BEST MANAGEMENT PRACTICES FOR VEHICLE MAINTENANCE FACILITIES IN BARBADOS

Environmental Protection Department
Ministry of the Environment
and Drainage
Barbados

BEST MANAGEMENT PRACTICES FOR VEHICLE MAINTENANCE FACILITIES IN BARBADOS

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Glossary of Terms

Term	Explanation
Bodywork	is any repairs done to a vehicle. This includes sanding, spray painting, welding or panel replacement.
Filter	A device used to block specific solids, liquids or gases while allowing others to pass through
Hazardous chemicals	Any chemical for which there is significant evidence, that acute or chronic health effects may occur
Manometer	An instrument used to measure the pressure of gases and vapours.
MSDS	Material Safety Data Sheet, a document containing information and instructions on the chemical and physical characteristics of a substance, its hazards and risks, safe handling requirements and the actions to be taken in the event of fire, spill or exposure
Pollution	The presence of chemicals which leads to instability, disorder, harm or discomfort to the environment.
Spray Painting	A painting technique that uses compressed air to apply a coating onto a surface.
Ventilation	This is the intentional movement of air from the outside of a building to the inside.

Term	Explanation
VOCs	Volatile organic compounds are emitted as gases from certain solids or liquids. These include a variety of chemicals, some of which may have short and long term adverse health effects.
Waste	Any materials unused and rejected as worthless or unwanted.

Introduction

Over the years, the Environmental Protection Department (EPD) has had an increase in the number of complaints relating to air and noise pollution from vehicle maintenance facilities (VMFs). These facilities are dotted across Barbados ranging in size from small "backyard" operations to larger commercial and government run entities. They may perform various essential activities which range from mechanical maintenance to bodywork. Service stations, tyre shops and vehicle customisation workshops also fall into this category.

EPD statistics show that 47.8% of the ambient air quality complaints received, were associated with VMFs and their impact on adjacent communities. Activities such as spray-painting, bodywork, use of degreasers, improper disposal of waste and inefficient or nonexistent pollution control measures conducted in a VMF can be hazardous to both human health and the environment. It is therefore imperative that these activities are conducted in the most appropriate facilities and follow Best Management Practices (BMPs) in order to minimise the potential impact on surrounding areas.

The purpose of this booklet is to help VMF owners and operators better understand how they can implement BMPs to improve the standard of their operations, and to reduce their impact on the environment and human health (employees, neighbours and/or customers).

What is a Vehicle Maintenance Facility (VMF)?

A Vehicle Maintenance Facility (VMF) can be defined as any operation (small scale or large commercial) that is involved in the repair, maintenance and/or painting of automobiles or their parts. These include:

- Mechanical shops
- Auto body shops (repair, body work & spray painting)
- Paint booths
- Service bays
- Valet facilities (engine cleaning, interior and exterior cleaning)
- Air conditioning maintenance, retrofitting and installation facilities
- Tyre repair and replacement shops
- Battery fitting and replacement facilities

An example of a poorly designed vehicle maintenance facility

What are Best Management Practices (BMPs)?

Best management practices (BMPs) are practical methods that prevent or reduce negative impacts on the environment and human health.

Implementing BMPs will ultimately:

- Prevent or reduce the amount of pollution VMFs contribute to the environment.
- Minimise the negative human health impacts on employees, neighbours and/or customers that result from poor VMF practices.
- Improve the facility's relationship with neighbours and the community.
- Improve the facility's image by making sure that the surroundings are cleaner, which also improves the professionalism of the business.
- Improve efficiency and ultimately save the business money!

What Laws Apply to the Operation of VMFs?

Health Services Act (Cap 44) 1969

This Act relates to the promotion and preservation of the health of the inhabitants of Barbados.

The Health Services (Nuisances) Regulations 1969 prohibit anything that may be regarded as a public nuisance such as stack emissions or the accumulation of debris on the premises, which are left or placed in a manner that may be injurious or dangerous to health.

The Health Services (Disposal of Offensive Matter) Regulations, 1969 restrict the disposal of offensive matter to approved disposal sites only.

Health Services (Building) Regulations, 1969 require persons to obtain the permission of the Minister of Health in order to:

1. Construct any building
2. Extend any building
3. Effect any material alteration to any building

Town Planning Act Cap 240

This Act directly addresses applications for planning permission for new and existing developments and primarily focuses on the appropriate locations for and design of buildings or structures including VMF.

Building plans for any vehicular maintenance facility must be submitted to the Town and Country Development Planning Office and the Environmental Protection Department for approval prior to construction. Failure to do so may result in the destruction of your facility.

The Safety and Health at Work Act 2005-12

The Act makes provision for:

- securing the health, safety and welfare of persons at work
- protecting other persons against risks to health and safety in connection with the activities of persons at work;
- controlling certain emissions into the environment and;
- specifies penalties such as fines and/or terms of imprisonment for noncompliance.

The Factories Act

This Act regulates occupational health and safety at industrial facilities. The Act allows for the investigation of occupational accidents and routine factory inspection. It also allows for training and consultation at workplaces.

The Road Traffic Act CAP 295

This Act governs the use of roads, in an effort to ensure the safety of all road users. The regulations within this Act prohibit the parking of vehicles on public roads.

Marine Pollution Control Act (CAP 1998/40)

This Act covers the discharge from land based sources, sea bed and dumping activities as well as airborne sources that may have a negative impact on the marine environment. Contravention of this Act may result in a fine of up to BDS $200,000.00.

Draft Environmental Management Act

When this Act is passed it will work in concert with other environmental legislation to address the control of pollution of the environment and prosecute any persons and/or businesses that are found to be in contravention of the Act.

Are People and the Environment affected by my VMF?

Yes! A poorly designed, operated and/or managed VMF can cause various types of pollution.

Poor practices can lead to pollution of the environment which can result in harm to people, animals and structures. This may take the form of air, noise, soil, water and marine pollution.

Noise Pollution

Sources

Noise is considered as any 'unwanted sound'. Typical sources of noise from VMFs include:

- sanding operations
- welding and cutting activities
- hammering and banging
- heavy duty tools and cleaning equipment
- tools powered by air compressors
- grinding parts
- valet processes (i.e. vacuum cleaning, pressure washing)
- pumps, motors or compressed air spraying, pneumatic drills

A compressor is a typical example of a noise source

Effects of Noise Pollution

Excessive noise over an extended period of time can result in negative health impacts such as:

- Tinnitus (ringing in the ears)
- ulcers
- aggravation of asthma
- high blood pressure
- headaches
- sleep disturbance
- absentmindedness

Headache

Research has shown that it is difficult for children to understand language or study in a noisy environment. This can affect how they learn or concentrate and eventually how they integrate into society.

Prolonged and/or repeated exposure to noise above 85 decibels (dBA) can cause permanent hearing loss. To give you an idea of noise levels, a quiet library can be around 30 dBA, a normal conversation can be between 60-70 dBA, while a motorcycle engine is 100 dBA.

Air Pollution

Sources

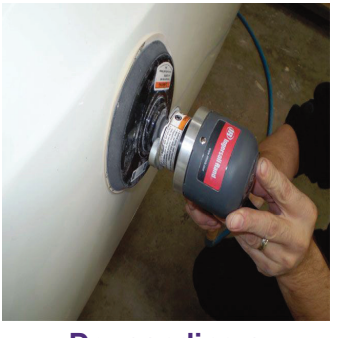
The primary sources of air pollution from VMFs are particulate matter (PM) and volatile organic compounds (VOCs).

Particulate Matter

Particulate matter refers to very fine particles of solid or liquid. PM can be created by activities such as:

- sanding to remove paint from surfaces, or to smooth out body panels after body filling
- sanding fibreglass
- burning of waste materials
- grinding and buffing

Chemicals that may be present in PM include silica from sand blasting and lead and chromium from surface coating.



Dry sanding a vehicle can generate particulate matter

Volatile Organic Compounds

Volatile Organic Compounds (VOCs) are substances that are easily vaporized under normal conditions. VOCs are released from solvents, paints and fillers used in activities such as:

- paint mixing,
- spray painting,
- drying and
- equipment cleaning processes.

Refrigerant Gases

The fixing and or gassing of air conditioning systems can result in the release of refrigerant gases such as; Chloro-florocarbons (CFCs), Hydro-chloroflorocarbons (HCFCs) and Hydroflourocarbons (HFCs) to name a few, depending on the age of the air conditioning system.

Effects of Air Pollution

Exposure to air pollution can be primarily through inhalation (breathing in) and dermal (skin) contact.

Inhalation of toxic vapours may cause:

- nausea
- fatigue
- dizziness
- headaches
- eye, nose and throat irritation
- aggravation of pre-existing conditions such as asthma
- cancer, after extended time periods or in extreme cases.

Person experiencing eye irritation

- Paints, varnishes and similar substances contain isocyanate, toluene, xylene, chromium, nickel and lead. These chemicals are considered to be carcinogenic (may cause cancer) and may damage the lungs if persons are exposed for prolonged periods.
- Skin contact may cause skin irritation or allergic contact dermatitis in severe cases.
- Repeated exposure to air pollution may affect the nervous system.

Soil, Water and Marine Pollution

Pollution of soil, water and the marine environment may occur due to the use, handling and disposal of liquid e.g. oil and solid substances.

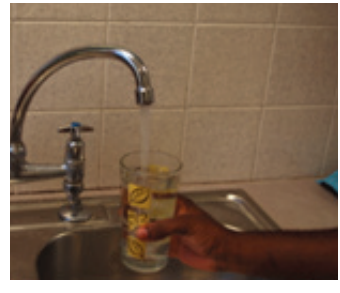
Sources

Waste generated by the activities of VMFs include solid, liquid and gaseous wastes. Some of which, can be considered hazardous because they may be toxic, flammable, reactive and/or corrosive.

The following are a list of wastes generated by VMFs:

Solid Waste

- metals
- painting utensils (old brushes, old airbrushing canisters, masking tape)
- used oil filters
- spent filters
- materials used to contain spills i.e. cleaning rags



Hazardous waste can pollute drinking water supplies

Liquid wastes

- used thinners
- paint
- old coolant
- used oil
- used degreasing solvents
- battery electrolytes
- rinse water used to wash floors
- detergents & waxes
- petroleum products

Effects of Solid, Water and Marine Pollution

Water & Marine Pollution

Waste and contaminated storm water can contaminate drinking water supplies. It can also contaminate coastal waters via underground and above ground channels.

This contamination can damage marine life, and affect the fishing industry. It can also affect bathing beaches, which would not only have an impact for locals, but tourists as well.

Various metals and other objects being stored inappropriately

Soil Contamination

Soil contamination can affect food crops. This can cause severe illnesses if contaminated food is consumed.

Exposure to hazardous substances such as thinners can result in negative effects on health if they enter the body, whether through the skin, mouth, nose, eyes or ears.

Liquids can leak into the ground from cans that are improperly stored

Improper disposal of solid waste can cause an increase in pests such as rodents and mosquitoes, as the waste can provide a breeding ground for these pests.

How can VMFs Improve their Operations?

Obtain planning approval

Operators should apply for and receive permission from the EPD and the Town and Country Development Planning Office to construct and operate their VMF.

New VMFs should be constructed at a distance which will not have any impact on sensitive receptors such as residential areas, hospitals, schools and churches etc.

VMFs should not be constructed in residential districts because their activities are considered to be light-industrial and are incompatible with such areas.

Use a good design

The entire structure of a VMF must be enclosed to prevent the release of fumes or particulate matter. The walls should be solid, and finished to provide a nonporous surface which does not allow pollutants to be released. Canvas, plastic and wire mesh are unacceptable construction materials for VMFs.

Designate specific areas for different activities. In other words, mechanical work can be done in one area with the appropriate drainage and collection systems, while bodywork activities can be done in another area with the appropriate ventilation and pollution control systems.

Noisy activities should be conducted in soundproofed areas in order to reduce noise levels.

Use spray-painting booths

Activities which produce airborne emissions should be confined and completely separate from the general work area. These activities should be conducted in a spray painting booth. Activities include:

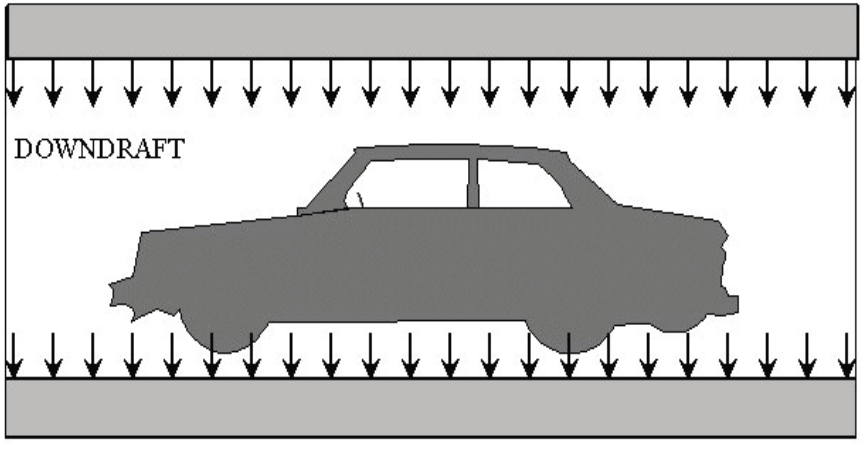
- welding
- fibreglass work
- sanding
- paint mixing
- priming
- spray-painting and drying

Spray-painting booths may be bought prefabricated or they can be built on site. The booth should be constructed from concrete or any other solid material. Canvas, plastic or tarpaulin should NOT be used.

The booth should use a dedicated ventilation system to control the volume of air coming into the booth and an adequate pollution control system to properly treat the air and remove all hazardous pollutants from the exhaust air.

Downdraft Ventilation Spray-Painting Booths

These booths are recommended because when properly operated, they produce lower concentrations of paint over-spray compared to the cross-draft and semi-downdraft booths. Downdraft booths also produce a cleaner paint job that requires less buffing.



Air flow in a downdraft ventilation spray-painting booth

Semi-Downdraft Booths and Cross-Draft Booths

Semi-downdraft booths and cross-draft booths are sometimes used for spray-painting. However, they are not recommended as they do not efficiently control paint overspray and they are more dangerous to the operator who may breathe in toxic fumes. These booths also have higher operational cost due greater amounts of wasted paint.

Install a pollution control system

Pollution control systems should be installed to reduce any health risks and environmental pollution that can arise from contaminants and particulates discharged into the air.

Pollution control systems should reduce the concentration of pollutants from the spray-painting, sanding and/or similar activities to levels required by the EPD.

For example, exhaust filters (paint overspray arrestors) and vacuum systems should be used on any equipment that generates dust.

The following types of filters are suitable for dust removal:

- Fibreglass
- Paper
- Styrene
- Composite

Paper filters like the ones shown above are quite popular due their efficiency and cost

You should note that particulate filters do not remove odours and harmful gases from the exhaust air stream.

The system should be properly maintained to make sure that the activity does not negatively impact on the environment.

Ensure that the type of filter chosen is appropriate for the type and volume of emissions which are likely to be released.

Maintain the pollution control system

Your filter manufacturer will recommend a range of 'static pressure drop' in which your filters will work effectively. Therefore, you should install a manometer or dial gauge in the extractor duct so you can measure the static pressure drop across the filters.

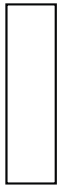
The manometer should be checked frequently, while the booth is operating and compared to the range of pressure drop recommended by the manufacturer. Records of the reading should be kept for inspection by the EPD, Environmental Health Department or any other regulatory agency. When the filters are operating out of the manufacturer's suggested range, it's time to replace them.

Install the appropriate exhaust ducts

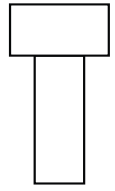
Exhaust fans and ducts should be specifically designed for the space and the use in this case to extract odours, particulate matter and hazardous pollutants.

Exhaust ducts should direct the exhaust vertically upwards instead of at an angle, so that the exhaust is effectively dispersed. The recommended extraction duct designs are shown at the top of page 19.

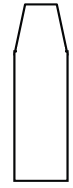
Angled ducts are often used in Barbados to prevent rain from entering the duct. However, these types of ducts are not recommended since they direct the exhaust stream towards the neighbouring communities or establishments. See also the ones at the bottom of page 19.



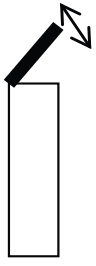
Straight duct



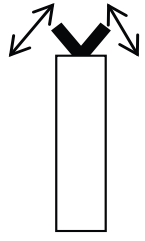
Rain ring



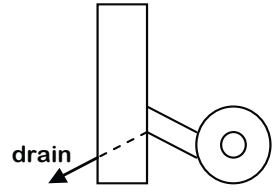
Cone duct



Straight duct with rain flap

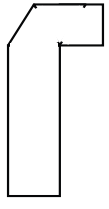


Straight duct with two rain flaps

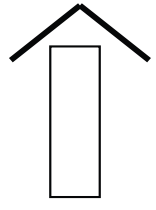


Straight duct with drain

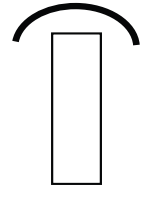
Extraction ducts recommended for use by spray painting facilities. The top three are suitable for continuous operation. The bottom three are designed to ensure that rain does not enter the duct when they are switched on.



Elbow



Chinese hat



Mushroom

Types of extractor ducts that are not recommended for use.

Use good spray-painting techniques and practices

- Train employees about proper paint application techniques. Proper training can reduce your waste and VOC emissions.
- High volume, low pressure (HVLP) spray painting guns are recommended instead of conventional gravity or siphon-feed spray painting guns.
- Do all spray painting in an enclosed paint booth equipped with filters.
- The solvent that is used to clean spray guns can be reused to thin paint of the same colour.
- Use solvents with low or no VOC content.
- Consider buying a solvent recycler so that you can reuse paint thinners and gun cleaners.
- Do not use paint strippers that have a methylene–chloride base because it can negatively affect health.
- Switch from lacquer to enamel-based paints. Lacquer paints may contain 70%-90% solvent by volume, while enamels contain 55%-75% solvent by volume. More so, consider switching to water based paints and primers altogether as emit lower levels of VOCs.
- Waste from spray painting activities should be disposed o in the appropriate manner.

Deal with spills/leaks promptly

- Always check storage containers for leaks. If a leak does occur, fix or replace the container immediately.
- Clean spills immediately with shop towels or mops. Never clean spills by hosing them down with water.
- Use as little water as possible to clean up.
- Rags should be used to clean small spills, dry absorbent material (e.g. shop towels) for larger spills and a mop for general clean up.

Shop Towels

Store your shop towels in metal cans with lids to reduce the risk of fires. The lid reduces the chance of spontaneous combustion and if the towels do ignite, the metal container would contain the fire.

Absorbents and Floor Drying

Absorbents are used to collect spilled liquids such as oil. If you must use absorbents, make sure to buy reusable absorbent material. For example, absorbent “socks” can be reused up to ten times.

- After wiping up a spill with absorbents or a mop, drain excess liquids into a clearly labelled container. Do not mix waste liquids.
- Contact the EPD for advice on the disposal of large quantities of liquid waste or rags.

Handle and store substances appropriately

- All chemicals used within a VMF should be stored in a separate room away from the general work area.
- Containers should be clearly labelled and a list of all chemicals should be kept for inspection.
- Both indoor and outdoor storage areas should have a containment sump/structure so that if there is a leak or spill the structure could collect the contents. The sump should be able to capture 110% of the volume of materials stored. The sump can be a built-in or a portable multipurpose one. The sump material should be compatible with the material to be stored.
- Shelving units should be spaced at least three feet apart, both for ventilation and ease of access.
- Incompatible materials should not be stored together. For example, acidic substances such as bleach should not be stored with alkaline substances such as ammonia.
- Flammable materials should be stored at the correct temperature and away from any sources of flames.
- Always keep Material Safety Data Sheets (MSDS) for all chemicals on hand.
- Refer to the MSDS for all of the chemicals to ensure that they are stored correctly.
- Whenever possible, change vehicle fluids indoors and only on floors constructed of nonporous materials.
- Avoid working over asphalt and dirt floors or any other surfaces that absorb vehicle fluids.

Coolant

- Separate your coolant from other liquids and store it in clearly labelled containers that are kept closed.
- When removing coolant that can be reused, save it and return it to the radiator when you have finished the repairs or servicing. Remember to use drip pans and try to avoid spills.
- Do not discharge coolant into a drain, septic tank or directly to the ground. Refer to the disposal table page 29 for further information.
- Make sure your coolant storage tanks or drums have proper containment that can hold at least 110% of the volume in case there is a leak or spill.

Used Oil

- When working on vehicle engines, place drip pans underneath leaking vehicles to collect dripping oil. Don't forget to pour oil from drip pans into a used oil container.
- Store used oil in tanks or sealed containers labelled "Used Oil". Keep these containers closed.

Potential oil spill

- Make sure your used oil storage tanks or drums have proper containment that can hold at least 110% of the volume in case there is a leak or spill.
- Use large drum funnels or fill tubes when filling used oil drums.

Lead-Acid Batteries

- Lead-acid batteries should be stored indoors on an acid-resistant, leak proof rack or tub. Batteries should also be covered to prevent acid run off.
- Keep a neutralizing agent such as baking soda nearby, in case of leaks or spills. If a spill does occur the waste must be treated as a hazardous waste.
- Contact the EPD for advice on the disposal of any hazardous waste. Also refer to the disposal tables on pages 27 and 29. When stacking batteries, make sure they are stored so that any fluid from leaking batteries will not be released into the environment.

Tyres

- Store as few tyres as possible at your facility. Make sure unwanted tyres are hauled away on a regular basis.
- Keep tyres stored indoors or keep tyre piles covered to stop them from collecting water. Tyres are perfect breeding grounds for mosquitoes, rodents and other pests.

Aerosol Cans

- Where possible replace aerosol cans by using refillable spray bottles.
- If you use aerosol cans, use all of the material and propellant in the can before opening a new one. Empty cans are not considered hazardous waste.
- Collect and recycle empty cans as much as possible.
- Where possible purchase a puncturing system that will make sure that the cans are empty.

Refrigerants

- Remove and recover refrigerants from the system before servicing a vehicle. Do not mix R-12 and 134a since contaminated refrigerant cannot be put back into the vehicle.
- Only use alternative refrigerants containing liquefied petroleum (LP) if you are fully qualified to do so. These can explode!
- Be sure to use the proper O-rings, lubricants etc. when retrofitting automobile air conditioning systems.
- When retrofitting, re-label and install the proper fittings to prevent accidental contamination of the system with other refrigerants.

Use environmentally sound alternatives

- Try to substitute solvents with water based cleaners which contain less than 5 % of VOCs and, unlike petroleum-based solvents, they are typically non-flammable. Aqueous cleaners perform just as well as solvent degreasers.
- Steam cleaning and pressure washing could be carried out instead of solvent cleaning. However, the wastewater generated from these methods must be disposed of appropriately.

Reduce, reuse and recycle

- Buying items in bulk can help you to reduce packaging waste.
- Identify ways to use used materials in house. For example, used office paper can be cut up and used for notepads.
- Materials that cannot be reused should be recycled.
- Separate materials for recycling.
- Keep recycling areas clean, tidy and free of vermin
- Waste that will not be recycled must be appropriately disposed of to avoid prosecution.

Tip

By switching to refillable spray bottles, you will protect the environment by eliminating some of your solid waste. You will also save money by avoiding the high cost of aerosol cans!

Dispose of waste appropriately

Deliver waste through a reputable commercial hauler to permitted sites ONLY. The following table identifies the authorised waste disposals sites and the designated waste materials for each site:

Waste	Disposal Site	Comments
Bulky Metal	Bagatelle Waste Metal Facility, St. Thomas	Any vehicle or parts sent here must be completely drained of all fluids (gasoline, diesel, coolant etc.) before disposal
Liquid		Contact EPD for disposal advice
Solid	Mangrove Landfill, St. Thomas	There must be NO free liquids mixed with the solid waste. NO metal can be disposed at site.
Hazardous		Contact the EPD for more information

Waste Filters

Paint contaminated filters are considered hazardous and therefore should be properly disposed of at the end of their life-span.

- Do not throw out old filters with the regular trash that is collected by the Sanitation Service Authority.

- Dirty filters sometimes spontaneously combust (catch fire on their own), which makes them potential fire hazards. They can also cause fires by emitting vapours that cause other combustible materials to catch fire. These should be stored in metal containers with lids to prevent fires.

Booth Intake Filters

- Keep the MSDS handy to assist the EPD in advising on disposal methods.
- Booth intake filters remove dust and other small airborne particles from incoming air to provide a dust free environment for painting. These are not hazardous under normal circumstances and can be disposed of with the regular waste.

Styrene Filters

If you generate a lot of used filters, you may want to think about using styrene filters. Since they can dissolve in thinners, these filters can be mixed with the waste solvent after they are used. This would mean that only the solvent would need to be discarded. You should only explore this option when a large volume of solvent is produced. The solvent must not be poured down the drain.

Remember

If you don't know how to dispose of a particular type of waste call the EPD.

Do the right thing!

Recommended Disposal Methods

Waste Type	Recommended Disposal Method
Old Paint Filters	Double bag and send directly to Mangrove Landfill
Solvent *	Solvent can be sent to Mount Gay Rum Refinery for use in their fuel blending process
Rags/Shop Towels	Package separately and send to Mangrove Landfill for disposal. For larger amounts contact the QEH Engineering Department as they may be able to utilise them in their incinerator.
Liquid-waste e.g. oil	Send to used oil collectors such as Mount Gay Rum Refinery
Coolant	Capture coolant from repairs and reuse it in radiators.

* in which styrene filters have been dissolved

Use safety equipment and Procedures

- Ensure that employees are equipped with the proper personal protective equipment such as air supplied respirators and chemical resistant gloves.
- Protective clothing should be worn when painting and sanding.
- All employees should be properly trained in the use and the appropriate waste disposal and spill clean up procedures.

Respirators and gloves should always be used in VMF activities

Establish a maintenance program

- Service equipment often so that they run efficiently. Replace worn out equipment.
- Check compressors to make sure that there are no leaks or breaks in the lines.

Reduce noise pollution

- Avoid unnecessary revving of engines, horn blowing and other noise activities.
- Do not test standby generators after dark this can lead to noise pollution.

Improve management of operation and community relation

- Let neighbours know when you will be operating and approximately how long you intend to operate.
- Discuss any concerns that they may have and make the appropriate adjustments to minimize impacts.
- Do not work in the road because this can obstruct the flow of traffic. This contravenes the Road Traffic Act and is also dangerous to pedestrians, drivers and the employees of the VMF.
- Improve staff and community relations by keeping your surroundings clean and tidy.

ENVIRONMENTAL PROTECTION DEPARTMENT

Environmental Protection Department
Ministry of Environment and Drainage
Government of Barbados
L. V. Harcourt Lewis Building
Dalkeith
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