates. Are they based on the amount of actual product you should apply, or on the amount of active ingredients? Is the product you're applying the same as the product on which the recommendation was based?

Above all, work safe and work smart. Don't rush and neglect important details. As you spray, periodically check yourself to verify accurate application.

**NB! IF YOU DON'T WORK SAFELY THE OCCUPATIONAL HEALTH AND SAFETY ACT WILL ENSURE THAT YOU DO:**

#### 16. *Offences and penalties*

*Any person who contravenes or fails to comply with any provision of regulation 3, 4, 5, 6, 7, 8, 9, 9A, 10, 11, 12, 13, 14 or 15 shall be guilty of an offence and liable on conviction to a fine or to imprisonment for a period not exceeding six months and, in the case of a continuous offence, to an additional fine of R200 for each day on which the offence continues: Provided that the period of such additional imprisonment shall in case exceed 90 days. (R. 16 amended by GNR. 930 of 2003)*

ENVIRONMENTAL  
SERVICES